AUGMENTATION OF CLASS ROOM ENGAGEMENT AND LEARNING USING GAMIFICATION APPROACH

A Thesis

Submitted in partial fulfilment of the requirements for the award of the degree of

DOCTOR OF PHILOSOPHY

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COMPUTER SCIENCE AND ENGINEERING

By

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DECLARATION

This thesis is an account of research undertaken between February 2016 and June 2021 at the Department of Computer Science and Engineering, Lovely Professional University, Phagwara, India.

Except where acknowledged in the customary manner, the material presented in this thesis is, to the best of my knowledge, original and has not been submitted in whole or part for a degree in any university.

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CERTIFICATE

This is to certify that the declaration statement made by the student is correct to the best of my knowledge and belief. She has submitted the Ph.D. thesis **Augmentation of Class Room Engagement and Learning Using Gamification Approach** under my guidance and supervision. The present work is the result of her original investigation, effort and study. No part of the work has ever been submitted for any other degree at any University. The Ph.D. thesis is fit for the submission and fulfillment of the conditions for the award of Ph.D. degree in Computer Science and Engineering from Lovely Professional University, Phagwara.

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ABSTRACT

Technology has improved the teaching and education process; however, it lacked in boosting the self-motivation and involvement among the juveniles. The absence of self-motivation and erratic engagement is one of the crucial challenges faced by educationalists today. Bewildering tasks for the professors are to ensnare students during the class. To evaluate the impact of the changes in education, a survey comprising of research questions, each with a specific objective, is conducted among students to assess the problems/lacunae faced by them in the prevalent education system. In this survey, analysis done in Python to help comprehend the effectiveness of gamification in education was emphasized while simultaneously addressing the flaws of traditional education. Elements of gamification are listed, and the student's motivation levels describe the variation in the psychological and behavioral aspects. The conducted study aims to show how to inculcate a feeling of competitiveness/ interest amongst the students and to lure them into performing better and achieving greater success. Therefore, it becomes essential for the instructors to add the game elements according to their requirements. Moreover, the proposed comparative analysis is evaluated to determine the need for Gamified framework and to portray the benefits of such a system over the traditional education system. An exclusive concept of hope enabler is presented, a novel tool for expectation, and it generates the next level of motivation for enticement and involvement.

The classroom teaching unique architecture of hope establishment and hope provision mechanism is formed. Factor analysis and other statistical tools are applied to the survey results to identify the Gamified classroom learning factors/elements. The contribution of each factor would be differential; the subsequent second survey was conducted on faculty to suggest the level of contribution by the coefficients of each factor identification. The classroom hope formula consists of four key elements: faculty conduct, teaching methodology, environment, and rewards. The entire theory of the gamification mechanism encompasses a hope enabler, and even the D6 Process comprising the atoms of hope and summarises the gamification methodology. Whenever an organization intents to include the new gamification model for boosting productivity, there are always hope enablers involved by the game designers to make the job more involving, productive, and eloquent. This work paves new-fangled ways for scaling up the enticement using artificial intelligence and machine learning. The

intellectual framework proposed here is built on another unique methodology used globally for user involvement and is termed gamification. The prime objective of the current research work is to refute the issue of disengagement by designing and implementing a Gamified framework on students from higher education that will include student commitment, enticement, and motivation. Usually, mechanisms are designed for explicit courses; however, the gamified system proposed here is an open-ended method regardless of any course and the program being studied, and this framework has endeavored on various courses. To augment the utility of the gamified framework, a novel ANFIS model is utilized for smart decision-making concerning rewards distribution that is directly proportional to the numeral of coins gained by the juveniles. Consequently, significant participation of a group of students beneath the proposed intelligent gamified system is reported compared to the control group, thus sanctioning the model's success.

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LIST OF ABBREVIATIONS

AECCG	Academic English Competition Cloze Test
AAS	Absolute Average Shift
ANN	Artificial Neural Network
ANFIS	Adaptive Neuro-Fuzzy Inference Systems
ATT	Attendance Coins
ANOVA	One-Way Analysis of Variance
BLAP	Badges leaderboards achievements and points
DGBL	Digital Game-Based Learning
ECI	Emotional Competency Inventory
FS	Fuzzy System
FDG	Feature Deviod Game
FEG	Feature Enriched Game
GAFCC	Goal-Access-Feedback-Challenge-Collaboration
GBL	Game-Based Learning
GES	Gamified Educational System
ICT	Information and Communication Technology
IQ	Intelligence Quotient
K-map	Karnaugh-Map
MOOCs	Massive Online Open Courses
ML	Machine Learning
MEDAE	Median Absolute Error
PPT	Power-Point
RQ	Research Questions
RMSE	Root Mean Square Error
RCG	Real-Competition Game
SPSS	Statistical Analysis Software Packages
VCG	Virtual-Competition Game
VAF	Value Account for

CHAPTER 1
INTRODUCTION

1.1 Introduction

Education is a lifetime process of gaining knowledge, constantly learning from every possible source in every possible way [1]. In the present scenario, technology has become an essential part of our day-to-day life, and it has found extensive use in almost all spaces of industries. The one sector which has not kept pace with the technology change is our present education system. This is the reason the traditional style of book-based learning is followed in most primary and higher education. To adapt to the latest technology, the overall mindset of the present educational community needs to change. The major concern is the present education system that lacks student engagement and enticement. The present methodology focuses on completing the topic in a definite amount of time rather than ensuring the high engagement of students during the delivery of the lecture. In recent years, a shift from traditional blackboards to smart classes [2] has been observed as a step towards modernization of the education system to enhance the engagement amongstudents.

Education 4.0 is the new trend that involves the latest technologies like iPads, tablets, and interactive videos to make the students more engaged. Learners nowadays being exposed to a wide variety of technologies have found traditional teaching-learning environments such as classrooms and museums are disengaging [3]. Gamification has the prospective to enhance the user's motivation [4]. The combination of extrinsic and intrinsic motivation parameters helps to surge the motivation of the students. As a concept, gamification involves employing game design thinking and various gaming elements in a non-gamimg environment [5]. Researchers in the field of gamification have demonstrated that the outcomes produced of gamified systems are multiple folds better than non-gamified systems [6]. Some key features are identified as autonomy, motivation, progressiveness, experimentation, feedback, and adaptation [7]. The usage of various game design elements such as levels, leader boards, badges, achievements, points, rewards, progress bar, feedback system, challenges, etc. is good reinforcement for motivation, engagement, and learner's performance [8].

Gamification encompassing Badges, Leader-Boards/Levels, Achievements, and Points to a non-gaming scenario is referred to as BLAP Gamification. Leader boards create a sense of competition among learners. Badges reinforce a sense of competence, and a point-based system increases students' motivation. On the other hand, a level-based system enhances students' motivation while learning complex concepts due to its potential of creating a sense of flow [8]. Gamification enhances the user's experience while implementation of appropriate game mechanics engages them and ensures that the educational outcomes last longer [3]. Rhetorical gamification adds standard game elements such as those mentioned above, with not much attention paid to narrative and game design thinking [9].

1.2 Existing Education System

Building, emerging, implementing, and exchanging knowledge in different disciplines is practiced through education. One of the biggest outcomes is ensuring that students memorize, process the information, and evolve as critical thinkers. Higher education institutions need to be flexible to change and anticipate the future of education [2]. The education system needs to evolve time-to-time to match the needs and requirements of younger generation students. Reformation in education is the need of the hour and has to be addressed at the earliest. Two important factors that can result in:

- Lacuna in the motivation of students
- Low levels of emotional intelligence

1.2.1 Lacuna in Motivation of Students

One of the essential contributors to academic success is the student's motivation [10]. In the article [11], authors have presented a diminishing trend in learner's motivation over academic semesters and years throughout the learner's academic career. However, it is not an effective practice to evaluate the academic performance of a student. The possible aspect of the academic performance of a student is evaluated by taking an example and presented in the form of a definition as follows:

Definition 1: Let X be a cumulative performance factor calculated on three factors,

such as difficulty level, intrinsic motivation, and the teaching methodology. The correct combination of these three factors presented a high understanding of the subject to the student. Some of the combinations with their outcomes are presented in Table 1.1.

- Subject ‘X’ 0: Subject is difficult 1: Subject is easy
- Student ‘S’ 0: Low Intelligence quotient (IQ), low intrinsic motivation, low interest 1: High IQ, high intrinsic motivation, high interest
- Instructor ‘I’ 0: Low subject clarity, bad teaching methodology, low motivation given to students 1: High subject clarity, good teaching methodology, high motivation given to students
- Result ‘R’ 0: Low Subject Matter Knowledge 1: High Subject Matter Knowledge

Table 1.1. Boolean table of students’ success in a subject.

X	**S**	**I**	**R**
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

R: Pupil’s Subject Matter Knowledge, I: Instructor Characteristics, X : Nature of Subject, S :Student Characteristics

Drawing a Karnaugh-Map (K-map) for ‘R’ to form a Boolean expression for determining a student’s success in a subject ‘X’ considering the aforementioned factors in Figure. 1.1.

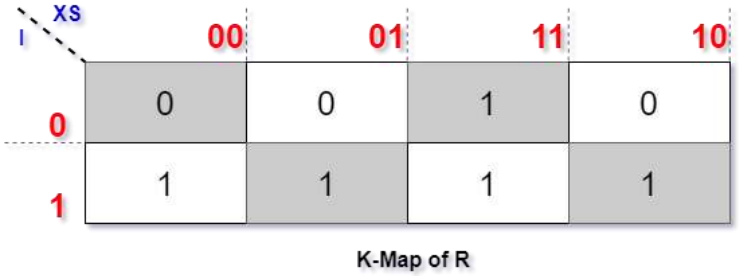


Figure 1.1: K-Map of R

Upon grouping the 1's and simplifying, the obtained empirical formulais –

R= I +(X*S) where,

R – Pupil's Subject Matter Knowledge

I – Instructor Characteristics

X – Nature of Subject

S – Student Characteristics

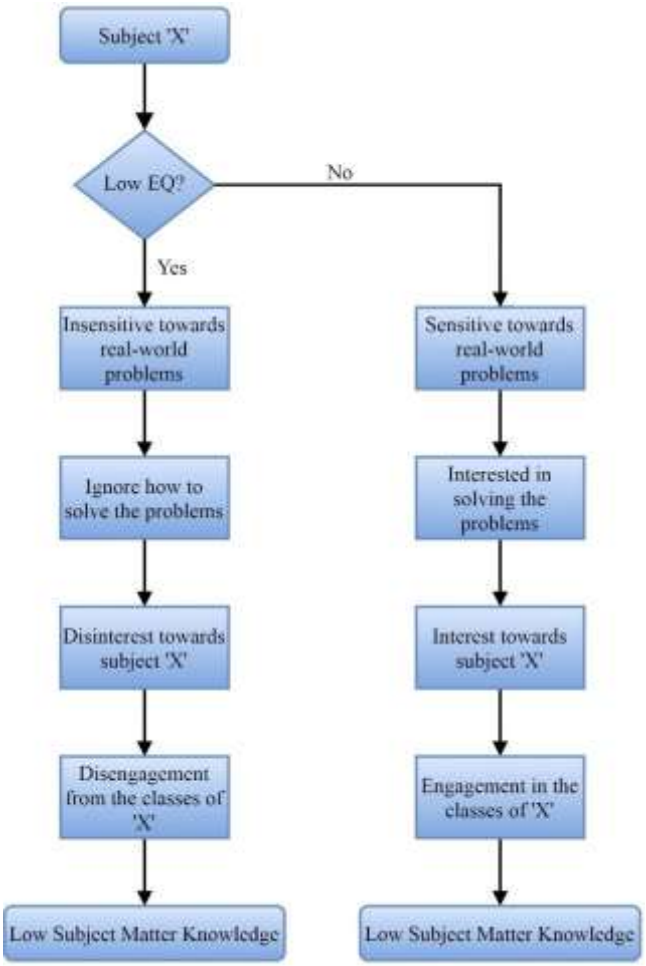


Figure 1.2: A Flow diagram of the effect of student's EQ ontheir subject matter knowledge for a subject 'X'

Thus, the obtained Boolean expression is used to determine the high attainment of subject knowledge. On the other hand, a drop in motivation leads to disinterest and disengagement from the subject matter. Hence, measures have to be taken to keep a constant check on the motivation levels. Motivation, engagement, and interest while learning activities are vital for developing learner's skills and competencies [8]. Adding social elements to the teaching methodology ensures good collaboration among peers and encourages them to exchange their thoughts, ideas, and experiences. Elements make them feel more involved and integral in the whole education process [3].

The interest to comprehend the part played by emotional intelligence in an individual success has increased off late. The ability to realize, utilize, and manage emotions positively with the intention to self-motivate and create positive social interactions is defined as Emotional Intelligence [1]. The Emotional Competency Inventory (ECI) acts as a measure of emotional intelligence based on emotional intelligence competencies [12]. A total of 20 measures are broadly classified into the following four categories: self/relationship management and self/social awareness. The present education system primarily deals only in improving students' IQ does not focus on their emotional quotient (EQ). Schools and colleges must work on student's emotional quotient for their overall development [1]. Researchers have stated that sound emotional intelligence should be a requirement for students before they are given formal academic material in classes [13]. A consequence of a low level of emotional quotient is insensitive towards real-world problems. This in turn leads to ignorance on how to solve these problems. Thus, low EQ indirectly affects your interest in education, as depicted in Figure. 1.2.

Therefore, creating intrinsic interest by instilling enthusiasm, motivating periodically, carrying out interactive and engaging lecture sessions, regularly conducting activities, ensuring fun-based classroom learning, and maintaining decent EQ levels is essential towards students' engagement. The data obtained from the conducted survey shows that not many of these are being followed in the existing Indian education system. The education system should not ignore the fact that many students of this technical age just are not finding it interesting to read from the prescribed textbook. Such an approach will eventually drain students' interest and motivation to grasp a particular course [14].

1.3 Gamification

Gamification is defined as the usage of game components such as elements, design thinking mechanics, frameworks, and dynamics in a non-game scenario. The primary motivation behind this technique is to solve a particular real-world problem by engaging users/players, improving user experience, promoting desired behavioral, and psychological changes [5]. The impact of gamification in different fields is discussed in Table 1.2. There are a few terms and concepts people usually are confused among [15]:

- **Gamification** - Uses game ideas, elements, and mechanics in a different environment [5]
- **Game Inspired Design** – Does not express addition of game elements but rather use of playful design [16]
- **Serious Games** – Games designed explicitly for physical or mental training [17]
- **Simulations** – Similar to Serious Games, but similar to real-world entities/scenarios [18]
- **Games** – It is a period of play that involves fun and ends in a final result [17]

Table 1.2. Impact of gamification in various fields.

R.no	**Fields**	**Impact of gamification**
1	Gamification in E-Commerce [19]	Gamified components applied on various websites have the competency of not only spreading positive impact on people but also enhances the confidence of its customers online. The foremost benefit of using gamification in e-commerce websites for generating a huge amount of profit, customer relationships, and increase their brand value.

2	Gamification involving customers engagement through fitness application [20]	Recent research implies that in some cases gamification may not necessarily generate anticipated results; rather, the efficiency of Gamified model may depend on the defined elements used for some specific task. In a nutshell, game elements in an application will matter the most.
3	Gamification technique used to increase Mobile app users [21]	Gamification is the best option for increasing mobile application users' brand value and loyalty towards the brand. Research on gamification reveals the fact that user experience is directly proportional to the frequency of users using it explaining high and low brand loyalty.
4	Gamification in tourism [22]	It classifies various game design elements and deliberates essential extrinsic motivational features that add value to eloquent gamification. Gamification is evolving as an intrinsic form of marketing for attracting potential tourists, growth opportunities for new upcoming tourism brands, especially in those cities which have beautiful destinations but are never discovered. For the tourism industry, essential game elements are, reward points, badges (extrinsic elements), relation, sovereignty, and competence (intrinsic elements)
5	Gamification in health care [23]	This research emphasizes gamification mechanics for engaging multiple users in varied (i.e., emotional, behavioral, and cognitive). For enjoying these privileges users are generally expected to incorporate and experiment with these skills.

6	Gamification in education	Gamification has significantly acquired the interest of various educational institutions as it will not only enhance the learning skills of students but also helping them in learning skills for their professional careers. The crucial elements are motivation, effective task design, identifying games for students to engage with learning more, short term activities, various kinds of rewards which is the staple of gamification

While the term 'gamification' remains inconsistently used by different individuals in different contexts, the concept of gamification is gradually drawing massive attention in several domains such as human-computer interaction, health care, and education [24]. Gamification makes learning a lot more fun and engaging through the usage of game components and elements. It needs to be noted that not all game elements are applicable in all contexts. Game elements have to be chosen according to the context and then implemented [25]. In the article by [26], authors have shown that gamification has a very constructive impact on an individual's cognitive, behavioral, and emotional engagement through game elements like badges, progress bars, avatars, etc. A healthy teaching-learning environment with active student engagement is essential for their learning. The higher motivation and engagement in educational institutions implementing gamified education systems can be attributed to three reasons:

1. The usage of game avatars, such as science-fiction characters or secret agents gives a sense of social recognition and credibility to the player.

2. Decent game designs map the game's difficulty to the player's cognitive abilities appropriately. This makes sure that the player does not feel discouraged at any point and constantly motivates him to do alittle better.

3. Games, especially simulation types, allow players to experiment without the fear of being wrong. This lets players see failures in games and gamified education as opportunities to learn.

Thus, implementing a gamified teaching-learning system in high schools and will motivate students and increase their interest in learning the subject matter. However, pseudo gamification does not yield the results expected from gamification [9]. An experimental comparison study on flipped learning was conducted. Students were divided into gamification-enhanced flipped learning groups and non-gamified flipped learning groups exhibited the former team producing better quality artifacts in pre-course thinking activities [27]. Not just in schools and colleges, gamification of education has also yielded positive results in higher education including management and science courses [28]. The benefits of gamified learning systems help to understand how these systems can be used and classify their worth in educational institutions. In a learning environment, gamification leads to the employment of game components such as elements and mechanics in appropriate contexts to give the desired output. Optimal challenges based on the player's current level are translated into points that provide rewards in which gamification can be leveraged.

1.3.1 Comparison Between the Existing Education System and Gamified Education System

The comparison is discussed to depict the clear demarcation between the existing system and Gamified education system by considering seven key points.

- **Concept:** In the existing system, the concept is directly proportional to the time factor. Whereas, the gamified system is variable.
- **Challenges:** Existing system has internal assignments and tests as challenges, while the gamified system provides challenges in engaging activities and online quizzes.
- **Environment:** Gamified system has a game-like environment while the existing system has a formal structured environment.
- **Teaching Methodology:** One-way teaching is followed in the present education system. While, the two-way teaching process is followed in the gamified framework that includes points-based discussion, flipped learning, etc.
- **Results:** In the existing system, final marks are used as key performance

indicators. However, daily performance visualization is followed in the gamified framework.

- **Rewards:** In gamified education, students are rewarded badges, ranks, leaderboards, etc., while grades/marks are rewarded inthe existing system.
- **Content deliverance:** 1: m (Faculty: Students) content deliverance process is followed in the traditional education system while n:m (Students: Content Representor) process is followed in the modern gamified education system as represented in Figure. 1.3.

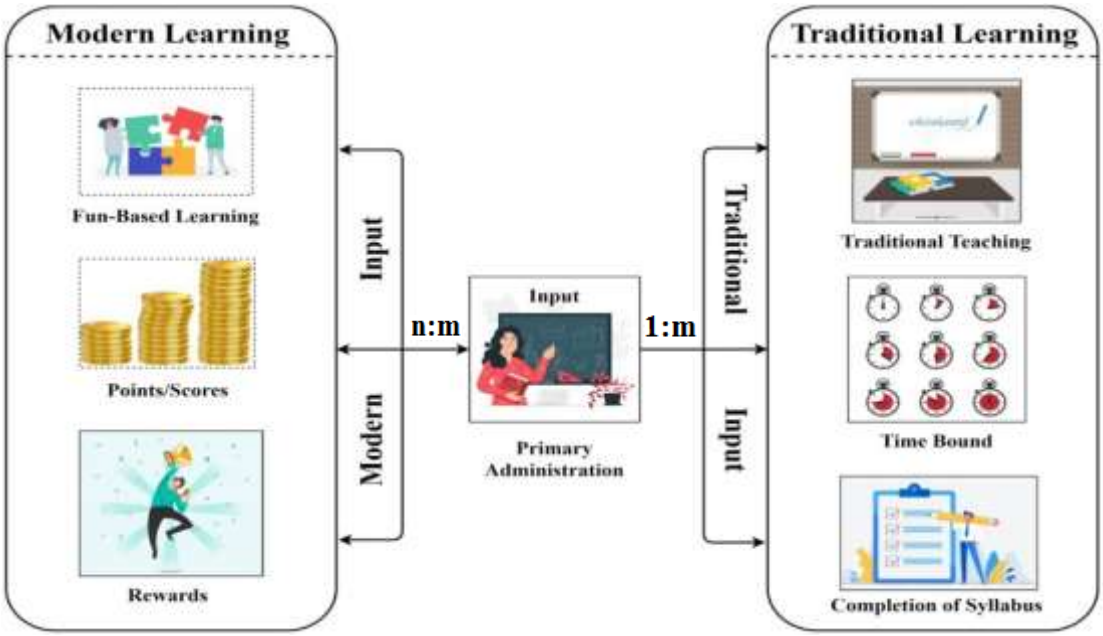


Figure 1.3: Comparison between existing system and gamified system

Gamification has been proved fruitful by showing several desirable outcomes such as enhanced student engagement, increased time spent on independent research, and completing lab work. It also provided a frameworkfor reflective tasks designed to engage students [4].

1.3.2 Some Common Misconceptions and Challenges

One of the most prevalent misconceptions among the common masses is that gamification can become a fully automated learning-teaching system. It is very important to remember that gamification requires hours of bug-fixing and fine-tuning in the presence of a subject matter expert. Gamification is a teaching strategy and not a complete replacement for actual human teaching or training [26]. Also, following a

gamified teaching approach would not lessen the burden on the instructors but rather increases the workload. Instructors would be required to regularly deliver feedback and check on the students' progress in a gamified learning environment. This feedback has to be provided as soon as possible and continuously throughout the course, unlike the present system where the instructor must evaluate tests only twice or thrice in the entire course duration [27].

Gamification, unlike commonly misinterpreted, is not just limited to adding game elements like points, badges, and ranks [9]. Adding game elements without properly thinking about the desired behavioural and psychological changes will not yield the desired results. Designing game mechanics and dynamics for the Gamified framework is a real task. Extrinsic Motivation undermines intrinsic motivation [28]. Once students start receiving rewards for doing something they originally love, eventually, they would lose interest in the activity and do it just for the rewards. This might result in students wanting to study or learn something only when provided with external rewards.

1.4 Need for Gamification

To understand the students' attitude towards the existing education system, an online survey was conducted. The survey consisted of 13 research questions, each addressing a particular factor relevant to either the present education or gamified education system. Thus, the data collected was analyzed through mathematical modeling to figure the flaws in the current education system and the desirable features of a gamified teaching-learning system.

1.4.1 Research Flow Overview

In this study, the behavioral and psychological impacts created by the existing education system is analyzed through a question-answer survey and compared with a gamified education environment. The proposed survey begins with the identification of gaps in the existing education system, creating objectives, making relevant research questions, sorting the formed questions into multiple sections (namely 'Questions on Current Education System' and 'Questions on Gamified Education System'), sharing about the survey on various online platforms and analyze the obtained results.

1.4.2 Research Questions

It is crucial to realize gaps in the existing teaching approach to be able to suggest an improved and efficient gamified teaching approach. A set of researchquestions have been framed, each addressing one specific objective trying to figure out the setbacks of the current system as given in Table 1.3.

Table 1.3. Research questions (RQ) and their objectives

Q No.	Identified Research Question	Objective
RQ1	The current classroom teaching approach motivates to learn new concepts.	Aims to understand how motivated students are.
RQ2	The current classroom teaching approach is interactive and engaging.	Intends to find out the opportunity provided to students to ask questions during the lecture session.
RQ3	Current classroom teaching is filled with activities and fun: Fun-Based Learning.	Aims to find the conducted activities apart from regular teaching.
RQ4	Current classroom teaching creates a sense of satisfaction, comfort, and determination while learning a new concept.	The emotional intelligence of the student is being addressed.
RQ5	I am willing to attend college even if attendance was not mandatory.	Aims at figuring out the interest levels of the student.
RQ6	The current education system is not just for marks but for the overall learning and growth of the student.	The learner's interest in the subject matter is identified.
RQ7	Marks are a good judge of subject matter knowledge.	To understand the student's mind towards the approach of marks-based merit.
RQ8	Rate the current education system on a scale of 1-5.	Intends to understand the overall students' opinion on the current teaching approach.

RQ9	"There is a need to improve the existing education system."	To analyze the need for a new teaching approach.
RQ10	"A new teaching approach which reinforces your engagement and motivation would help in learning the subject matter better."	Intends to figure out the attributes required in a new education system.
RQ11	"I am willing to attend college if every subject was taught in a gamified fashion even though the college follows a 0% minimum attendance requirement policy."	Anticipates if a gamified system would interest them in learning the subject matter.
RQ12	"On a scale of 1-5, how urgent is it to work on the current education system."	Anticipates how urgent students feel it is to improve the current system.
RQ13	"On a scale of 1-5, how necessary is it to work on the current education system."	The necessity to figure out the upgrading required in the present education system.

1.4.3 Survey Participants

The survey form has been shared within the student community with the support of several social platforms like Twitter, WhatsApp, Facebook, etc. The survey has been conducted online, and significant data of 137 students from different academic backgrounds are considered. We had 96 male and 41 female students from different colleges (e.g. Gayatri Vidya Parishad, KL University, Lovely Professional University, Bits Hyderabad, etc.) across various Indian states (like Punjab, Andhra Pradesh, Gujarat) pursuing a variety of courses ranging from BBA, B.Com, B.Tech, M.Tech, M.Com, B.Sc, M.Sc took part in this survey. The results obtained from both the sections (namely 'Current Education System' and 'Gamified Education System') were analyzed to determine whether it is required to pivot from the exiting learning-teaching system to a gamified environment.

1.4.4 Reliability Tests on Data Sets

The consistency of the analysis has been verified through Cronbach's Alpha Test.

This test validates internal consistency and is considered a scale of reliability. Hence the consistency, validity, and acceptance of statistics are plaid through this method. Software named SPSS is used for this purpose and the steps followed are depicted as follows Open file - insert data - analyze - scale - Apply reliability test. The output of Cronbach's Alpha Test is given in Table 1.4. It shows that the data collected is valid and no inconsistent data points are existing. Table 1.5 defines the alpha value which is greater than 0.6, demonstrates good internal consistency in the collected data.

Table 1.4.Data validation

Cases	**N**	**%**
Cases Effective	137	100.0
Debarred	0	0.0
Total	137	100.0

Table 1.5. Cronbach's alpha test

Cronbach's Alpha	**Cronbach's Alpha**	**Based on Standardized Items**
0.734	0.703	13

1.4.5 Results

The survey results in Table 1.6 show that not many are satisfied with the existing system; the opinion is rather neutral or dissatisfied. Survey shows that students are not motivated to study new ideas, and the current teaching methodology is not engaging and interactive enough. RQ1 clearly states that only 8.8% of students strongly agree, and the rest, 91% of students, have low motivation levels. There is a need to inculcate intrinsic motivational factors, which creates an environment to complete a particular task or engage them with interest. RQ2 survey results state that 6.6% of students strongly agree that the current approach is interactive enough, while 93.4% feel there's still a lot of room for improvement. Interactive teaching methodology enhances the retention of the topic, which makes it very essential for education. RQ3 states that only 8% of students strongly believe that project-based teaching methods are

conducted. Another, classroom learning is highly theoretical, and the activities are limited, or in few cases, non-existent. The teaching methodology opted by the present education system is still based on the lecture system and the least involvement of students. Results of RQ4 state that while 8.8% of students strongly believe, the current system is comforting and generates determination and satisfaction. The teaching system needs to create engagement and determination while teaching a new topic for effective student learning.

Attendance is one of the enforced parameters used in the present education system. In RQ5 results, only 13.1% of students would like to attend physical classes if attendance is not mandatory. RQ6 states that 87% of students believe that the current education system is marks-oriented but does not cater to the overall development of the student. Students need to learn things outside of the books and not study just for the marks. While marks are a metric for measuring an individual's knowledge, they cannot be the sole judge for the same. RQ7 states that 93% of students feel that marks are not the only measure of knowledge. A considerable number of people (44 students) have said that the existing approach is pure marks oriented but not for the overall development and that marks are not an singular measure of an individual's subject knowledge. Overall, 10% of students gave our existing system a rating of 1, 20.4% gave a 2, 41.6% gave a 3, 19.7% gave 4, while only 8% gave a 5.

The need to improve the current education system by bringing a new one that reinforces students' motivation and engagement is depicted through RQ9 and RQ10. Close to 90% of students agreed that there is a need to improve the present teaching approach with a more engaging one. RQ11 shows that students are interested in attending college even if attendance was not mandatory if classes were taught in a gamified mode. More than half of the survey responses (90%) have stated a need to improve the current education system. Results show that a new teaching methodology supporting students' motivation, interactivity, and engagement would help them better. A huge number of students (81%) said that even though the college followed a 0% minimum attendance requirement policy, they would be willing to attend if every subject was taught in a gamified fashion.

Table 1.6. Survey Result (*Measured on a scale of 1-5; the columns 'Strongly Agree' represents 5 and Strongly Disagree' represents 1

Q No.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
RQ1	8.8%	42.3%	28.5%	15.3%	5.1%
RQ2	6.6%	43.1%	29.9%	15.3%	5.1%
RQ3	8%	24.8%	29.2%	27.7%	10.2%
RQ4	8.8%	38%	30.7%	17.5%	5.1%
RQ5	13.1%	40.1%	21.2%	16.8%	8.8%
RQ6	14.6%	32.1%	21.2%	20.4%	11.7%
RQ7	7.3%	26.3%	21.9%	29.2%	15.3%
RQ8*	8%	19.7%	41.6%	20.4%	10.2%
RQ9	55.5%	33.6%	6.6%	3.6%	0.7%
RQ10	40.9%	49.6%	7.3%	0.7%	1.5%
RQ11	38.7%	43.1%	13.1%	4.4%	0.7%
RQ12*	45.3%	28.5%	21.9%	2.9%	1.5%
RQ13*	47.4%	30.7%	16.8%	4.4%	0.7%

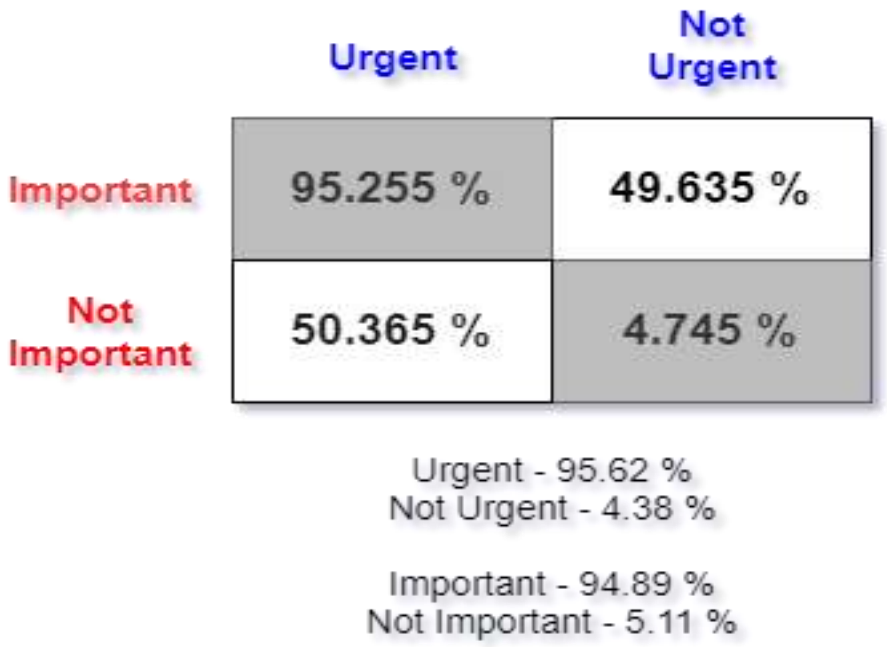


Figure 1.4: Eisenhower's decision matrix

The survey also collected information on how urgent and how necessary (RQ12 and RQ13) it is for our education system to be gamified. Drawing from Eisenhower's Decision Matrix given below, the obtained responses can be placed as in the below Figure. 1.4.

A very high percentage of students have reported that it is very urgent and highly necessary to take an action and improve the existing education system as shown in Figure. 1.4, thus placing it in the first box, the 'DO' box, of Eisenhower's Decision Matrix.

1.4.5.1 Analysis Using Python

Analyzing the columns in detail by dividing the students into 9 categories:

1. Satisfied with the current system and Satisfied with the new system
2. Satisfied with the current system and Neutral for the new system
3. Satisfied with the current system and dissatisfied with the new system
4. Neutral for the current system and Satisfied with the new system
5. Neutral for the current system and Neutral for the new system
6. Neutral for the current system and dissatisfied with the new system
7. Dissatisfied with the current system and Satisfied with the new system
8. Dissatisfied with the current system and Neutral for the new system
9. Dissatisfied with the current system and dissatisfied with the new system

Results

Category-1: 76, Category-2: 1, Category-3: 0,

Category-4: 45, Category-5: 1, Category-6: 0,

Category-7: 13, Category-8: 1, Category-9: 0.

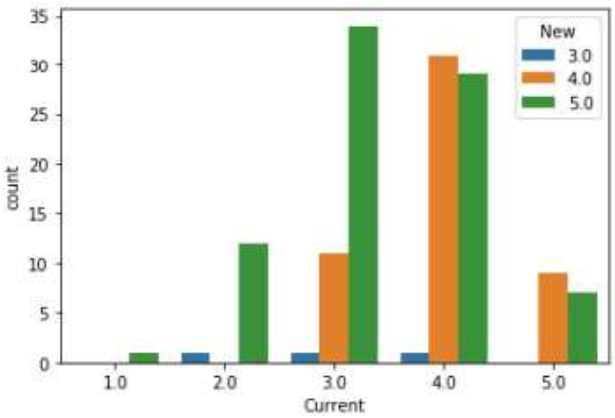


Figure 1.5: Level of satisfaction of students

Figure. 1.5 compares the level of satisfaction of students for the current system with the level of satisfaction for the new system.

- All students that are strongly dissatisfied with the current system strongly support the new gamified system. (Rating 1.0 for current, rating 5.0 for new)
- Most of the students that are dissatisfied with the current system strongly support the new system, while only one of them is neutral for the new system i.e. the student is dissatisfied with the current system but it doesn't matter for him/her if the new system is implemented or not.
- Out of all students who have a neutral approach towards the current system, most students are in strong favor of the implementation of the gamified system, while one of them is neutral towards the new system also i.e. for this student, it doesn't matter which system is brought into use.
- All but one of the students who are somewhat satisfied with the current system, also agree to the implementation of the new system and are in its favor. Only one student has a neutral approach towards the new system.
- All the students who strongly favor the current system are also in favor of the implementation of the new - gamified system.

1.5 Research Objectives

The major concern in academic institutions is student engagement in the classes. In the present scenario, it isn't easy to find self-motivated students. It is challenging to find regular students in classes without enforcing them with attendance constraints. The prime objective of the proposed study is to design a gamified framework that will embrace student enticement, engagement, and self-motivation among students. If the students are motivated in the class, it will be directly proportional to good future results and more productive classroom teaching/learning outcomes.

In this era of modernization, Teaching has become one of the biggest challenges. The ample amount of knowledge is available on the internet, and attracting the students towards the classroom requires knowledge of the instructor, his teaching expertise, and the pedagogy involved in the classes. The latest pedagogical tools available with the instructor are whiteboards, simulated environments, access to multimedia content like audios/videos, animations, PowerPoint presentations, etc. The primary objectives include:

1. To access and evaluate various methods and means for self-motivated engagement and learning of students for various disciplines.
2. To develop the game elements, mechanics, and dynamics for engagement and higher-level learning of different categories of students studying in different disciplines.
3. Implementation of the Gamified system on the selected set of students and evaluation of the outcome thereafter.
4. Reengineering the Gamified system for an optimal outcome on engagement and learning through an assessment done in objective 3.

The proposed and promising approach to answer above mentioned questions is to use the augmentation of classroom engagement and learning using the gamification approach in classes. A gamified framework may include many deployment features. Some of those features may include: a credit-based system to earn rewards, points with regular attendance, participation in extra activities, scoring good marks.

1. Formulation development and characterization of the gamified framework by following:

   - **Delineate target behaviors:** Regularity of students, students' class participation, Use of latest technologies (like mobile phones for tests, enfoldment, and learning of students through games), Student participation in extra activities.
   - **Describing players:** Faculty, students, support system.
   - **Device activity loop:** Engagement loop and progression loop.
   - **Deployment of tools:** Points, badges, leader boards, redemption options, feedback.

2. **Evaluation of Gamified framework:** Implementing the Gamified process in various streams to check its practical feasibility.

3. Quality control evaluation of optimized framework through Student and faculty feedback.

4. Statistical analysis of result set.

1.6 Research Methodology

The expected outcome of the research work is to create a Gamified education system to enhance student engagement and enticement towards classroom learning. A flow chart in Figure. 1.6 is a depiction of activities followed to achieve the mentioned objectives.

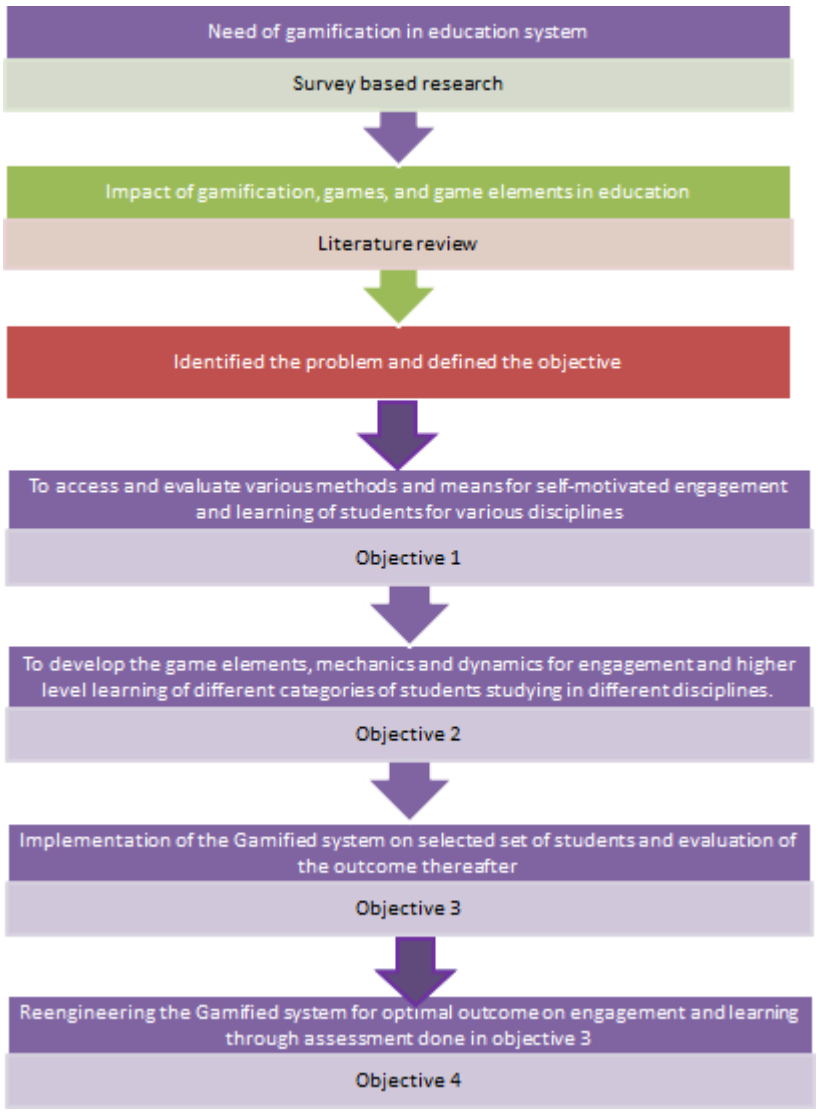


Figure 1.6: Research methodology

1.7 Thesis Organization

The thesis structure and dependencies are shown in Figure. 1.6, Chapter 1 focused on the existing system and the need for the Gamified education system. Chapter 2 presented the taxonomy-based literature review on various Gamified systems, game-based learning, and various game elements available. Chapter 3

elaborates various methods and means for engaging the students. Chapter 4 explains the development of the unique hope enabler equation that defined the various game elements involved in the Gamified framework. Chapter 5 focused on the implementation of the Gamified framework and its results that are further reengineered to make the teaching/learning process more efficient elaborated in chapter 6.

- **Chapter 2:** The taxonomy based on various Gamified educational methods is analyzed by defining the number of participants, descriptions, benefits, and findings in this field. A description of how games are different from gamification is elaborated with the use of a flow diagram. The taxonomy based on various game elements with the demarcationof the element type, description, and benefits is analyzed and evaluated. The Various challenges faced in the Gamified education system are elaborated.

  -***Kavisha Duggal***, *Parminder Singh, Lovi Raj Gupta.* "Impact of Gamification, Games, and Game Elements in Education" during Innovations in Information and Communication Technologies IICT-2020 from 7-8 November, 2020.

- **Chapter 3:** To access and evaluate various methods and means for self-motivated engagement and learning of students for various disciplines. Various games are implemented and elaborated that acts as strong motivators among students.

  -***Kavisha Duggal***, *Lovi Raj Gupta, Kavya Sri.* "Games Transmogrified to Make Classroom Teaching More Effective" International Journal of Computer Sciences and Engineering, Volume-5, Issue-12 E-ISSN: 2347-2693, published on 31/Dec/2017.

  -***Kavisha Duggal***, *Parminder Singh, Lovi Raj Gupta.* "Accessing various means for Classroom Engagement to justify the need of Gamification" Communicated to a referred journal.

  -***Kavisha Duggal***, *Parminder Singh, Lovi Raj Gupta.* "Intrinsic and Extrinsic Motivation for Online Teaching in COVID-19: Applications, Issues, and Solution." Emerging Technologies for Battling Covid-19: Applications and Innovations (2021): 327-349.(Scopus)

- **Chapter 4:** To develop the game elements, mechanics, and dynamics for engagement and higher-level learning of different categories of students studying in different disciplines. The survey is conducted on Methods adopted for present Classroom teaching, it consists of 16 questions. The four elements were formed faculty conduct, teaching methodology, environment, and reward applying factor analysis and further hope equation was defined applying regression and One-Way Analysis of Variance (ANOVA) test.

  -***Kavisha Duggal****, and Lovi Raj Gupta*. "Hope Enabler: A Novel Gamification-Based Approach to Enhance Classroom Engagement." In Proceedings of First International Conference on Computing, Communications, and Cyber-Security (IC4S 2019), pp. 501-519. Springer, Singapore, 2020.(Scopus)

- **Chapter 5:** Implementation of the Gamified system on the selected set of students and evaluation of the outcome thereafter. Re-engineering of Reward-based Decision Making using ANFIS (adaptive neuro-fuzzy inference systems) model for decision making is elaborated.

  -***Kavisha Duggal****, Lovi Raj Gupta, and Parminder Singh.* "Gamification and Machine Learning Inspired Approach for Classroom Engagement and Learning." Mathematical Problems in Engineering 2021 (2021). (SCIE)

- **Chapter 6:** Reengineering the Gamified system for an optimal outcome on engagement and learning through an assessment done in objective 3.
- **Chapter 7:** The complete conclusion and future scope is elaborated.

1.8 Summary

Formal education for youngsters is an important aspect of building the future of this world. From the current survey, it has been analyzed that the present education scenario has several limitations concerning the overall engagement and knowledge of the students. The critical survey defines the low level of interest of the student towards the present education system that is a concern that needs to be taken into consideration on a priority basis. Games are considered a source of fun and entertainment that creates a positive impact on the psychological level. These can be used to fill in the gaps of the existing teaching-learning approach. The

derived empirical boolean expression can be utilized to determine the motivation of an individual towards their studies. Students conveyed their opinion, through the survey, that it is highly essential to improve the existing system at the earliest possible; thus, placing it in the 'Urgent-Important' quadrant of Eisenhower's Decision Matrix. A gamified education system can increase student engagement and enticement for classroom learning.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

In education usage of games or game elements is not new. In the early 1960s, Piaget (1962) figured out that not only the games would help learners to master their skills but also helps to build a life of their thoughts and creativity. Throughout the history of mankind, [29] games have been a part of human societies. They take on numerous forms specifically: card games, tabletop games, dice games, different sports, etc. In the present era, games are getting progressively common with the approach of computers and the Internet. It can be inferred that practically everybody born after 1980 plays or has played computer games. It's implied that for this multi-billion industry, understanding and advancing games is essential. However, getting games – in specific, their excellent inspirational force – can be helpful in an assortment of different fields and applications. The elements, which make the games interesting and exciting, and the games' basic nature are considered intrinsically motivating. Therefore, the game mechanics, when applied to these two, may increase the students' overall intrinsic motivation in the classroom [27].

Gamification means using the gaming elements and structure to entice the users to lure them into the specified task and in turn, provides a better user experience and more effective learning [30]. Gamification is defined as changing the non-gaming environment into game settings [5] which includes proper usage of game elements. In higher education, gamification is used to increase learner's motivation and engagement in a task. Gamification tends to increase the engagement of people in the activities being undertaken through increasing their intrinsic and extrinsic motivation [31]. The engagement word can be implicated in various meanings based upon various situations. Engagement in the context of learning is defined as [32] "a collection of mindfully goal-directed states in which motivation arising from positive emotions serves to grab and sustain the learner's cognitive and motor competencies, typically requiring some level of effort". Throughout the game, the active involvement of the players is referred to as engagement in the context of gamification.

Gamification is a process of utilizing the Gamified structure and providing a platform for each student to act like a player. This feeling of involvement increases their focus and learning ability. Gamification has successfully influenced individuals to practice the piano staircase as the replacement for the elevator and acted as a medium to change one's habit [13]. Several day-to-day activities in our routine work include the process of gamification. Therefore, by inculcating various levels with increasing difficulties and requirements of different skills we can help them imbibe new skills and perform higher difficulty problems by focusing on the key areas and increasing their concentration [33]. One way to show how implementing a Gamified environment can be helpful is by including a game in the class in which every day the teacher asks the students 5 questions from the newspaper and give them the points which get reflected in their semester grades. This will lure or motivate the students to read the newspaper daily leads to overall development.

Motivation:- This work aims to find various guidelines to implement the concept of gamification in the education system. Different methodologies and terminologies are used to create an education system more exciting and engaging. The concept of gamification, learning based on games; usage of various game elements is applied at various stages of the education system. The important aspect of the work is to enlighten the various parameters used to make the education system more engaging and enticing. There is a need to explore game elements that inculcate intrinsic motivation among students irrespective of the course they study.

Contribution:-Future researchers will be benefited from this article as the latest advancements done related to Gamified education system are explored. The taxonomy based on various Gamified educational methods are analyzed by defining the number of participants, descriptions, benefits, and findings in this field. The motivation behind the work is RQ1: To provide insight into the work done in the field of education to enhance the students' motivation, engagement by examining the different learning modules that explores the impact of gamification and games on learners.

A description of how games are different from gamification is elaborated with the use of a flow diagram. The taxonomy based on various game elements with the demarcation of the element type, description, and benefits is analyzed and evaluated for RQ2.

RQ2: The correct usage of game elements in the Gamified framework to enhance the

learning process among the students.

Even after attaining successful results in the field of the Gamified education system, various challenges need to be addressed to enhance the overall education system.

RQ3: Various challenges faced in the Gamified education system are elaborated.

2.2 Impact of Gamification in Education

The setup provided utilizing the Gamified approach will prove to be beneficial in the present-day approach of higher education institutions. The study lays stress on the fact that the Gamified approach will be highly beneficial as it will entice much more participation and will be an enjoyable method of both teaching and learning. Gamification will be a major role player in the success of MOOCs due to the influence that it will have on individuals and organizations [25]. Reflex is the study of the newly developed gamified learning system. It presents 3D virtual world in a browser which helps the user to enhance his learning and give his feedback. Based on the concept of gamification design Reflex can predict learner behavior during interaction [34]. Components like relatedness, flow, autonomy, mastery, and purpose in the design have been integrated into the proposed framework. The main focus is on dimensional flow and motivational determinants to deliver a sustainable gamified experience to the user. The author has constructed game-based learning for law students. They have discussed the challenges being faced during the designing of game elements for better, engaged learning for law students. An interactive slide-based storyline was developed for the teachers for the creation of simulations quickly and easily for the addition of game-based elements in interactive learning [35]. Programmers, developers, or learners may face a challenge when it comes to the understanding of programming. There are web forums available like Stack Overflow where one can post his questions, queries, and get n rapid responses from online communities. To let the system go on websites like Stack Overflow, community people must come up with a rapid response. As gamification proposes a reward-driven approach, measured by response time. It has become a popular method for increasing active participation on such websites [36].

Classroom lectures are a traditional staple of formal education. Due to advancements in technology and the importance of class attendance, students are bound to sit in classes. To increase the students' engagement and motivation to attend classes,

gamification has been introduced in teaching. Experimental work is done to use technological aids to encourage students for better attendance and engagement in classes. Quantitative analysis has been done to estimate the gamification impact on students' learning and attendance [37]**.** Students who work and study simultaneously may face certain challenges like arriving on time in class, low participation in-class activities, and submission of assignments on time. It may be tough for these students to survive in today's trending world. Virtual 3D blends are being used very commonly these days. The gamified concept introduced by using a virtual 3D environment to teach programming in classes got excitement among students. Due to lack of motivation and high students' dropouts in programming classes, a need for gamification was identified. Gamification helps students to gain confidence in their capabilities and increased participation in classes [38]. Gamification is an innovative approach used to enhance engagement among students related to in-out-class activities. The study revealed that students were encouraged through the Goal-Access-Feedback-Challenge-Collaboration (GAFCC) gamification design model to finish the pre and post-class tasks before the closing date in comparison to non Gamified group [27]. In reference to gamification, basic game elements such as game mechanics and dynamics are precisely used and applied in rural schools to facilitate the integration of user devices in the teaching and learning environment. Among various design fundamentals, Gamification was used in teaching and learning engagement to engage and encourage teachers with an end goal [39]. The research has been conducted among 136 students and was concluded that the gamified course design can help to create an engaging substantial impact on the learning environment for the students based on technology [40]. Comprehensively, this study can be utilized for professionals willing to establish contact with the capacitive population. The study advocated the effectiveness of gamified courses by evaluating the identification and implication of numeral background variables from the previous works. Furthermore, the meaningful gamification course design has been introduced representing the examination of the relationship among a gamified course, learning process, student involvement, and progress. Additionally, in each stage of the course, design process outcome indicators, and engagement of students have been identified that offer meaningful gamification. By focusing on meaningful teaching and learning, the results conclude that the technology-mediated gamification can facilitate supplementary enhancements with the condition of better-fitting enabling the lifestyle

and the motivations to the working environment of students. Table 2.1 based on various Gamified educational methods are analyzed by defining the number of participants, descriptions, benefits, and findings in this field.

Table 2.1. Research on previous Gamified methodologies implemented in Education

Ref.	**Participants**	**Description**	**Benefits**	**Findings**
[41]	205 students (average age=23).	The research proposes a concise view of representing a basic methodology of game design elements that utilize definite mechanisms for reward points and group leader boards.	A quick task-level response means learning process progress provides an application-specific experience.	Limited use of game components and mechanics with short intervention and short duration composition.
[42]	365 College students	A gamification approach is named "Horses for Courses" to investigate the Gamified learning in the field of statistics. The study comprises focuses, levels, challenges, and a leader board.	Three Diversified study domains were considered.	Game design by incentivizing the post-test Experience. The main focus is to achieve a higher rank on the final leader board.
[43]	120 Primary students	To teach numeracy, the adequacy of gamification in educational factors has been examined. Two versions are created in this study i.e. Feature Deviod Game (FDG)	Well-defined game mechanics are implemented and are utilized for result analysis.	More emphasis is given to game-based learning. The progression loop of gamification is not defined.

		and Feature Enriched Game (FEG).		
[44]	30 Students higher education	Gamification can be applied to six categories used for teaching and learning to enhance student engagement. Couse without online support, MOOC, flipped classroom learning, E-learning site, Gamified platform, Mobile learning.	Good examples are discussed on how gamification can be applied to the 6 categories.	The framework for gamification categories for teaching and learning is not explained.
[45]	130 Grade 3 students	The study focuses on the growth of a base model for basic comprehension to acknowledge the use of gamified mobile applications along with creating an engaging classroom learning environment.	A balanced mix of student-centric learning approaches is followed along with those students cooperatively helping each other to finish their games.	It is more like game-based learning rather than Gamified learning.
[30]	30 students Age 6-8	To inspire students to attempt new things and avoiding the dread to make mistakes, gamified learning situation as an activity is used. Further, the study retains the game-like environment.	The activity consists of fun elements, motivation, and engagement.	The game elements involved in Gamified learning activity are not highlighted.

[46]	80 Students	The comparative study over time showed that learners enrolled in the gamified classroom recorded insufficient inspiration, fulfillment, and empowerment than the students who are registered in the non-gamified course.	Students enrolled for two courses, their effort, learner empowerment, social comparison, academic performance, motivation, satisfaction, and motivation was analyzed for a semester.	More focus is on earning badges, coins, and leader boards. The framework lacks Game elements like narration, cooperation, feedback that lead to intrinsic motivation.
[47]	3rd-year students	To analyze and build a technological platform aiming to introduce gamification methodologies or game mechanics in the teaching-learning process of engineering students in the computer science field.	The steps and mechanics involved leads to the development of student motivation for formal and informal learning.	The engagement and progression loop are not discussed in the methodological proposal.
[48]	50 Software engineering students	Explored the value and trend of implementation of gamification in software development team. In the entire process, it is being noted that the gamification pattern is going in very encouraging.	It appears that usage of game design and game mechanics can be the best fit in teaching software development processes.	Team performance evaluation and observation were done manually which makes the system dependent on the facilitator.

Over the past years, gamification intended to leverage the interest in academics which seems to remain a trending methodology among the few percentages of teachers and approximately 11.30% utilize gamification in their courses consistently. In the educational research, there is negligence in the actual use of gamification teachers' perspectives towards gamification [44]. The concept of gamification is not only implementing a system that is effective, useful, and can change behavior. An efficacious Gamified application should provide the experience more engaging, enjoyable, and should have different levels of enticement [6].

2.3 Games and Edification

Many researchers are influenced by PC games due to their capability to engage and allure the player's consideration for broadened timeframes [46]. While in the field, a player always feels engrossed and committed in the game and lays stress on each minute detail of the scenario for accomplishing his goal and success. The educational instructional practices have been redefined and reshaped with the help of gaming [47]. An instructor must recognize the role of games for his students and himself in learning. The majority of students carry an optimistic approach towards the usage of games in their classes during teaching. But the game design has a main and crucial impact on the successful implementation of learning based on games. Learning based on games is considered one of the efficient learning processes that help learners comprehend the topic by visualizing and learning the concept with the help of a game designed to overcome a specific task [48]. Technology-oriented games are considered a vital part of our social and cultural environment.

2.3.1 Game-based Learning

Games-based learning plays a major role in creating different impressions on the mindset of players. Various studies have been implemented to show such effectiveness of game-based learning on human emotions. Researchers have shown an experimental study to analyze the effect of various traditional games which produce the different intensities of emotions likely positive, negative, or ambiguous). This helps in examining the different social structures and various emotion levels produced while participants taking part in traditional games [49]. The suggested way of combining two game-based approaches Digital Game-Based Learning (DGBL) to analyze the learning behavior of students by providing empirical evidence. The study

included real competition and virtual competition covering aspects of easy tasks and difficult tasks that can be synthesized for improvising the competitive design of DBGL[50].

In the Game-Based learning (GBL) context, students usually get instant feedback about their solutions and are required to submit their responses. Based on this concept, a comparison of the performance of learners with persistence on various methodologies was proposed. The study illustrated that each learner provides multiple computations for every methodology [51]. In the earlier years, game-based learning has been evolved with the utilization of video games, serious games, and more other technologies providing integration of analysis on the impacts of DGBL on various fields in education.

GBL facilitates the chance to expand one's aspects in a sense of authentic situations of science which leads to comprehensive learning. The study presented an approach to encourage students to take part in the GBL implemented physics class. The approach explains the interest and involvement of students in physics in various aspects. The study proposed a method explaining the usage of a simple board game to enhance the learning skills of students and creating awareness about complex subjects like physics. The methodology developed in this study has reduced the subject complexity and utilized the course syllabus in a systematic approach to mitigate the efforts of teachers [17]. With the flexible adaptation environment to various education goals and skill improvement, game-based learning facilitates a student-centric strategy toward education.

2.3.2 Serious Games

Serious games provide the learning process with the guidance of accomplishing one’s goal. This learning assists in aiming to track user behavior while inhibiting the unsuitable activity of the user during the process. Gamification can be utilized in the context of serious games. In addition to this, game mechanics and game dynamics can be used in any subjective field. Serious games can fit into the training course which can be improved while teaching. Serious games are highly impactful and are of wide capability on learning methods of participants in education due to their dynamic and normal design. Other than entertainment, serious games emphasize learning mechanics to implement engagement, motivation, and amusement. Here, research

proposed describing the findings utilizing a novel serious game. The study was conducted across schools in Ireland using a game directed on coaching along with entertainment. The study estimates the opinion of students and teachers while operatively involving students with astronomy and physics and using the game-based learning receiving the learning process [17].

Various studies have been implemented using serious games; for example, the research conducted in aviation safety education where the participants include children, students, or adults. The findings conclude the effectiveness of serious games over conventional teaching approaches, in turn, provides a safety-based opinion of learners [52]. The research [53] presented Game-based learning as a tool for amusement for all games also used for teaching. Further, a survey was carried out among private education students in Malaysia. This research focuses to determine the pupils' opinion and their thinking of GBL while considering the benefits of serious games implemented in their regular education.

2.3.3 Impact of Games in Education

The successful development of games has to overcome plenty of challenges like a more attractive design and better user experience. The authors have identified four commercial games that can be used for education. Their gameplay experience and potential learning may be used as an enhanced learning tool during implementation. Moreover, a systematic approach should be used to facilitate video games in educational settings [54]. Information technology subjects have been incorporated into the medical degrees of Spain to achieve horizontal competencies in the curriculum. Medicine disciplines lack tailor-made technologies so engaging learners in complex real-world situations is a big challenge. A model has been proposed to draft a simple method for the identification of teaching needs in the subjects of medicine degrees so that serious game-based implementations may be deployed during the development process [29]. Tobias Mettler and Roberto Pinto have presented a novel approach for designing serious games with knowledge transfer. They have also tried to identify the circumstances where game elements may be considered better than traditional learning forms. Primary factors for the increased usage of serious games in scientific knowledge are activities, providing plural learning ways, substitute problem-solving, and decision-making actions [55]. Dr.

Ernesto A. Pacheco Velazquez [56] has developed a business game named LOST. The primary goal of this game is to teach logistics in a simulator mode. Students learn the concept of logistics in the virtual world which gives them mere confidence as they are doing it in the real world. Gamification elements have been used behind the implementation of LOST stands for Logistic Simulator.

In the past decade Research in gaming has brought valuable changes in the form of career awareness area or as a tool to help students to learn subjects. Gaming motivated struggling students to continue their studies and avoid dropouts [16]. Good games usually hold successive sub-targets and as an alternative approach to resolve their problem as it can be very encouraging and challenging. Good games impersonate personalize learning maintaining morale and engagement between the players. Furthermore, good game plans utterly meet the player's intellectual capabilities with the complexity level [30].

Games facilitate a playable environment such as to enhance operative proficiency and social interaction. As a training system, games can be used in several areas such as business, non-profit, conventional, and social areas including education, defense, well-being, and various sectors [57]. With the integration of mobile technology involving the features of gaming into an educational layout, various searches have disclosed that the trends in mobile technology-supported gaming and its applications shows fewer systematic review. This means among various gaming platforms, learning strategies and gamification models could be an important part that affects the progress of students during the learning process [58]. Puzzle: Puzzles are based on an intrinsic concept to promote cognitive intelligence which is indirectly present in every instructive situation [59]. This intrinsic concept is also recognized as an intellectual activity, real puzzles, challenges, etc. The participants are provided with various activities such as quizzes or challenges and which are considered as the learning activities that focus on the cognitive challenge. The puzzle game approach emphasizes puzzle resolving that can be implemented by introducing various puzzle types [41]. Herein, various puzzle types can be used to test the skills of participants to conclude problem-solving skills. The author characterized games-based learning and its impact on the emotional behavior of students [49]. The study has shown various types of emotions such as cooperation, competitive behavior, and other emotional

changes such as psychomotor variations. The method proposed the intensity of emotions with an analysis of students' experience based on their motor action. The various games which are implemented in the education sector are elaborated with game objectives, game features, and learning in Table 2.2.

Table 2.2. Research on previous games implemented in education

Ref.	**Game implemented**	**Users**	**Objective**	**Game features**	**Learning**
[60]	The research presented a Matlab-based game	Undergraduate students	Analyze a statistical effect on students' performance by introducing the game and its features.	The contestants' results are carried out in an online database accompanied in the game and admitting an analytical report thereof.	Matlab-based game for teaching the interplay from evaluating the plot magnitude of linear filter.
[51]	Game-based learning environment (CodeMonkey™)	Elementary school children: first to sixth graders	Focus on Micro-level persistence by acquiring computational thinking.	To examine persistence in various occurrences a micro ++ the level approach during the training process is used.	The purpose of individual characteristics in aiding persistence in obtaining a suitable solution to a given task in the game.
[61]	Crystal Island multimod	College students	To examine the possibility of multimodal	Post-test performance and engagement,	Offers deeper insight into a student's

	al learning analytics		predictive modeling.	prediction using predictive models comprise of facial expression, gaze, and gameplay data.	performance by facial expression and gameplay to predict posttest scores.
[17]	astronomy board game	119 post-primary school students	To evaluate the game from the students' and teachers' perspectives and estimate the usability, attractiveness of the game.	Promote teaching resource based on the astronomy concepts arranged with the science course.	Learning through playing makes complex topics such as physics and astronomy more interactive and pleasant.
[62]	SumMagic game: DGBL	Seventh grade students (109 total (59 males and 50 females) 10 to 12 years old	Implementing teachings and practices to resolve science difficulties in the context of DGBL.	collaborative learning combined with tutorial video benefits in intrinsic motivation for students which Increases the utilization of intellectual resources.	DGBL video delivers the required information to students to utilize their time to play the strategic game while performing task-based activities.
[58]	Study on various games	Elementary school students	Study of publications between 2007	Focus on the technology trends in various	Emphasized on problems of

	based on the Game characteristics along with its context	to Working adults including educators and instructors etc.	to 2016 executed on game based mobile Technology.	perspectives of game-based learning different aspects in mobile technology.	encouraging game based learning in future mobile technology and research area.
[49]	Various traditional games consistent to various fields of motor action	1st-year pursuing a physical education and sports science degree (N=556)	Built on players' emotional experiences, to inspect the level of emotions produced.	The mixed-methods approach was applied to examine statistical differences between emotion, motor domain, and result type.	Traditional games can play an essential part concerning the emotional aspects of physical learning.
[63]	PlayIT: game Light Bot 2.0 a non-academic education facilitator providing ICT associated subject courses at various	Selected two different groups one with programming module and second who had recently complete	Involving participants in training to improve their coding skills.	The gaming elements were included along with traditional teaching to make active learning allowing students to use programming constructs in a game scenario.	Learner's are inspired to extend learning by using games that propose course materials and specified that games are beneficial in learning some coding

	education stages	d the program ming			concepts.
[50]	Developed (DGBL) and (AECCG)	Research conducted on university students (71 students)	The study suggests the outcomes of a Virtual-Competition Game (VCG) and Real-Competition Game (RCG) on student learning.	Two experiential research were conducted comprising RCG and VCG.	First Study focused on the effects of RCG wherein the second study emphasized on differences between the VCG and RCG.
[64]	Studied the impact of usage of acoustic and points	A different group of students	To teach new material and to estimate the outcome of using acoustic and points for game-based learning.	Kahoot! was used to deliver interaction with the use of audio and points.	Music effects and audio add to improve the classroom dynamics in a significantly optimistic manner.
[57]	Conducted research on current studies in GBL effects in leadership skills	8 Game-Based Learning processes with total of 120 participants and 15	The research focuses on the usage of games as a new learning tool to assist with complex scenarios and develop the	The study provided a correlated course for games scenarios and the organizational culture to create a leadership	GBL provides leadership skills development along with primary skills such as mindset, motivation,

	growth along with analyzing the emergence of new leadership styles	individuals for each course	skills required to analyze the leadership skills with the development of leadership styles.	typology analyzing content from the discussion forums of different GBL courses.	coaching, etc.
[53]	The survey conducted to identify GBL activities	students in private education (103 students and lecturers)	To identify the efficacy of GBL in a tertiary teaching environment and select the thinking and opinions of students.	Application of serious and commercial games	GBL is implemented in higher teaching systems providing positive responses to understand students' opinions and learning.

2.3.4 Differentiate Between Games and Gamification

In the present era, Gamification is an innovative concept that is realistic play-based learning. Introducing the concept of game-based learning is considered as one of the numerous exercises that can be part of the Gamified curriculum; on the other hand demarcation of gamification goes much beyond this conventional game concept where the engagement students will be from the beginning to the final lecture of the course. The students act as players provided with many challenges, competitions ahead to overcome [33]. Games are dependent on good graphics [30]. The idea of gamification is based on the capability to meet the basic human motives or necessities such as appreciation, bonus, fulfillment, competition, collaboration, self-expression, and selflessness. The design of the game is not the only parameter of gamification but

is directly associated with the habituation element of its implementation in various conditions to successfully execute specific activities [47]. Using gamification, the students can observe their earlier mistakes and cause of repetition failure which benefits students to improve the performance based on the analysis. This led students to accomplish the required target. The students are engaged to perform difficult tasks achieving the desired goal within a short period. Wherein, games permit the user to replicate a specific mission in the event of failure [65]. The difference between games and gamification is specified in Table 2.3.

Table 2.3. Difference between games and gamification

	Games	**Gamification**
Goals	Short Term goals	Long Term goals
Co-relation	Changing the learning method completely into a game	Utilizing game as a portion of the training course
Motive	Teaching a Skill: specific learning outcome focused on teaching a discrete skill	Learning system: complete pedagogical system
Elements	Usage of play-based elements e.g. puzzles, quizzes, etc.	Usage of game mechanics and gameplay elements e.g. leader boards, badges, trophies, point systems, etc.
Focus	Typical game structure for playing and training	Emphasizes Motivation and user engagement
Players	Users	Socializers, Explorers, Achievers, Killers

2.4 Game Elements

In Gamification, the game components are applied in non-gaming conditions with the main agenda of improving the user experience [43]. Deployment of gamification in the education system results in various game mechanics. Motivation, commitment and good behavior from students is the generic expected outcome from students. The use

of game elements in a non-game environment is increasing so that everyone can acquire appropriate skills and knowledge [47]. It has been elaborated that introduction of play elements into non-game environments is quickly going on top. Gaming has emerged as a new marketing strategy. Educators are using digital games in their classes to increase students' engagement. Influencers are using serious games to raise awareness about aspects of gaming as it has become a common way of engagement [29]. Gamification is being used to deploy game elements in educational environments to progress student learning and engagement during classes. Game elements like experience points and badges are being used in the gamification process. It was identified that the correlation of badges with learning is high as compared to experience points [39]. Online courses are becoming tremendously popular these days. Involvement of game mechanics like points, rewards, goal setting, and reputation, etc. are the primary reason for this popularity. Massive Online Open Courses (MOOCs) are influenced by the use of gamification but they do not guarantee that they will result in a better learning performance [25].

In practice, a restricted set of game elements are deployed in gamification applications such as points, leader boards, and badges [6]. There is a need to discover a different set of game elements and mechanisms that can create a difference in gamified applications.

2.4.1 Various Game Elements in Education

Gamification is a vast technology that can be transformed into various systems viz. the incentivizing of user activities through the token of appreciation and reward systems is another trait of gamification which is also named as point system [46]. The author stated that when a Facebook-like structure and game-inspired pattern were given to the students, they performed many exploratory activities. It was also identified that richness and complexity of multifaceted open social learner modeling positively affect the user learning involvement in terms of efficiency, effectiveness, and gratification [66]. Educational Gamification aids in achieving teaching and learning goals that can be observed as the layout plan of applying game layout components in educational settings [39]. The dynamics are applied to build the motive to accomplish the task manifested via Mechanics in classification. The dynamics are

the considerations associated with the task which is to be gamified. The methods which are used to drive the actions of the user are defined as mechanics. Mechanics are the components that are presented in the form of extrinsic rewards points and response characteristics like badges, etc. [59]. The game elements are different from game characteristics as mentioned in Figure. 2.1.

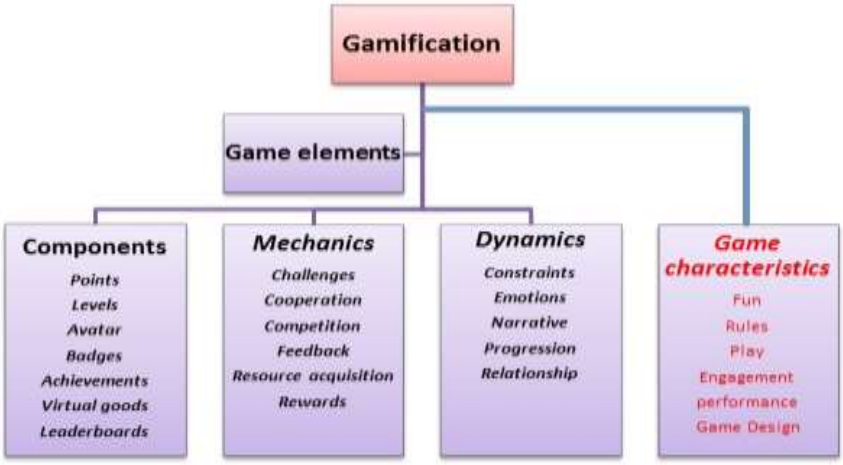


Figure 2.1: Game elements are different from game characteristics

Game elements are divided into components, mechanics, and dynamics. The game layout is a framework assisting the creator to create a better design by comprehending the game's pros and cons. An exemplary architecture of gamification described [65] the gamification model with extracted essential elements of game dynamics and game mechanics. Further, these extracted elements are mapped in the gamified learning application. Throughout the gameplay, the two-game elements namely game dynamics and game mechanics are interrelated while creating a better-gamified environment and are discussed further in detail in Table 2.4.

Components: Components are the effective elements that are used to form a gamification environment. These are the formal and dramatic aspects of the game which engage the user in the game environment. As an example, the various game components are the foundation, roles, and story. While combining such aspects with the inclusion of game dynamics and providing user experience [67].

Table 2.4. Features of game mechanics and game dynamics

S. No.	Features	Game Mechanics	Game Dynamics
1.	Functionality	Game mechanics describes the control means to gamify various actions and also several activities create a combination of participative and persuasive user experience.	Game dynamics explain the evolution mechanism of games and players.
2.	Application	The implementation of mechanics to various interfaces such as application, utilities, site, etc. corresponds to the users adapting play experience into present actions.	Game dynamics are developing behaviour that emerges from gameplay.
3.	Target	Game mechanics comprise definite actions with which, users can enhance their motivation allowing them to meet their basic requirements along with addictive engagements. This gamified experience results in the creation of a motivating environment of game dynamics to surround an association with the game mechanics [68].	Game dynamics are collaborated with mechanics to target the specific motivations of the participants.
4.	Usability	Humans desire achievement in the form of	There is a requirement of different elements for

		progress, bonuses, accomplishment, rank, etc. which are common throughout the world irrespective of caste, age, lifestyles, etc. A specific set of game mechanics is required to fulfill these natural necessities.	different learners i.e. learners' preference may vary such that some learners seek social collaboration while others seek competition.
5.	Examples	Game mechanics are moreover related to rewards and observations. Mechanics include numerous activity, structure, code sequence in-game systems in assistance with the game dynamics in gameplay e.g. getting fixed rewards or bonuses upon completion of certain actions [67].	Game dynamics are the essence of game mechanics which incorporate the fulfillment of desires or wishes [68]. Dynamics are associated with the game's limitations, preferences, outcomes, achievement, context, succession, engagement, and collaboration. For example, preventing negative actions during the gameplay is similar to overcoming an obstacle [67].

An important game element used in the learning process is required to inspire the student to progress with a given task. While considering the game design layout for the educational purpose, the primary key element which is required is motivation and which can be achieved by leveraging affective computing based on emotions to endorse the motivation aspect during the designing interfaces [65]. With an increasing trend in gamification, the present researches proposed that the specialists have a keen

interest in using gamification but due to various factors like lacking time or resources to apply the logic of alterations and resemblances to select and decide particular game elements among the variety of elements in the gamification system to use which are more appropriate to implement in a specific system [44]. The various game elements like team activities, competition, cooperation are highly ignored which indirectly forms the foundation of goal structures [6]. The various game elements implemented in the education are explored in Table 2.5.

Table 2.5. Taxonomy based on game elements description and benefits

Elements	**T**	**Description**	**Benefits**
Points	C	This game element is also known as scores.	Most common game element used to encourage the contribution of the users.
Badges	C	Badges are visual tokens in the form of logos or icons. Winning the badge is like attaining the virtual status symbol [27].	Indicates the performance of students.
Levels	C	Players' expertise is judged from the level of their performance in the Gamified framework [42].	To track progress in terms of performing a particular activity and attaining a higher level step by step [27].
Feedback	M	Element to provide information to learners regarding their progress and understanding of the concept.	Analyze and check their progress along with gain acknowledgment in respect to positive conduct [43].
Collaboration	M	The group activates to create a sense of	Collaboration leads to team formation and there exists the

		relatedness; inculcate team learning ethics [27]. It also enhances group exercises solitary than individual performance on a similar related topic.	mutual responsibility of teamwork [33].
Challenge	M	Something new and different for students to participate as Gen-Z is not interested in handling dummy illustrative problems [33].	A competitive environment enhances student interest and involvement. Goals lead to uncertain results [64].
Leader boards	C	A scoreboard is used to raise social pressure on other teammates It is used for the comparison between players' performance [42].	Should be carefully used to project the best students' performance by considering the fact not to expose the students who are not doing well [33].
Progression	D	Momentum or a milestone used during the participation. It means splitting the process into more than one small progressive level instead of an overwhelming bigger leap.	It makes the task interesting and randomness in any task act as intrinsic motivators for players [31]. Progression is the keystone to the game layout which can be characterized as advancing to the next level or leveling up.
Co-operation	M	It is a process to achieve a common target collaboratively [59].	Teamwork or group formation defines an intrinsic perception.
Avatar	C	It is an appearance that depicts the virtual	Visual representation in the form of an icon or display

		representations of the students optionally provided to choose their particular tutor to interact with the system [44].	picture to their profile act as a fun element [31].
Narration	D	It states the sequence of actions as they occur in the game via user experience [59].	Narration is also an intrinsic concept.
Competition	M	The constructive competition takes place when its orientation is based on fun and structured ways are designed to grow positive [46]. Competition is categorized as the social element the gamified learning. During the gameplay, each player challenges their respective opponent to accomplish a common target.	Helps to explore hidden skills, Increases self-confidence. This element defines the user learning based on the intrinsic concept of competitiveness which includes the listing generation based on scoreboards, leader boards, conflict, etc. As an example, users can check their progress of competition by using scoreboards which are composed of several scores, levels, badges, etc. [59].
Emotions	D	Enjoyment, enticement, surprise.	Emotions create a sense of gratitude, a feeling of joy to perform a particular task.
Constraints	D	Formulation of rules and guidelines creates a balanced environment.	The boundaries of specific tasks are specified. On a wrong attempt the defined penalty or action to be applicable as a liability.

Virtual good	C	Virtual goods are a mode of incentivizing one's interest to earn reward points by offering the prospect of customizing something which will reflect their individuality.	Using points that the user collected over time can be used to purchase virtual goods that are intangible items or non-physical objects [68].
Rewards	M	Like Virtual goods, rewards are also tangible or intangible objects. After completion of a task, the user has presented rewards and can be earned on a repetitive progression.	Rewards are one of the impactful extrinsic motivators.

T= Type, C=Components, M= Mechanics, D= Dynamics

Different game elements can be interconnected to achieve a specific goal that represents the overall structure of the game along with the gaming methodology. Gamified learning is centered on engagement, enticement, and motivation. The layout of Gamified learning can be understood as the reason behind the requirement of developing such models to enhance learning. Further, after identifying the purpose of creating a learning environment, it is required to define metrics or parameters for the learning platform. These parameters give a structural appearance to the learning platform configuring the different game elements. The game elements are categorized into components, dynamics, and mechanics. Each game element is interconnected and based on the action performed by the user, it signifies a specific task along with its outcome presented in Figure. 2.2.

2.5 Challenges

- **Focus on intrinsic motivation:** The presence of intrinsic motivation is required in the design methodology. Intrinsic motivation is the willingness to act irrespective of expecting any obvious external rewards, which means that an individual acts

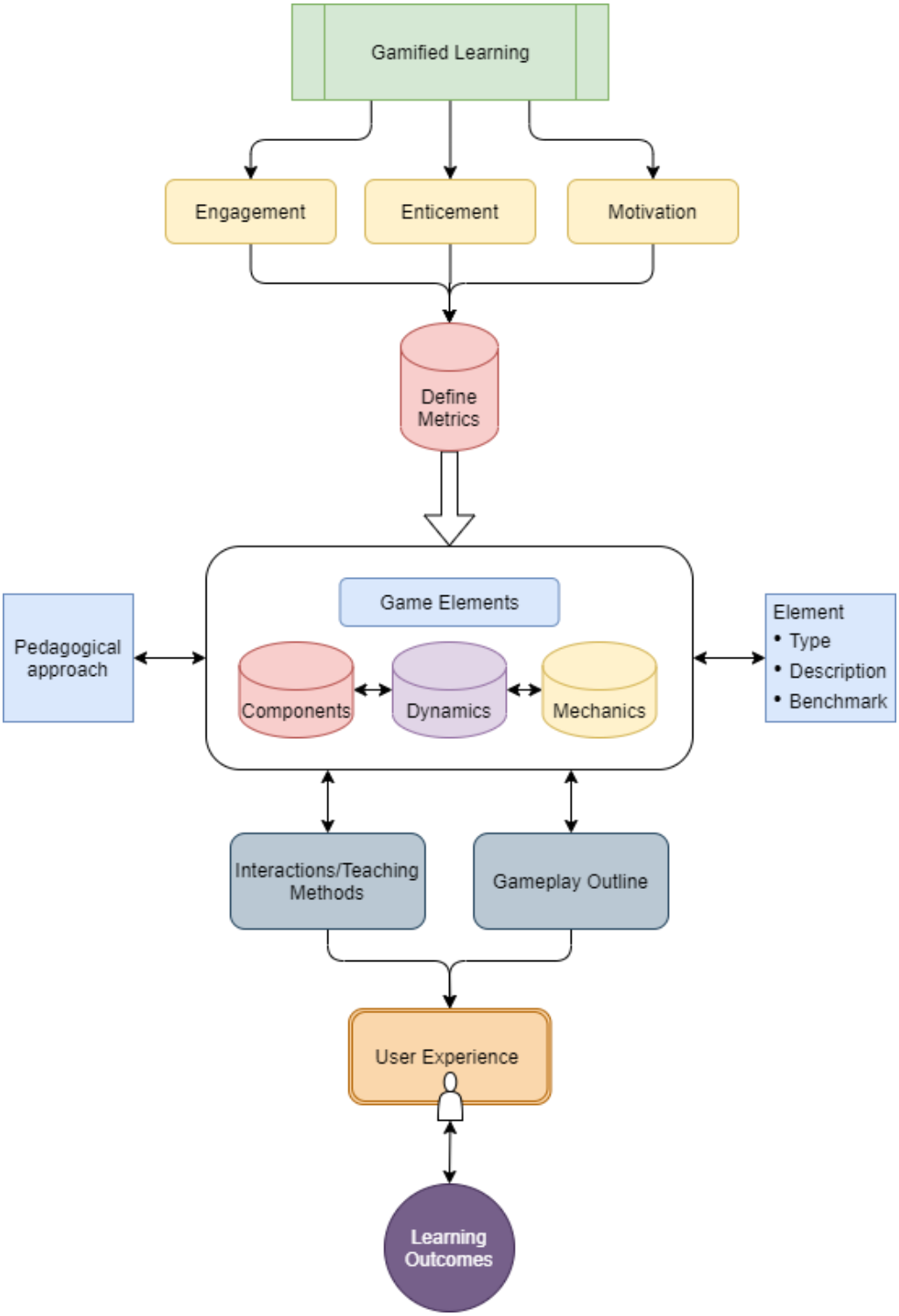


Figure 2.2: Layout of gamified learning.

because it is founded as interesting and joyful, instead of external pressure or incentive such as a reward or deadline to act upon it. The various factors can lead to influencing intrinsic motivation. The points and various other gaming elements motivate the participants to contribute to the performance [69]. Other than the rewards system, in intrinsic motivation, the participants are keen to achieve a goal in the best

way possible by having self-actualization, joy, progressive sight, competition spirit, etc. This can derive a passionate mindset providing a genuine sense of accomplishment. The user positively enjoys the process of learning that can help to fuel the user's cognitive ability and a strong sense of fulfillment. The bigger challenge in implementing intrinsic motivation is activating a free mindset regardless of expecting rewards after an achievement. Following are the few key impacts offered by intrinsic motivation in Table 2.6.

Table 2.6. Key impacts of intrinsic motivation

S. No.	Key impacts	Description
1.	Passion for learning	Learning is one of the prestigious activities of human life. Every individual attains knowledge when they learn. Therefore, it is important to ensure that the learning approach must be joyful and delighted. A passionate learner can joyfully gain knowledge very easily and quickly.
2.	Clarity in progression	Intrinsic motivation makes the participants check their progress, making them clear about the goals of what they want to be and their state in the gameplay learning.
3.	Self-realization	While in the progress of learning, the users can actualize themselves and understand their weaknesses and strengths, helping them improve their psychological personality and better proceed with the task.
4.	Self-esteem to grow	Gamification enables learners to seek growth as intrinsic motivation helps them attain a sense of self-esteem, inspiring them to level up their skills and achieve more goals.
5.	Better quality participation	The major impact of intrinsic motivation is improved engagement and participation in the learning process. Hence, it provides better-quality participation of learners with a focused mindset.

- **Utilizing the latest technology**: Integrating the latest technologies in the education system inculcates interest and enhances the student enticement to perform a particular task. The use of mobile/ tabs in the form of quizzes or puzzles acts as an intrinsic motivator. Integrating gamification with such technology requires a lot of effort and complex mechanisms to follow for better results. To design a gamified system with the inclusion of the latest technologies, the developers or creators are required to work along with the tutors and learners. The biggest challenge is implementing the latest technologies and train the needed participants with such technologies. There is a need to make and present complex and complicated technologies in an easy and approachable way.

- **Fun-based learning**: As a part of the learning process, while performing the activities, learners consider them as fun to which executes engagement, passion, motivation, and builds inventive modes of learning. The more interactive game environment creates better engagement while considering the enjoyment in the learning environment. Just as the conventional learning methods promote learning as fun, various methods, tricks, and activities are required, which is reliable to create a joyful atmosphere implementable to the different age groups.

- **Identification of elements:** Usage of efficient game elements results in efficient outcomes. Rewards/ badges should not overpower the actual essence of the gamified framework, and their use should be optimal. Essential framing comprises the participation of the user that can recognize a purpose. Game elements play a crucial role in the gamified framework. Different elements have a different impact on the user's learning. So, it is very important to identify the target users and choose the elements accordingly.

- **Classroom engagement:** The main focus of the gamified framework is to enhance engagement among the players. The engagement should not be temporary; it should be a long-term engagement with a high level of enticement among the players. Regular classroom courses and teaching methods require an effective approach to engage students, which is not much efficient to accumulate students' interest. For a better outcome, it is necessarily required to gain the learner's engagement during the course. One study shows the effect of a gamified environment and its influence on student engagement [28].

2.6 Summary

Gamification, games, and game elements are different terminologies and make a huge difference in the education system. The primary goal of this chapter is to explore different gamification studies, a variety of games and game element opportunities that exist, and enhance the education system. Gamification has a great deal of perspective; however, some exertion is as yet essential in the implementation and design of the user involvement to augment participation of the players' to help and to motivate while enhancing engagement with the platform. The Gamified environment and game-based learning differences are well elaborated, and it is stated that games are a subpart of Gamified application. Usage of applicable game elements in the Gamified application is still being evolved. To enhance the education system, there is a need to explore new theories and implement new opportunities to enhance the engagement among the students towards classroom learning.

CHAPTER 3

TO ACCESS AND EVALUATE VARIOUS METHODS AND MEANS FOR SELF-MOTIVATED ENGAGEMENT AND LEARNING OF STUDENTS FOR VARIOUS DISCIPLINES

3.1 Introduction

Today's Generation –Z lacks the self-motivation towards classroom learning concepts [69]. The major point of any teacher is to gather the students' attention and teach them how the concept stays with them even after leaving the classroom. The arrangement of high task engagement and strong motivation leads to simplified successful learning with the involvement of students. In India, the teaching method is quite different compared to other countries. Rote learning is the major drawback in the education system by and large. The method of teaching lacks an interactive session between a teacher and a student. Not every pupil participates to the fullest in class every day. Classroom teaching nowadays has gone beyond pen, paper, notes, and books. More involvement of technology is there, such as Power-Point(ppt), smart classes, etc., but can we say that using power-point and smart classes have inculcated more learning among students?

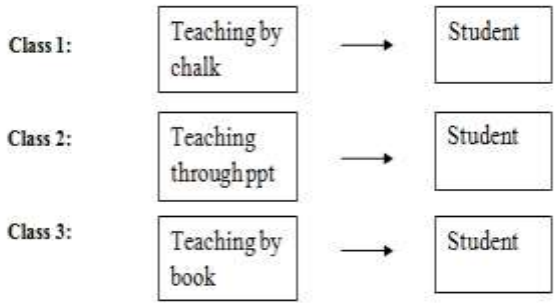


Figure 3.1: Classroom teaching scenario

In Figure. 3.1, the major concern is the absence of the interactive conversation between a teacher and a student; it creates a one-sided scenario. To overcome this problem, the teaching method needs to be revamped in order increase the level of interaction between the teachers and the students and the focus should be on including various activities that can lead to better results. The introduction of various game elements creates a fun and challenge-based learning environment that intrinsically motivates students to perform better instead of putting them under pressure [17]. Therefore, there is a need to inculcate self-motivated means of engagement methods, which have a high level of enticement for students towards classroom learning.

Problem identification: It is a great matter of concern to enhance the student engagement and learning outcomes the Gamified education system is implemented. While attending classes, if there is a lack of interest, trivial discussions, and a low participation rate, it all leads to low student engagement. Therefore, self-determination theory plays a very important role, including various intrinsic and extrinsic motivation levels concerning student engagement for classroom learning [71].

Contribution: In this chapter, various means of motivational elements of teaching that should be implemented to make the classroom learning more interactive, inquiry-based; students should be allowed to explore by giving adequate tasks and assignments. Lectures will act as a medium of imparting education and lead to many more explorations in terms of modern teaching. Game-based learning can bring new excitement among the students to explore various activities. The involvement of various game design elements like points, badges, levels, challenges, feedback, leader boards, and avatars enriches user motivation, engagement, and learning experience. The major objective of Classroom learning is to make monotonous sessions more interesting and interactive. The concept of self-motivated classroom learning can provide the education system a new outlook in which the complete session will be based on discussion rather than a lecture-oriented session. Games act as powerful intrinsic motivators to enhance the student's engagement and increase student involvement. Various games are designed to create a sense of gratification, comfort of learning through the new medium by exploring new methodologies to make the student more engaged.

3.2 Related Work

Gamification is defined as ‘simple gameplay to support productive interaction for learners and instructors. In this heuristic definition, gamification is proposed as gamification of learning to assist gameful design. To make the learning goal-oriented and enhance student engagement through online teaching there is a need to emphasize various activities which include planning, monitoring, and implementation of well-defined levels or strategies [70]. There is a need to identify various motivational beliefs, student’s direct, and behavioral attitudes towards online learning [71]. It is important that while providing a gamified solution to a problem maximum user engagement must be achieved. This can be measured with game analytics. Designers

must understand what motivates users and how different game elements may be combined to achieve this result [72]. Grades are emerged as valued contributors to rate student's performance in class. It has been analyzed the fact that they are negative contributors to students' engagement and behavior in class. So instead of assigning grades to the students, it is proposed to assign experience points. Students earn points for several activities related to ethical analysis. Students have the freedom to earn extra points also by performing extra activities. Freedom to earn extra points has also helped to gain their scoring momentum back as this was not available with the traditional grading system [73].

Emotions contribute significantly to the learning process. The intensity and role of emotions are analyzed when players from different backgrounds are involved in-game. It is observed that traditional games have a strong impact on the emotions of players. Psychomotor, Cooperative, Opposition, and Cooperative opposition games were used for identifying the emotional intensity of users [49]. To increase the engagement and motivation of students in game playing, one should determine the interest of students by taking their preferences based on different parameters [74]. Didactic and Pedagogical Concepts are preferred among a wide range of various well-developed fields of game applications. Like teachers, parents are also trying to identify good educational games for interactive learning, the authors also state that a three-level metadata format may be developed for the elaboration of serious gaming [75]. Computer games help in developing problem-solving and logical thinking in players. Games are also considered as a prime factor of motivation and user engagement. They also constitute rules as per gaming constraints. Games can be used as a valuable contributor in gaining extensive learning during educational deployments [76]. The Gamification concept can be formulated with the help of motivational affordance, psychological outcomes, and behavioral outcomes. Measurement of the effectiveness of gamification was also varied from motivational to psychological outcomes [77]. The Gamified learning system called Reflex is developed. It presents a 3D virtual world in a browser that helps the user to enhance his learning and give feedback. Based on the concept of gamification design Reflex can predict learner behavior during interaction [34]. Whereas Gamification is a method to increase a user's motivation and behavior towards his routine activities. The concept of modeling in which gamification can increase user engagement in cloud computing. Gamification may be considered a potential means to achieve this mechanism. The study has been done to bind the relationship between game

mechanics and cloud computing volunteers so that it can be used more generically [78]. Learn2Mine supports a cloud-based environment for teaching purposes. Its architecture can be effectively used in teaching as well as in taking a formative assessment of data mining concepts. Student feedback was also taken on the completion of the course. It was observed that students were very positive in using Learn2Mine for the teaching of data mining concepts. Constructive feedback was also collected to improvise the proposed system [79] . User involvement is a very critical element of e-learning systems. Less user involvement signifies the fact that the traffic is being diverted to another system. Autonomy, competence, and relatedness are considered mandatory social needs to be fulfilled to support user engagement. Identification of the main objective and deployment of game mechanics must be done for increasing the effectiveness of the Gamified learning process. It can be used as a tool to reach user experience goals for increased user engagements [80]. Web technologies are playing an important role in improving learning methodologies whereas motivation and engagement are primary for the completion of any task [81]. Intrinsic motivation comes from within it is more self-determining and self-competent whereas extrinsic motivation is surrounded by various factors like results, rewards, punishment, to meet someone else expectations, etc., [82].

3.3 Motivational Factors in the Education System

Students need to focus on three parameters: curiosity to achieve the goal, self-efficacy, and self-regulation [71]. Intrinsic or extrinsic motivation influences student engagement in a particular task [71]. The factors which include curiosity or interest can be termed as intrinsic motivation. The student wants to explore its capabilities adopts the natural tendency to perform the challenges and achieve the best results without any external incentives. On the contrary, if we talk about extrinsic motivation, the students tend to perform to achieve their end-stage, and along with its results, grades, appreciation, or punishment are attached to the task [71]. High motivational level of students directly leads to increased engagement and enhancement in learning [23]. Conversely, low motivational levels presented by students degrade the student learning capabilities and result in a lack of interest [84].

3.3.1 Intrinsic Motivational Factors

Video tutorials/Powerpoint presentations: The availability of video tutorials plays a prominent role in education; this new learning method helps improve student

capabilities and competencies [85]. The student can view these videos at his own pace of time and can be viewed as many times as necessary until the student grasps the particular topic. This helps many students who might have any technical issues during classroom learning or want to revise the topic independently. Instructors should make full use of multimedia material to make the student learning more innovative and understandable.

Feedbacks/Interactive learning/Narration: There exist four key principles of learning that involve encouraging student interaction, understandable topic explanation, Collaborative learning, and feedback [85]. If the student is free to ask the question through online chat or during the class, then there exists a sense of community, collaboration among students, and also they feel inherently motivated to be connected through a virtual environment [86]. In addition, emotional engagement plays a vital role in which positive feedback from an instructor and students creates a good learning environment [87].

Activity-based learning: Various game elements can be incorporated to make the lecture more interesting and fun-based[87]. Students can also be involved in a multiplayer group-based task that can enhance their learning skills through collaborative learning behavior. Collective enjoyment can be achieved by completing the task as a team [88]. Students can share common applications and content resources that enhance informal learning abilities to attain a common goal.

Narration- based learning: One of the successful methods of engaging the student's attention with real time experiences and conceptualization is done through specific contexts and knowledge. Every narration of concept will be associated with the purpose which makes it more interesting.

3.3.2 Extrinsic Motivational Factors

Attendance: In the education system, the accountability of teachers and students is always considered important. Students are supposed to maintain a specific percentage of attendance depending upon their school/university regulations. Based on good attendance percentage, they are assigned a few bonus marks, regular attendance badges, nominated for class representatives, etc. The students who have low attendance are not allowed to appear in final exams or maybe not be promoted to their next semester or grade.

Rewards: Students feel motivated by receiving rewards it may be in terms of good marks, grades, virtual gifts [89]. It is believed that extrinsic rewards act as the important motivational factor which is much liked by the students [90].

Fulfilling the expectations of parents/teachers: Expectations of parents and teachers play a very critical role in the student's academic performance. It has been analyzed when parents/teachers hold high expectations from students. They perform better and get higher grades; it provides them with a positive and challenging environment to prove their ability [34].

3.4 Motivated Means of Engagement in Gamified Education

Motivation is defined as the factor which influences an individual to perform a goal-directed activity [83]. This is essential for an individual to perform an activity with dedication. Highly motivated individuals are more likely to take up comparatively thought-provoking activities, remain active, have a deeper understanding and realization of the task at hand, and display enhanced persistence, creativity, and performance. Research on students' motivation showed that learner's motivation is highly complex, sensitive to situational conditions. It was found that both intrinsic and extrinsic motivation co-existed and was highly influenced by the student's situation [83]. Most of the earlier gamification researchers have centered around game elements like points, ranks, leader boards, badges, etc. However, the narrative is an important factor that has often been neglected. The narrative is important in creating interest, especially when introducing a new topic. Any scientific law/principle/invention/discovery/policy has some history that defines a brief story on what social problem it is trying to address. This is usually overlooked, ignored, or not paid much attention to by the instructors. Teaching methods are the actual indicators of the education system which help us to attain the desirable results. The content, method, tools used to formulate the structure of a particular topic. Good audio feedback alongside narrative would help create a strong sense of positive attitude towards the subject matter.

Several other commonly used game elements include badges, leader boards, points, ranks, level, achievements, progress bars, challenges, etc., act as various means of motivation among the students.

The implications brought about by these elements and the nature of motivation generated by them are mentioned in Table 3.1. Successfully leveraging the energy, motivation, and sheer potential in games through gamification and directing it towards learning can result in students being winners in real life as well [83]. The behavioral change brought about by the aforementioned game elements are listed below –

Table 3.1. Means of motivation and their behavioral impacts

Sr.no	Game Element	Element Description	Motivation
1	Narrative	Generates interest (especially on a new topic); Creates a positive attitude towards subject matter [84]; Content delivery; Flow of theory	Intrinsic motivation [85]
2	Audio/Interactive learning	Creates positive attitude towards subject matter; Automated feedback mechanism [84][86]	Intrinsic motivation [87]
3	Fun based learning	Effective teaching pedagogy; Game-based learning; Engage in playful activities	Intrinsic motivation [88]
4	Score System	Motivates user, particularly when performing computational tasks; Engages user [69] [8] [86]	Extrinsic [85]
5	Badges	Generates interest; Decreases counter-productive motivational goals, if any (excessive use of badges might contradict the latter and harm intrinsic interest); Gives a sense of achievement and status [10] [89]	Intrinsic and extrinsic [89]

6	Leader Boards	Creates a sense of competition between players; Sustains user motivation; Enhances user's interaction with the subject and eventually their score [4] [8]	Extrinsic [89]
7	Levels	Creates a sense of the flow of subject matter; Gives a sense of accomplishment; inculcates fun and challenges [8] [69] [26] [90]	Intrinsic motivation
8	Challenges	The ability of competence; Enhances user performance [8]	Intrinsic motivation [87]
9	Rewards	Verbal appreciation; Grades; Marks; Tangible and intangible rewards;	Extrinsic motivation [91]

Intrinsic motivation comes from self-determination, self-motivation, and self-competence. Extrinsic motivation results from exterior influences like points, ranks, leaderboards, results, rewards, or an urge to meet someone else's expectations [83]. A successful framework is formulated with the combination of intrinsic and extrinsic motivation together.

Implementing various elements of the game such as narrative, scores, ranks, leader boards, badges, rewards, achievements, levels, etc., makes a positive influence on learner's motivation, as depicted in several previous studies and researches carried out [6]. Badges play a vital role in a learner's motivation. They are often used to showcase an individual's achievement within a community, giving a sense of validation to the user [97]. Gamification enables students' positive sentimental attitude towards the subject matter [92]. Levels, stages, or milestones are powerful tools instructors can leverage to set the right flow of information and quantify students' expectations at the end of each level. This ensures that students don't feel lost in the whole process and get a sense of flow, while the final objective seems

much more achievable and measurable [99]. Incorporating game elements to gain user attention, promote competition, encourage users towards the goals, result in team collaboration and communication can happen only in an interactive learning environment, gamification provides that, an interactive learning environment [7].

3.5 Importance of Games in Education/Game-based Learning

Games are important in every stage of life. Education has to be interesting in each stage i.e., at the school level, college level as well as post-graduation level. The idea of using games in education to engage students in learning is not new [100][1]. Educational games have been a trending topic for a couple of years [78][2]. Various games are implemented in the classrooms by teachers to create a fun and engaged learning environment. Traditional schooling is considered to be ineffective and boring by most students [101][3]. Many students enjoy learning through activities given by the teacher as it keeps the student engaged and motivated [100][1]. Some students tend to learn more when they involve in an activity. Games are competitive. Students show much passion for learning things when games are included in education as it gives amusement. Revisiting of games and activities helps in regaining foremost information [100][1]. Games bring out the higher-level thinking skills of a pupil. Students can build their problem-solving skills through games and activities.

There are a variety of teaching methods that coincides with active learning pedagogy. If learners didn't revise and learn the chapter and verse, is there any way to acquire knowledge? This creates a problem for students because their lack of knowledge may embarrass them. Games consist of skill exercises. Students compete individually against other students. Educational games are intended to teach students to discover various concepts. Educational game-based learning is a type of learning tool that has defined learning outcomes. Learning through performing in games is a powerful learning aid. Due to games, students can achieve planning strategic thinking, communication, group decision making, negotiating skills. It was observed that the students who were the least participant in class exhibited much interest when games are included in education. Games can be implemented in every subject to create a fun and learning environment. The standard of students can be increased by implementing games in education.

3.6. Innovative Games Designed to Make Classroom Teaching More Effective

3.6.1 Game Designed to Learn Aptitude

Different games can be involved and framed to make the mechanism of studies interesting. According to the game theory, every game will have its concepts and solution parameters implemented, keeping in mind the target players [4]. One such game is "TEST YOUR MATHEMATICAL SKILLS AND LUCK THROUGH HOUSIE." This game can be played manually as well as online**.** Nowadays, placement in college is a crucial thing for every student. Through this game, practice for placements in Quantitative Aptitude becomes more effective.

Winning in the game is a higher motivation than attaining full marks. The manual process of this game is that each student will be given a housie sheet, and the questions are displayed with the help of a projector. There are 90 questions mentioned in Table 3.2, and the housie sheet also chaotically contains 1 to 90 numbers. Each housie sheet that is given to the students will have six grids. The pupil, based on the given question, has to solve and identify the answer. The students who get the answer earlier compared to others will be given priority. With this gaming technique, every pupil will be interested in solving because of the tough competition. The housie sheet is as shown below in Figure. 3.2. Each student will be given a sheet with six grids. The student who solved it with great accuracy will be awarded points. For every grid in the sheet, there will be three rows. This game checks the knowledge and plays an important role in checking the student's concentration level. As this is the game of luck factor that will play its role, it may or may not be possible to win. Online application Geeker's hub is developed and played by students.

Figure 3.2: Housie sheet

Following are the 90 questions framed for solving.

Table 3.2. Mathematical questions prepared for housie (Tambola) game

Answers	**Questions**
1	A number that is unique in itself neither odd nor even.
2	The smallest number which when multiplied with any number makes it an even number.
3	A number that has the common difference i.e. 18-15, 15-12, 12-9, 6-3.
4	The number is the degree of the equation x^4+3x^2+2.
5	A number which when multiplied by any number outcome at one's place is 0 or 5.
6	The smallest number which when squared or cubed, always has 6 at its one's place.
7	A number that represents the seven constituents of white light when it passes through the prism.
8	A number is a rule to fill the number of electrons in a shell.
9	A number whose table is just counting in forward & reverse direction starting from (0 to 9).
10	A number that has a circle and a straight stick along with it.
11	Prime number next to prime number 7.
12	The two-digit number represents the number of months in a year.
13	The number is the sum of 2^2+3^2.
14	The square root of 196.
15	It is the number which is reverse of 51.
16	The number is four times the square of 2.
17	The number is the sum of squares of 4 and 1.
18	The number is the abscissa of the co-ordinate (18, 0).
19	The number is twice of 10 and then subtracted by 1.
20	The number is the product of the smallest even number and 10.
21	The number is next odd number to 19.
22	The number is twice the prime number next to 7.
23	Number is the profit gain when A buys a chocolate at Rs. 60 and sells for Rs. 83.

24	The number is the average of the of three same number If one number is 24, find the second number
25	The number is square root of 625.
26	The number is the mode of given number 26, 26,27,22,28
27	The number is thrice of square of 3.
28	The number is four times half of 14.
29	The number is the number of days in Feb in a leap year.
30	The number is the number of days in the fourth month of a year.
31	If n+n=62 then what is n ?
32	The number is the square root of 1024
33	MRP of a book is Rs 200, if the seller provides Rs 177 flat off on the book. How much does the book cost
34	If the Principle amount is Rs 340 and the rate of interest is 10% in time of 1 year. Find Simple Interest
35	The number is the profit If CP is 93 and SP is 128.
36	Number is in the series of 16, 20, 24, 24, 32,
37	The number is the cost of 1 game if Google play cost 6 games for Rs 222
38	The number is the square of 36^1/2 + 2
39	There are 40 students in class. Jay got 2nd rank in the class. What will be the rank from the last
40	The number is the product of square root of 100 and the square root of 16
41	A girl buys a book at Rs 100.If she gets cash back of 59%, So the number is the amount spent by the girl on the book
42	If z+101=127 then the number is z+16
43	Number is in the series of 19, 27, 35,
44	The number is the scores obtained by running between the wickets if a batsman scored 100 runs in which there are 8 sixes, 2 fours.
45	The number is the loss obtained when a book is bought at Rs 144 and sold at Rs 99
46	The number is twice ¼ of 92
47	In a deck of 52 cards first, five cards of the club are removed, so the

	number is the number of cards left
48	If a quarter kg of potatoes cost Rs 12 then what will it cost for 1kg
49	The number is the LCM of 7 and 49
50	The number represents a half-century in cricket
51	The root of 2601..?
52	How many numbers of weeks fill a year?
53	The root of 3809..?
54	A Boy buys a pen worth 60Rs. The seller provides him with 10% cashback what is the amount of the pen now?
55	Number, when added twice, gives 110.
56	In a row, a boy's place is 29th from left and 28th from the right. How many boys are there in the row?
57	The rank of Nish is 4 in a class of 60 students. What is her rank from last?
58	LVIII =?
59	What is the velocity, if a body is traveling with a velocity in km/hr of 16.4 m/sec?
60	Lt x-->2 (16x^2 +10x +36)/2 =?
61	Largest prime factor of 61?
62	Arum's age is 31; Sharma was the same age when Arum was born. What is the present age of Sharma?
63	The end points of a straight line are (49, 0), (77, 0). The abscissa of the midpoint is?
64	10*log2 (2) ^6.4 =?
65	(6*2*5)+5=...?
66	The quotient is obtained when 132 is divided by 2.
67	(13*5)+2=.....?
68	Number, when divided with 2, gives the quotient 34.
69	((11*2)+1)*3=...?
70	13*5+5=...?
71	The inclination is 45 degrees what is 75 times its gradient?
72	Number, when divided with 3, gives the quotient 24.
73	The average of 71, n, 80, 72 is 7. What is n?

74	1001010 in decimal form =?
75	A Man buys pizza at 500Rs. The seller charges an extra VAT of 15% on pizza. What is the amount man spent on VAT?
76	If 5x+4y=6 and 4x+5y=20 find 9y
77	2*(4! + 3!) + root of 289 =?
78	Sum of all first six numbers and first six odd numbers together is?
79	100-21=..?
80	125: 75: _:48?
81	L buys a Cassette at 100rs. The seller gives him 10% off. If L pays a further 10% tax on it, how much is L spent on cassette?
82	HCF of 3^4 and N is 1. N is?
83	(3*3*3*3)+2=..?
84	The two Diagonals of Rhombus are 14, 12. What is the area of this Rhombus?
85	The base and height of a right-angled triangle are 6 and 7 cms respectively. What is the square of its hypotenuse?
86	Square of the distance between (3, 6, and 7) and (10, 12, 8)?
87	Sum of the square of the first four primes is?
88	If b1=8 and b2=14 and height =8. Find the area of the Trapezium?
89	A number has 2 digits ‘a’ and ‘b’.If a+b=17,ab=72 and b-a=1,then find the number.
90	The angle subtended in a Semi-Circle is?

Working of the Game

Each student is given a housie sheet with six grids. The questions are displayed randomly. Whoever first completes the first grid with the given questions is asked for verification. After verification, the student is awarded points. Here, luck is also a major factor because not every student can get the same six grids.

3.6.2 Game Designed to Learn Theory Subject Effectively

Another game to make theory subjects interesting even for graduation and post-graduation students is the “CHAIN REACTION”. In this gaming technique starting

from alphabets A-Z, the student is given a form with the sub-headings of A-Z. The student has to fill in all the words concerning the alphabetical sub-heading. The keywords should be related to the academic subject. The student to whom the form is given first has to fill the keywords of first alphabet A, and he has to circulate the form among other students after he is done. The student who got the form next continues filling keywords for the next alphabet. This process continues until the students fill in all the keywords regarding the subject.

With this gaming technique, a pupil can improve his/her vocabulary skills as well as he/she can attain knowledge over the subject. For example, Table 3.3 depicts data mining subject-related words. In addition, this gaming technique enhances coordination between students.

Algorithm 3.1 Chain reaction

1 : Start.
2 : Read the alphabet from the user.
3 : If the alphabet matches with text, go to step 4.
4 : If text is found in the textbook, add it to the dictionary.
5 : Score is incremented with 1 if text is added to the dictionary,i.e.,score= score+1.
6 : else,if the alphabet doesn't match with the text goto step 1.
7 : Stop.

Table 3.3. Dictionary prepared for theory subject (Data mining)

A	Analysis of system, Altering the industry infrastructure
B	Business information system, B2C, B2B
C	Customer relationship management, C2C, cybermall, competitive advantage
D	Data, Data processing, demand planning (E-commerce)
E	E-commerce, Ecommerce benefits
F	Fraud detections, Five force model
G	Global e-commerce
H	Hardware, http, https
I	Information systems, Information, Input, Investment fraud

J	Jobs In information systems
K	Knowledge workers
L	Limitations of m-commerce
M	M-commerce, Multistage model of e-commerce, Market segmentation
N	Niche strategy
O	Output, Organization, online stock trading
P	Product configuration, Phishing, Pyramid Schemes
Q	Questionnaires (Used in system analysis)
R	Relevant information, Return on investment, Risk
S	Supply chain management, Secure socket layer, System
T	Traffic analysis, Treats of e-commerce,The total cost of ownership
U	User training
V	Virtual trail room
W	WAP ,Website tracking
X	--
Y	--
Z	--

3.6.3 Game Designed for Programming Beginners

Another game is "FLASHCARDS," which is a type of puzzle that helps create a passion for the students to progress their programming skills. With this gaming technique, practice for programming becomes more effective. The student has to place the program in a correct sequence to obtain the correct output. During arranging the cards in a sequence, the student acquires the knowledge of syntax, semantics, and debugging. The following is an example program for finding the average of two numbers. These flashcards are given to the students in a jumbled manner. The student has to place all the flashcards based on the structure of a basic program as shown in Figure. 3.3. This gaming technique can be implemented for all programming languages. The students will be allocated the flash cards in jumbled way they need to sort them and add the missing entries. The one who will do the task in the least time with maximum correct answer will be the winner. The game can be easily modified as per the subject and teacher requirements.

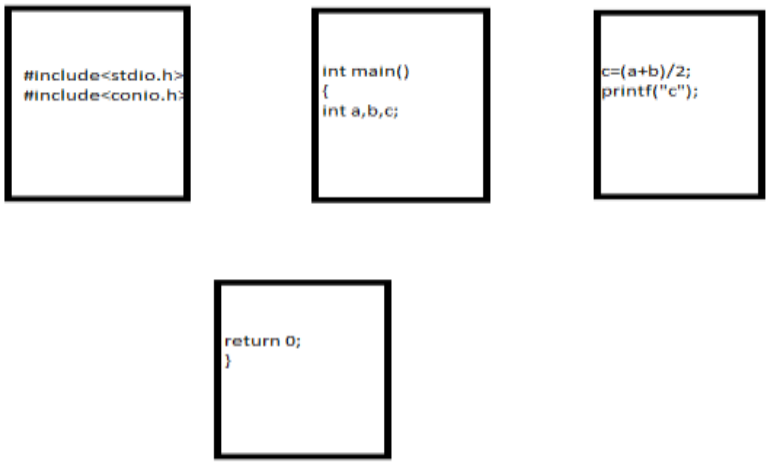


Figure 3.3: Flashcards prepared for C programs

3.6.4 Following are Other Games That Aids Students

3.6.4.1 Open Book Test To Increase Concentration

Open book test is a game that aids in improving concentration among students. In this game, a student has given a question and a material that consists of a solution to that particular question. The student has to go through the provided material and should find the answer to the given question. As the student has to search for the solution in the material provided, he/she should check the entire material for the solution, which helps improve concentration.

Algorithm 3.2 Open book test

1: Start.

2: Reading Question and Material from the user

3: Finding the length of the given material and start a loop to find the answer to the question.

4: If the search is successful go to step 5 else go to step 6

5: Initializing the got to 1 indicating search is successful (student got the answer)

6: Search is not successful (student didn't get the answer)

7: Stop

This open-book test will improve the student's concentration skills and remembering the key points and managing the time to write an answer. Conditions applied are there must be a time limit and questions should be unique to a set of students.

3.6.4.2 Rapid Fire for Increasing Communication Skills

Rapid-fire is a game in which the teacher frames the questions on a particular chapter/lesson/topic. These questions are asked orally to the students. Students have to answer them. This game helps in improving communication skills and promptness. This game also helps in interacting with the teacher.

Algorithm 3.3 Questions in form of rapid-fire

1: Start
2: Input n from the user indicating the number of questions
3: Input time limit as input from the user indicating time limit given for the student to answer n questions
4: Initialize Student Score = 0, run a loop with time limit
5: If the condition is true goto step 6 else goto step 9
6: If the answer is correct increment Score by 5 i.e. Score=Score+5
7: else if answer is wrong decrement Score by -1 i.e ; Score=Score-1
8: else increment score by 0 i.e.; Score=Score+1
9: return score
10: Stop

Here, the teacher has to ask the question from a topic with different questions. Conditions applied are questions must be asked from the topic which is taught and time taken by the student to answer is one of the prominent criteria.

3.6.4.3 Role-play to Avoid Stage Fear

Role-play is a gaming technique in which a situation is given to a student and is asked for the solution that how would he react if he was in the given situation. This gaming technique helps in minimizing stage fear among students.

Algorithm 3.4 Role-play

1: Start
2: Students are provided with a particular situation and scores are allotted on basis of their performance. Initialize score=0.
3: If acting == 'excellent' then score is initialized to 5.
4: else if acting == 'good' then score is initialized to 4.
5: else if acting == 'avg' then score is initialized to 3.

6: else if acting == 'poor' then score is initialized 2.

7: else score is initialized to 1

8: return score

9: Stop.

The main reason for this role-play is to remember situations. When they feel that they are in that situation they can do much better and remember the story well.

3.6.4.4 Quiz to Think Fast

A quiz is to ask questions to the students. The questions are answered by the students. This helps the students to think faster and answer.

Algorithm 3.5 Quiz to think fast

1: Start.

2: Initialize score to 0.

3: Run a loop n time (n=no of questions)

4: If the condition is true Goto step 5 else Goto step 7

5: If answer is correct, score is incremented with 5 i.e., score= score+5, goto step 4

6: else score is decremented by 1 i.e., score=score-1,goto step 4

7: return score

8: Stop

The main reason for this is to inculcate zeal of competition. Secondly, the students have to read the lessons before they have to take part in the quiz. There will be points in all the games; the student who got the highest score will be awarded extra points.

Implementation of games in education helps students achieve planning, strategic thinking, and most importantly, gaining knowledge. Games are competitive, which inbuilt the problem-solving skills among the students through various stages of activities involved in gameplay. Teaching methodology should be changed to overcome this problem where there should be more interaction among students and teachers. Along with that, learning should be through various activities which can lead to valuable results. Gaming techniques help students to think faster. The complied comparison of various games is mentioned in Table 3.4.

Table 3.4. Comparison of various implemented games

Game	Game purpose	Execution in Academics
Tambola/Housie	Increase strategic thinking and problem-solving skills	Aptitude, placements
Chain Reaction	Content understanding	Theory subjects
Flash cards	Skill acquisition, Improve coding	Programming Subjects
Open book Test	Increase student concentration	Case based learning
Rapid-fire	Exhibit and execute spontaneously	Oral tests
Role-play	Overcome stage fear.	English, law subjects, performing arts.
Quiz	Time management and concept clarity	Multi-discipline

3.7 Summary

Elements of gamification ranks, leader boards, achievements, and badges create accomplishment among individuals. Furthermore, narration, positive interaction, feedback sessions, fun-based learning are several other elements that define the combination of intrinsic and extrinsic motivation that helps students learn the subject properly. Hence, consideration must be taken while adding any particular game element is realizing the need for the study. In this chapter, few examples are discussed which show how the games can be embedded in day-to-day curriculum to make classroom teaching more effective and interesting to enhance student engagement. With these games, imparting education among students will be more exciting. Although games cannot be implemented in the everyday curriculum, they should be practiced at least once a week to make the interaction between teacher and students more effective. These games can be implemented at the school level, graduation level as well as post-graduation level. The games which are designed can be used for reference purposes and different methodologies can be formed according to the course requirements.

CHAPTER 4

HOPE ENABLER: A NOVEL GAMIFICATION-BASED APPROACH TO ENHANCE CLASSROOM ENGAGEMENT

4.1 Introduction

Gamification is the use of game design elements in a non-game environment to encourage desired behavior and to enhance the participant's engagement [5]. Gamification is classified into two kinds- structural gamification and content gamification [92]. Applications related to structural gamification mostly use levels, points, achievements, leaderboards, badges, and progress bars to track individual performance. Content Gamification is the usage of game thinking and game elements, to sort the content more game-like [92]. Without turning the content into a game this type adds either challenges or story elements [93]. An increase in Marketable deployment of 'gamified' applications to huge spectators possibly assures innovation, inquiry-based on exciting lines and data sources for human-computer interaction and game studies which indeed, "gamification" is gradually gathering the responsiveness of researchers [5].

Gamification is now trending, especially for those who want to embed elements of a game into their services or products to motivate and enhance the engagement of their customers or employees in a better way [94][95]. There are gamification principles that increase engagement through hope [96]. Hope acts as a yearning for a goal-congruent result, positively facilitates the relationships between the engagement and gamification principles [96]. The two major concepts of gamification:- engagement and motivation are directly proportional to hope. Students prefer to learn with the help of e-learning components. Adequate motivation and user engagement are expected when it comes to achieving a good score with the help of e-learning. It is possible to achieve adequate motivation with the deployment of gamification [97]. Enhancing community engagement motivates the users and in return contributes to a sustainable environment [98]. Gamification is a vast concept that is not at all about points, leader boards, badges apart from this it includes dynamics such as self-expression, the competition which plays a major role to enhance the intrinsic motivation factors [99]. Rewards, recognition, feedback are significant elements in gamifying a task [100].

Game mechanics are creating playful experiences and massive user engagement. But the factor of mixing game mechanics to achieve an enhanced playful experience is missing [18]. Gamification taps into the simple desires and prerequisites of the user's impulses which revolve around the idea of achievement and status. Game mechanics that are used for gamification can be transformed conferring to the requirements [101].

These game mechanics like short-term goals, points, leader boards, badges, leveling, onboarding can be attained with the highest level of enticement with the combination of hope (% of success) and motivation elements. In simple terms, it can be stated a good employee hopes to get the best employee award, and motivation to become the best employee includes bonuses, status, and ownership.

Both game-based learning and gamification objective is to make learning more fun and worthwhile through the introduction of game-oriented values[91], which is accomplished by introducing mechanisms of games or creating a Gamified learning process with the help of gamification or using games as a part of the learning process (game-based learning). Gamification in education not only includes learners (students) but instructors also play a vital role [60]. In this chapter, the various classroom teaching elements will be identified with the help of a survey that further enhances Gamified classroom learning. The elements introduced should nurture curiosity and intrigue effectiveness in Gamified learning patterns.

Contribution:- A unique concept of HOPE ENABLER is presented herein which is an innovative tool for Hope and it creates the next level of motivation for enticement and engagement. In this chapter, the classroom teaching novel architecture of hope creation and hope support mechanism is formed. Factor analysis and other statistical tools are applied to the survey results to identify the Gamified classroom learning factors/elements. The participation of each element would be differential hence the present work is based on the survey to propose the level of participation by the virtue of the coefficients of each element identified. The complete theory of gamification mechanism involves hope enabler even the D6 Process involves the atoms of hope and concludes the gamification methodology. When the new model of gamification is proposed by any organization to boost up productivity, there are Hope enablers involved by the game designers to make the task more engaging, productive, and meaningful.

4.2 Related Work

Some of the previous studies are defining the imperative aspects of gaming in education as follows: In 2014, Heilbrunn et al. [102] has recognized tools that are available for monitoring; analyzing the performance of gamification as compared to non-game contexts. Certain software tools have been identified to be used in the gamification analytics domain. Badgeville behavior analytics, Gigya gamification analytics, and Bunch-ball nitro analytics are some of the gamification analytics solutions. In 2015, Laskowski, M. [103] defined the potential of gamification in the education system. The author has deployed gamification techniques in two courses and analysis has been done. It was identified that students' involvement was improved after the deployment of gamification techniques in both courses. In 2015, Toda et al. [104] have defined gamification as being used to motivate, engage, train, educate, or modify the behavior of users. Gamified math system (SiGMa) aims at training math concepts to students. Gamification was implemented and students were motivated to involve more in problem-solving activities. SiGMa was ready to be applied within a classroom where students are being trained for learning math concepts**.** In 2016, Schreuders and Butterfield [4] have conducted a study to provide knowledge on the topics of computer security using game-based learning and gamification. The conducted training proved that gamification has an encouraging influence on students' engagement, experience, and overall subject content completion. Gamification also enhances the emotional intelligence of the learners. In 2017, Yildirim [84] through his study found that gamified teaching practices developed positive sentimental attitudes towards the subject matter among students. In 2018, Van and Zaman [28] proved the use of game elements to upsurge the level of motivation among the students. A downward trend in students' motivation over their educational years has been successfully observed. In 2019, Aparicio et al. [25] Showed that gamification of the education process played a decisive role in the attainment of Massive Online Open Courses (MOOC).

Gamification in education is augmenting the formal academics with a game-like setup whereby students would find immense motivation and interest. A gamified learning system makes use of game elements like points, leader boards, feedback mechanisms, etc. thereby ensuring persistent student engagement and high levels of interest. A considerable positive impact can be realized in the behavior of the students that can

lead to the improvement in the skills [15]. In this manner; gamification in education can yield amazing results when implemented efficiently, unlike pseudo gamification [9]. Table 4.1 gives a list of various game elements used by earlier researchers for enhancing student's motivation and engagement.

Table 4.1. Elaboration on Gamification Elements used in the state-of-the-art.

Ref.	**Purpose of Research**	**Target**	**Gamification Elements**
[33]	Applied gamification approach in the operations research to students of undergraduate management program	150+ undergraduate students	Points, Badges, Leader boards. Activities, Online Participation
[26]	Study on the implementation of gamification to enhance student engagement	7 groups (approx. 20 participants per group)	Badges, Points, Levels, Avatars, Progress Bars, Leader boards
[69]	Impact of gamification on the engagement of undergraduate students to contribute to OSS projects	17 undergraduate students	Quests, Points, Ranking, Levels
[3]	Using gamification in an AR educational platform to enhance lifelong learning	Children between ages 10-12	Badges, Onboarding, Replay, Challenges, Points, Unlockable Content, Levels, Customization
[27]	Gamification effect on student engagement is explained in a flipped learning course	48 undergraduate students	Goal, Access, Feedback, Challenges,

			Badges, Collaboration, Levels
[105]	Research on student engagement with engineering lab activities is performed through gamification	150+ students	Badges, Points, Avatar, Leader boards, Levels, Feedback
[106]	A survey study on students being motivated in an online environment to enhance their learning is conducted and analyzed	466 students participated in the survey	Grades, Progress, Learning Strategies
[4]	A unique approach towards teaching computer security using gamification is implemented.	10 students in year 1 and 22 from year 2	Points, Rewards, Feedback, Grades
[28]	Study to define the paraphernalia of gamification of education on students' motivation levels	40 students	Points, Challenges, Badges, Competition
[84]	Impact of gamification on student attitude towards understanding the lesson taught in the class	97 undergraduate students (49 under the gamified system and 48 under the traditional system)	Points, Badges, Levels, Leader boards, Challenges, Competition

4.3 Hope Enabler Mechanism

The small atoms of hope enjoin to build a mechanism of engagement termed as hope enabler. Hope acts as an imperious motivator as if there is something that one desires; it is hope that motivates the individual in that direction. Hope plays a major factor that influences to take or avoid certain steps depending upon what one hopes to achieve in life. One of the most crucial aspects is to determine which game elements will be most meritoriously used in the learning context and will help us to attain learning objectives [107]. HOPE Enabler elements(x,y,z,k) will be derived from the survey analysis. The participation of each element would be differential hence the present work is based on the survey to propose the level of participation by the virtue of the coefficients of each of these elements.

a_0, a_1, a_2, a_3= coefficients.

4.3.1. Questionnaire for Faculty Based on the Hope Equation

1. The processes which involve thinking and reasoning are more important than specific content in the curriculum.
2. Inculcate positive social behavior among students. E.g helping, sharing, waiting.
3. Desire to have 100 percent pass percentage.
4. Today's classroom session will be full of live examples and will involve more student participation.
5. Allow students to use cell phones in the classroom.
6. Do you have a laugh and a talk with students (learn through play)?
7. Creating a game environment while teaching in class.
8. The environment of the classroom is based on scaffolding (handholding, feedback, slow yet steady).
9. Well-defined levels for demonstrating the concepts to the students.
10. Deployment of appropriate tools to make your teaching effective.
11. Use verbal redirection for students who are disengaged.
12. Warn or threaten the students for their misbehavior in the classroom.
13. Motivating the students by giving them positive feedback.
14. Reward the achievers with incentives (e.g. stickers, badges).
15. Do you follow the continuous reward system?
16. Are you confident in your ability to encourage students socially, emotionally, and inculcate problem-solving skills?

The survey is conducted on Methods adopted for **Classroom teaching**, it consists of only 16 questions with the help of the (Feedback) taken from the faculty the values of x, y, z, k will be generated and Linear parametric modeling of equation will is done with the graphical representation.

Link For the Google forms: - tinyurl.com/questionnaireforfaculty

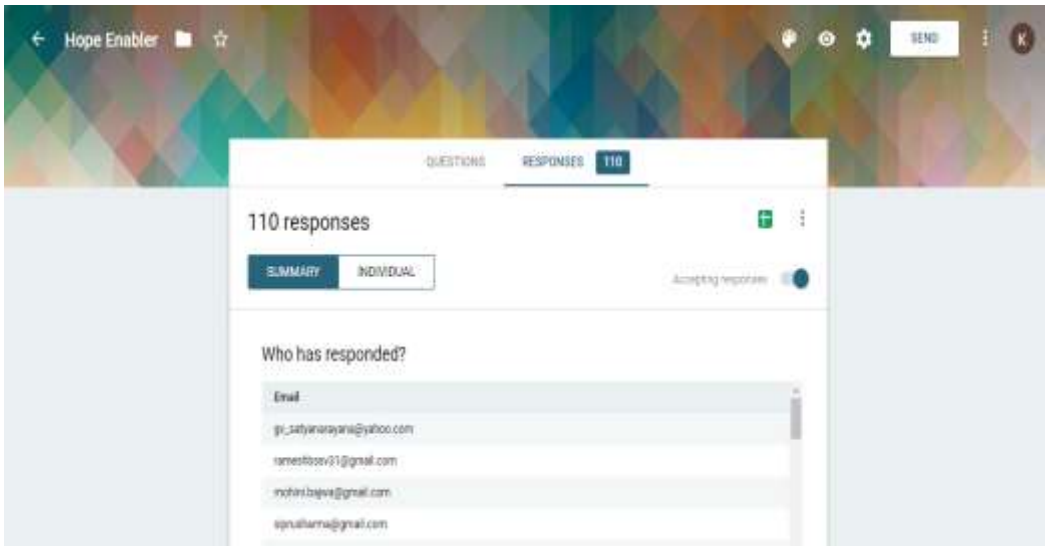


Figure 4.1: Hope enabler survey response sheet

This survey has been filled by more than 100 faculties from different Universities/colleges teaching in various domains. Only strongly agreed versions are taken to gauge the most acceptable outcomes of the survey.

4.3.2. Results of the Questionnaire

The questionnaire consists of 16 questions and the response of each question is taken in the form of "Strongly Agree", "Somewhat Agree", "Neither agree nor disagree", "Somewhat disagree", Strongly disagree". The responses are collected through Google forms and are further recoded into the numeric number to be further used in the SPSS software to generate the valid results of each question consisting of frequency, percentage, and valid percentage according to the options mentioned in the survey. Steps involved to generate the following tables:- open data in the SPSS- Analyze -Descriptive statistics- Frequencies. Table 4.2- 4.17 consists of the results of the survey question depicting the frequency, percentage of each attribute used in the survey form Figure. 4.1.

Table 4.2. Thinking and reasoning

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	0.9	0.9	0.9
	Somewhat disagree	1	0.9	0.9	1.8
	Neither agree nor disagree	4	3.6	3.6	5.5
	Somewhat Agree	34	30.9	30.9	36.4
	Strongly Agree	70	63.6	63.6	100.0
	Total	110	100.0	100.0	

Table 4.3. Inculcate positive social behavior among students

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat disagree	4	3.6	3.6	3.6
	Neither agree nor disagree	3	2.7	2.7	6.4
	Somewhat Agree	23	20.9	20.9	27.3
	Strongly Agree	80	72.7	72.7	100.0
	Total	110	100.0	100.0	

Table 4.4. Desire to achieve 100 percent pass percentage

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	8	7.3	7.3	7.3
	Somewhat disagree	7	6.4	6.4	13.6
	Neither agree nor disagree	15	13.6	13.6	27.3
	Somewhat Agree	37	33.6	33.6	60.9
	Strongly Agree	43	39.1	39.1	100.0
	Total	110	100.0	100.0	

Table 4.5. The classroom session will be full of live examples

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat disagree	3	2.7	2.7	2.7
	Neither agree nor disagree	3	2.7	2.7	5.5
	Somewhat Agree	16	14.5	14.5	20.0
	Strongly Agree	88	80.0	80.0	100.0
	Total	110	100.0	100.0	

Table 4.6. Laugh and talk with students

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	0.9	0.9	0.9
	Neither agree nor disagree	5	4.5	4.5	5.5
	Somewhat Agree	52	47.3	47.3	52.7
	Strongly Agree	52	47.3	47.3	100.0
	Total	110	100.0	100.0	

Table 4.7. Use cellphones in the classroom

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	64	58.2	58.2	58.2
	Somewhat disagree	16	14.5	14.5	72.7
	Neither agree nor disagree	17	15.5	15.5	88.2
	Somewhat Agree	11	10.0	10.0	98.2
	Strongly Agree	2	1.8	1.8	100.0
	Total	110	100.0	100.0	

Table 4.8. Game environment

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	9	8.2	8.2	8.2
	Somewhat disagree	10	9.1	9.1	17.3
	Neither agree nor disagree	16	14.5	14.5	31.8
	Somewhat Agree	37	33.6	33.6	65.5
	Strongly Agree	38	34.5	34.5	100.0
	Total	110	100.0	100.0	

Table 4.9. Scaffolding classroom environment

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	6	5.5	5.5	5.5
	Somewhat disagree	8	7.3	7.3	12.7
	Neither agree nor disagree	18	16.4	16.4	29.1
	Somewhat Agree	55	50.0	50.0	79.1
	Strongly Agree	23	20.9	20.9	100.0
	Total	110	100.0	100.0	

Table 4.10. Well-defined levels

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat disagree	1	0.9	0.9	0.9
	Neither agree nor disagree	9	8.2	8.2	9.1
	Somewhat Agree	24	21.8	21.8	30.9
	Strongly Agree	76	69.1	69.1	100.0
	Total	110	100.0	100.0	

Table 4.11. Deployment of appropriate tools

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	0.9	0.9	0.9
	Somewhat disagree	1	0.9	0.9	1.8
	Neither agree nor disagree	3	2.7	2.7	4.5
	Somewhat Agree	20	18.2	18.2	22.7
	Strongly Agree	85	77.3	77.3	100.0
	Total	110	100.0	100.0	

Table 4.12. Use verbal redirection

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	0.9	0.9	0.9
	Somewhat disagree	4	3.6	3.6	4.5
	Neither agree nor disagree	13	11.8	11.8	16.4
	Somewhat Agree	54	49.1	49.1	65.5
	Strongly Agree	38	34.5	34.5	100.0
	Total	110	100.0	100.0	

Table 4.13. Warn or threaten the students

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	9	8.2	8.2	8.2
	Somewhat disagree	11	10.0	10.0	18.2
	Neither agree nor disagree	23	20.9	20.9	39.1
	Somewhat Agree	45	40.9	40.9	80.0
	Strongly Agree	22	20.0	20.0	100.0
	Total	110	100.0	100.0	

Table 4.14. Motivating the students

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	2	1.8	1.8	1.8
	Somewhat disagree	1	0.9	0.9	2.7
	Neither agree nor disagree	3	2.7	2.7	5.5
	Somewhat Agree	22	20.0	20.0	25.5
	Strongly Agree	82	74.5	74.5	100.0
	Total	110	100.0	100.0	

Table 4.15. Reward System

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	0.9	0.9	0.9
	Somewhat disagree	3	2.7	2.7	3.6
	Neither agree nor disagree	12	10.9	10.9	14.5
	Somewhat Agree	27	24.5	24.5	39.1
	Strongly Agree	67	60.9	60.9	100.0
	Total	110	100.0	100.0	

Table 4.16. Continuous reward system

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	0.9	0.9	0.9
	Somewhat disagree	3	2.7	2.7	3.6
	Neither agree nor disagree	10	9.1	9.1	12.7
	Somewhat Agree	47	42.7	42.7	55.5
	Strongly Agree	49	44.5	44.5	100.0
	Total	110	100.0	100.0	

Table 4.17. Promote students emotionally and socially

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat disagree	1	0.9	0.9	0.9
	Neither agree nor disagree	3	2.7	2.7	3.6
	Somewhat Agree	27	24.5	24.5	28.2
	Strongly Agree	79	71.8	71.8	100.0
	Total	110	100.0	100.0	

4.3.3 Reliability Test on Data Set

To check the data reliability Cronbach's Alpha method is used, it helps to validate the data collected through the survey. The procedure used for validation makes the use of data more acceptable and checks the consistency of the received data. SPSS is the flexible software which is used for analyzing the data and performing statistical calculations. Steps applied in SPSS =Analyze -> scale -> Reliability Analysis. Table 4.18 depicts that the collected data is valid and no values need to be excluded. Table 4.19 shows that data is highly acceptable as the value of Cronbach's Alpha is greater than 0.6. The Alpha value is 0.720 which indicates that items have relatively good internal consistency.

Table 4.18. Validation of data set

	N	%
Valid	110	100.0
Excluded	0	0
Total	110	100.0

Table 4.19. Reliability statistics

Cronbach's Alpha	N
0.720	16

4.4 Mathematical Build for Hope Enabler

A statistical method will be applied to the given data. **Factor analysis** is a technique that is used to moderate a hefty number of variables into scarcer numbers of elements/factors. From all the variables this technique abstracts maximum collective variance and situates them into a communal score [26]. The rotated component matrix helps us to identify which question loads on which component after rotation. Steps to perform factor analysis Open data in SPSS- Recode the values - Analyze - Dimension reduction - Factor - Descriptives - Extraction - Rotation - varimax. The rotated component matrix values signify that the classroom learning survey is further classified into four components or elements and relevance of each question with the defined four components as shown in Table 4.20.

Table 4.20. Rotated component matrix to identify components

	Component			
	1	2	3	4
The processes which involve thinking and reasoning are more important than specific content in the curriculum.	0.034	0.684	0.165	-0.114
Inculcate positive social behavior among students. E.g helping, sharing, waiting.	0.595	-0.067	0.227	0.045
Desire to have 100 percent pass percentage.	-0.021	0.591	0.040	0.285
The classroom session will be full of live examples and will involve more student participation.	0.168	0.516	-0.013	0.089
Do you have a laugh and a talk with students (learn through play)?	0.233	0.290	0.542	-0.074
Allow students to use cell phones in the classroom.	-0.304	-0.226	0.649	0.128
Creating a game environment while teaching in class.	0.265	0.058	0.739	-0.079
The environment of the classroom is based on scaffolding (hand-holding, feedback, slow yet steady).	0.248	0.239	0.528	0.070

Well defined levels for demonstrating the concepts to the students.	0.478	0.463	-0.203	0.155
Deployment of appropriate tools to make your teaching effective.	0.575	0.261	0.051	0.016
Use verbal redirection for students who are disengaged.	0.031	0.517	0.385	-0.013
Warn or threaten the students for their misbehavior in the classroom.	-0.029	0.085	-2.48	0.848
Motivating the students by giving them positive feedback.	0.708	0.014	0.150	0.091
Reward the achievers with incentives (e.g. stickers, badges).	0.606	-0.062	0.180	0.454
Do you follow the continuous reward system.	0.414	0.138	-0.046	0.641
Are you confident in your ability to encourage students socially, emotionally and inculcate problem-solving skills	0.603	0.413	0.014	-0.021

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

4.4.1. Interpretation of the Rotated Above Matrices

Rotated Component Matrix[a]

	Component			
	1	2	3	4
Are you confident in your ability to encourage students socially, emotionally and inculcate problem solving	.603			
Well defined levels for demonstrating the concepts to the students.	.478			
Reward the achievers with incentives (e.g. stickers, badges).	.606			
Motivating the students by giving them positive feedback.	.708			
Inculcate positive social behaviour among students. E.g helping, sharing, waiting.	.595			
Deployment of appropriate tools to make your teaching effective.	.575			
Warn or threaten the students for their misbehaviour in classroom.				.848
Do you follow the continuous reward system.				.641
Creating a game environment while teaching in class.			.739	
Allow students to use cellphones in the classroom.			.649	
Do you have a laugh and a talk with students (learn through play)?			.542	
Environment of the classroom is based on scaffolding (hand holding, feedback, slow yet steady).			.528	
The processes which involve thinking and reasoning are more important than specific content in curriculur		.684		
Desire to have 100 percent pass percentage.		.591		
Use verbal redirection for students who are disengaged.		.517		
Today's classroom session will be full of live examples and will involve more student participation.		.516		
	faculty Conduct	Teaching methodo	Environment	Reward

Figure 4.2: Excel sheet for elements interpretation

Figure. 4.2 is the interpretation of Table 4.20. The concept of rotation is involved which reduces the number of factors on which the variables show high loading. These 16 questions are further divided into 4 components/elements. E.g. question" Are you confident in your ability to encourage students socially, emotionally, and inculcate problem-solving skills?" has four different component values component1=0.603, component 2= 0.413, component 3=0.014, component 4 =-0.021 as mentioned in Table 4.20. From the above value analysis, this question has high loading with component 1, so the rest three values are discarded and similarly, the lower values are discarded for the rest 15 question. Each question dependency is calculated and from this question relation with element is generated.Four elements formed are faculty conduct, teaching methodology, environment, and reward.

Faculty conduct:- A faculty's ability or desire/belief to make the classroom learning more effective and engaged to achieve goals. It includes Observation:- What they do, How they react to a given situation; Feedback loops:- Consistent or intermittent [108], A good faculty conduct is a combination of regular feedbacks, interactive two ways teaching, keen observation on students' performance and most important student connect, these all factors always help to enhance engagement among the students.

Teaching methodology:- Content-based teaching with the help of real-life examples. Various new teaching pedagogies can be incorporated to enhance classroom learning [109][110].

Environment:-The environment constraints always exist [111] and to apply Gamification concepts there is a requisite of the environment [48]. There can be two types of Environment positive and negative.

Positive:- When one's basic qualities i.e. academic background, work experiences, surroundings, player journey, etc. helps to complete the work and boost his morale in the right direction. Eg: A well-trained driver has to drive a car in a hilly area.

Negative: - What if one hopes for something that is beyond one's immediate control. A faculty wants to conduct a game-based learning session but the authorities of the concerned college don't approve.

Rewards:- They are like patrons which are given in recognition of services, efforts, and achievements.

Types of rewards

1) Tangible rewards-- Financial rewards [108] and Intangible rewards—Recognition rewards [112].

2) Expected and unexpected rewards
3) Contingency rewards
    - Engagement contingent – To be awarded during the start of the task.
    - Completion contingent -- To achieve award during the finish of the task.
    - Performance contingent—Reward if the task is accomplished well.

The rewards are one of the most important components of gamification (in form of points, levels, badges, verbal appreciation) which acts as an extrinsic motivator for developing the perfect Gamified learning environment. "The real accomplishment of the gamified system is to raise feelings of achieving mastery, sovereignty, sense of belonging" with continuous engagement and enticement [96]. Rewards enhance more contribution of participants but a good framework leads to better quality contributors [113].

The major challenge is to check the joint variability of the elements to define the Hope enabler to enhance classroom engagement.

4.4.2 Computation of Regression Coefficient's and Forming the Equation

Using least squares regression, develop a regression equation based on (1) Faculty conduct (2) Teaching methodology (3) Environment (4) Rewards.

Four-Independent Variables Regression

Independent Variables: k=4

No Intercept, e= error of tolerance

Through SPSS software regression is applied. Steps applied in SPSS:- open data in SPSS - Analyze – Regression - Linear - Statistics. The **ANOVA** Table 4.21 represents the F- ratio which experiments whether the overall model of regression is a virtuous fit for the data. Table 4.21 shows statistical data of independent variables as well as considerably envisage the dependent variable, $F = 24.367$, $p < 0.0005$.

H= a_0x + a_1y + a_2z +a_3k+ e

To define the regression coefficients, we use the following equation.

$$a = (M'M)^{-1}M'N \quad (1)$$

N= Dependent variable in form of survey result (%Strongly agree)have been scaled on 0-1.

M= Each question dependency on four factors/elements .The data is collected from SPSS rotated matrix component which questions load on which component after rotation Table 4.20.

Table 4.21. ANOVA test

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.460	4	1.115	24.367	0.000[a]
	Residual	0.549	12	0.046		
	Total	5.010[b]	16			

Table 4.22. Dependency table

	"N"	"M"			
Q	**Strongly agree(%) Results**	**Faculty conduct (M1)**	**Teaching methodology (M2)**	**Environment (M3)**	**Rewards (M4)**
1	0.636	0.034	0.684	0.165	-0.114
2	0.721	0.595	-0.067	0.227	0.045
3	0.391	-0.021	0.591	0.04	0.285
4	0.8	0.168	0.516	-0.013	0.089
5	0.473	0.233	0.29	0.542	-0.074
6	0.18	-0.304	-0.226	0.649	0.128
7	0.345	0.265	0.058	0.739	-0.079
8	0.209	0.248	0.239	0.528	0.07
9	0.691	0.478	0.463	-0.203	0.155
10	0.773	0.575	0.261	0.051	0.016
11	0.345	0.031	0.517	0.385	-0.013
12	0.2	-0.029	0.085	-2.49	0.848
13	0.745	0.708	0.014	0.15	0.091
14	0.609	0.606	-0.062	0.18	0.454
15	0.445	0.414	0.138	-0.046	0.641
16	0.718	0.603	0.413	0.014	-0.021

From Table 4.22 we have N and M values

Step 1:- M'M=Matrix multiplication of M' and M

Matrix M' dimensions = 4 * 16 and the values of the matrix are shown in Table 4.23.

Table 4.23. M' Matrix with values

	M'1	M'2	M'3	M'4	M'5	M'6	M'7	M'8	M'9	M'10	M'11	M'12	M'13	M'14	M'15	M'16
1	0.034	0.595	-0.021	0.168	0.233	-0.304	0.265	0.248	0.478	0.575	0.031	-0.029	0.708	0.606	0.414	0.603
2	0.684	-0.067	0.591	0.516	0.29	-0.226	0.058	0.239	0.463	0.261	0.517	0.085	0.014	-0.062	0.138	0.413
3	0.165	0.227	0.04	-0.013	0.542	0.649	0.739	0.528	-0.203	0.051	0.385	-2.4	0.15	0.18	-0.046	0.014
4	-0.114	0.045	0.285	0.089	-0.074	0.128	-0.079	0.07	0.155	0.016	-0.013	0.848	0.091	0.454	0.641	-0.021

M'M= The values of matrix multiplication M'M are mentioned in Table 4.24.

Table 4.24. Result of matrix multiplication M'M

1	2.626696	0.932046	0.614534	0.622695
2	0.932046	2.0342	0.191234	0.289339
3	0.611924	0.198884	7.84564	-1.982073
4	0.622695	0.289339	-2.058393	1.506441

Step 2:- $(M'M)^{-1}$= Inverse of matrix multiplication will be performed. The values of the inverse of the matrix are mentioned in Table 4.25.

Table 4. 25. Result of matrix multiplication $(M'M)^{-1}$

1	0.57423650014203807979	-0.19430779993547821765	-0.14160954971957816817	-0.38636351371991902016
2	-0.19487858321941898141	0.5883147491219530989	-0.011645793746616556911	-0.047864339918085802862
3	-013792248663654269	-0.012297207563460563261	0.23541817338108045478	0.369148974472218386 35
4	-0.38848551120244750804	-0.049580368966970063363	0.38244595111251443366	1.337117957778749399

Step 3:- M'N= Matrix multiplication. The matrix result is in the form of 4*1 as shown in Table 4.26.

Table 4.26. Result of matrix multiplication M'N

1	3.06892
2	2.244716
3	0.775267
4	1.017025

Step 4:- a = $(M'M)^{-1}M'N$

a = $(M'M)^{-1}M'N$

The matrix multiplication is performed and the final result is mentioned in Table 4.27.

Table 4.27. Final result

1	0.82339348925248777733
2	0.66598482153951469985
3	0.10685476612731086179
4	0.3528553136456018866

The values of a_0 , a_1, a_2 have been obtained which will further help us to define the hope coefficients.

The coefficient values are verified through SPSS software and the results of the coefficients are displayed in Table 4.28.

Table 4.28. Coefficients Values

Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**T**	**Sig.**
		B	**Std. Error**	**Beta**		
1	V1	0.825	0.162	0.597	5.089	0.000
	V2	0.666	0.164	0.424	4.058	0.002
	V3	0.104	0.103	0.132	1.014	0.330
	V4	0.348	0.248	0.191	1.404	0.186

Column B defines the values of the coefficients of defined elements.

a_0=0.82, a_1= 0.66, a_2=0.10, a_3=0.35

H= a_0x + a_1y + a_2z + a_3k

Hope equation for the classroom learning representing the elements like faculty conduct, teaching methodology, Environment, rewards.

H=0.8x+0.7y+0.1z+0.3k.

Rewards act as one of the important elements of gamification but not the only element. Faculty conduct and teaching methodology act as one of the long-term and

imperious motivators which completes the hope enabler equation. The gamification provides companies with a new platform to relate to customers enhance their employee productivity and innovation which can be easily achieved by Hope microelements.

4.5 Summary

A novel model of hope enabler is being presented which is the next level of motivation to boost the engagement and enticement of the learner. The continuous engagement and enticement of the scholar are not only based on extrinsic rewards (points, levels, badges, verbal appreciation, etc) it also incorporates microelements of engagement like (1) Faculty conduct (2) Teaching methodology (3) Environment (4) Rewards. These elements are obtained by applying factor analysis to the survey results. The authenticity and reliability of data are thoroughly checked with the use of SPSS software. The microstructure of the hope enabler actively takes part to form an impeccable gamified system to accomplish the goals of enticement and incessant engagement of the learner. The interpretation of the survey clearly states that we need to bring a meticulously captured and revisited revolutionary change in our present education system by adopting gamified frameworks of teaching, involving rewards system beyond the marks, more lessons to be defined based on regular feedback, and embracing the new wave of technology in our teaching practices. The Gamified framework will be framed taking into consideration the above elements.

CHAPTER 5

GAMIFICATION AND MACHINE LEARNING INSPIRED APPROACH FOR CLASSROOM ENGAGEMENT AND LEARNING

5.1 Introduction

Gamification is one of the prominent research fields that has grown up in the previous years and still a lot of unexplored areas exist [11][6]. Greater attention is required to integrate concepts of gamification and educational games to enhance the latest elements and use of handheld devices in the classroom to upgrade the traditional learning framework [114]. Elaborative use of game elements in specific educational contexts makes the concept of gamification more engaging, however, strong technical support is required for controlled implementation and evaluation of gamification in the field of education [115]. To support learning and teaching goals, a gamified educational system [7] can be viewed as the design scheme of using game design elements in contexts of education [39]. The process of gamification does not only involve the usage of various software, video games, or computers, it is much more beyond this [116].

Gamification is a vast concept that consists of game design elements, mechanics, and dynamics. Along with this, it is a combination of engagement and progression loop. Educational organizations are moving towards e-learning. They are providing online courses via MOOCs and material for their students. It has become a huge challenge for educational organizations to retain the students associated with their organization. Gamification may be used to create a bridge between education organizations and their students. This will help them to provide a more captivating environment to students that help the organizations to increase their productivity and user engagement on their portal [117][8]. The prompt development of mobile technology is shifting the paradigm from e-learning to mobile learning [109].

5.1.1 Problem Identification

Although gamification has provided a significant platform to be deployed in several fields, still it becomes an open quest to implement it successfully [28]. An adaptive analysis needs to be done to understand the fact that does gamification work. Therefore, it becomes crucial to design the gamified process very carefully. Missing required game design elements may result in unexpected output from gamification. As the focus is on generation-z students, they are losing their interest in the traditional education system to enhance new learning experiences. By analyzing the sensitivity of students towards their study and the advantages of gamification technology, a need of involving new gamification-oriented engagement technology in the education system has been realized.

Motivation: As gamification is an emerging technique, it motivates to enhance the traditional learning methods [118][119]. Gamification has also contributed to the development of the students suffering from several psychological issues such as dyslexia, depression, stress, anxiety, and many others [120]. Gamification is also used with virtual simulations to increase learning exposures that help students to gain competency and confidence. Moreover, gamification in environmental education has been implemented for social causes [121]. A mobile-based education system was developed in the form of a game to increase user awareness and participation to save the environment.

Contribution: By analyzing the above-discussed issues, a novel Gamification technology-oriented education framework is proposed to motivate the students for their studies. Gamified application is only complete when it has its well-defined components, mechanics, and dynamics [92]. A complete element-based pyramid of classroom learning is presented in Figure. 5.1. The primary factors such as valuable structure, meaningful choices, and quantifiable metrics are also included in the gamified framework to complete the process of Gamified Educational System (GES). In recent years, machine learning has shown remarkable development in terms of analyzing data and predictions. It plays a major role in the field of education for analyzing the performance of the students with identifying the early disengagement factors [122].

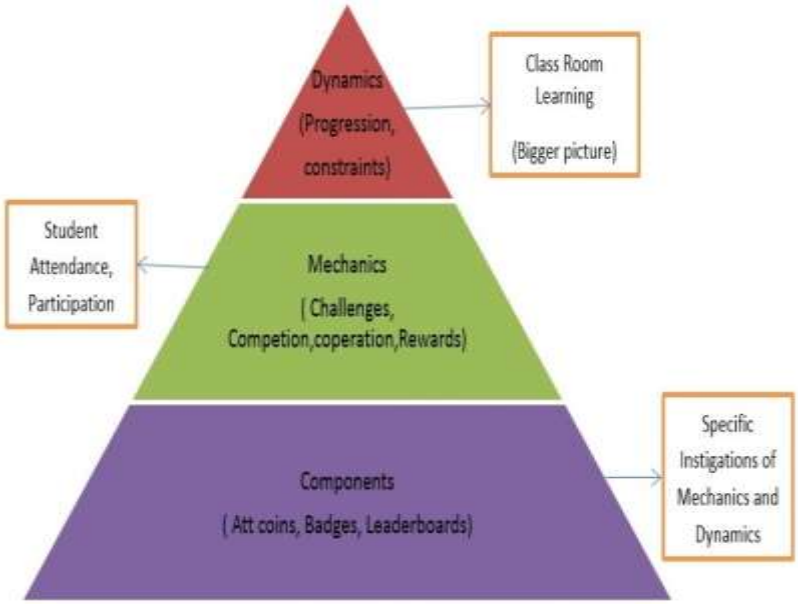


Figure 5.1: Element pyramid of classroom learning

The size and quality of data are two important factors for the prediction based on any machine learning technique. The data set involved for predictive analysis should be more indicative that leads to the more precise the predictions they are expected to make [123]. In this proposed study, an attempt of combining the most influential parameters of machine learning and gamification is made to enhance the effectiveness of the education system. The contribution of the proposed system is as follows:

1. Student's engagement and regularity to classes will be examined through attendance in a gamified framework.
2. Examination of the overall performance of students in the gamified framework on weekly basis.
3. The micro-level study elaborates the student's participation with respect to different attributes of the gamified framework.
4. Machine learning-oriented reward-based decision making for the enhancement of classroom engagement.

5.2 Literature Review

Some of the imperative work related to gamification and machine learning in the domain of education is discussed in this section. The review of the literature for the proposed solution is presented by dividing it into two subsections as follows:

5.2.1 Gamification in Education

There exists a lack of motivation among students; they are not highly motivated to come regularly for fulfilling the attendance. There is a need to design an educational tool that has high engagement and motivational techniques as commercial or online games are bestowed [43]. Gamification is a novel concept that needs attention in academics; researchers have gradually increased in the field of education [31]. Games can play a vital role to use education as a medium to talk about energy issues. Energy education, social interaction, and energy conservation have been used in gamification to enable support for smart grid technology. Intrinsic and extrinsic motivation is clearly explained. Games are a good example of intrinsic motivators [88]. Gamification helps to increase user engagement towards applications. Authors have introduced the concept of interactive mobile applications carrying the features of gamification. A simple and convenient application was developed for users to report road accidents in the interactive mode of the gaming layer [124]. Online education has become one of the largest demands in the field of the internet and as well as in education. Online platforms provide a typical scenario of providing valuable content online on a web portal. The author has analyzed the existing problems of interaction design for online education and has introduced the concept of gamification to improve the overall utilization rate of user experience [125]. The gamified approach involves various fun-based games and makes it a useful learning strategy for the easy and successful implementation of programming topics [63]. The concept of gamification is entirely different from game-based learning. Gamification can be used in broader aspects than game-based learning [114]. The concept of gamification enhances student's motivation and engagement is not short-term as compared to game-based activities. Game thinking and game mechanics are becoming popular day by day. It is being observed that trend of adoption of gamification is going in a very promising manner [48]. Game mechanics and game dynamics create engaging experiences and act as important tools of gamification [124]. The game mechanics include challenges, competition, feedback, rewards (redemption of points) whereas the dynamics include constraints, progression, implementation, and day-to-day analysis. To create a highly engaged gamified framework the usage of game mechanics and dynamics should be practiced carefully [68]. Deployment of gamification in the education system results in rigid game mechanics. Motivation,

commitment and good behavior from students is the generic expected outcome from students. The use of game elements in a non-game environment is increasing so that everyone can acquire appropriate skills and knowledge [47]. Gamification carries the use of game mechanics for engagement. Gamification-based solutions may fail if they lack a clear and formal design process [126]. Before deploying gamification in any field, it is important to know about the methods or frameworks that exist so that process of gamification design must be developed for a successful engagement experience. Games are an addictive part of people's daily life and gamification is encouraging the users to enhance their problem-solving capabilities with fun and learning mechanisms [127]. After exploring and completing the deployment process, it has been identified that usage of game mechanics and game design has shown a significant impact in the area of teaching software development processes [48]. Gamification may be used as a motivational and instructional tool to be embedded in the curriculum of computer science students. Redesigning of software engineering curriculum has been proposed and progression gamification techniques have been deployed during implementation [118]. Gamified learning activities are discussed to enhance student motivation and engagement. The activity is based on doing a pre-test, reach to the initial level, update on leader board, learning the material, doing exercise, pass the minimum score, revision and then proceed to the next module [30]. The comparative analysis of the related existing system is described in Table 5.1.

5.2.2 Machine Learning in Education

Revolutionary change in Information and Communication Technology (ICT) has brought significant change in the teaching and learning process of the education system. One of the biggest sources of information now a day is online tutorials and considered as one of the beneficial aspects to enhance student learning and performance. As there is a huge source of data availability the researchers have applied the machine learning vector algorithm to identify and classify the best subject-related videos of a particular topic [128]. The major challenges involved in learning analytics include big data framework, data collection, privacy, security, and the selection of the optimal algorithm.

Table 5.1. Comparative analysis

Ref.	I1	I2	I3	I4	I5	I6	I7	I8	I9
[124]	Yes	Yes	Yes	Yes	No	Yes	No	No	No
[125]	Yes	Yes	Yes	Yes	No	No	No	No	No
[88]	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes
[48]	Yes	No	Yes	Yes	50	No	Yes	Yes	No
[118]	Yes	Yes	Yes	Yes	30	No	No	Yes	Yes
[30]	Progression loop is not defined	No	Yes	Yes	30	Yes	No	Yes	No
[44]	Progression levels are not mentioned	Yes	Yes	Yes	No	Yes	Yes	No	No

Engagement / Progression Loop = I1, Game Based learning = I2, Gamified learning = I3, Game Elements/mechanics = I4, Sample size = I5, Gamified platform = I6, Visualization of result = I7, Analysis/validation of results = I8, Continuous defined reward system = I9

In terms of choosing the right machine learning algorithm, we have several dominant algorithms are available but to choose the best for the particular analysis is a tedious task [129]. Due to digital data availability, there is an increment in the development of various learning analytical techniques. Machine learning (ML) is a powerful technology that categorizes the data into a set of predefined generic classes. Supervised machine learning is applied to large-scale unstructured data of Facebook groups. ML algorithms are used in text categorization to achieve a high rate of effectiveness. The research in this clearly shows ML can be used as an effective method to identify who needs support within the personal environment of learning with the availability of educational data [130].

5.3 Methodology

Effective student learning is directly proportional to student classroom engagement. The classroom engagement can be enhanced by increasing the involvement of the

students by providing a platform with the most considerable parameters such as the facility of asking questions inside or outside the classroom, the advantage of creative learning, and a sense of belonging among students. The primary goal for the gamified framework is an effective environment that helps to enhance the engagement of the students. On the other hand, the secondary goal is to create interesting learning solutions to enhance student engagement through progressive methods. A perfect trade-off between engagement and progressive loops would be the ”Success Mantra”. The transparency has been maintained in the proposed gamified framework to motivate the students for active participation in the various activities and inculcates high engagement in a student-centric environment. The gamified classroom learning leads to intrinsic motivation among students, fun-based learning, opportunity to explore outside the classroom, and most important is a visualization of their performance. Furthermore, the process of reengineering has been done by utilizing the decision-making efficiency of Machine Learning (ML). Every step of the proposed solution is explained ahead.

5.3.1 Prelude

Classroom learning is a complete platform of content, pedagogy, delivery, and assessment that helps to increase the student's engagement in the class. However, student engagement is only possible with the presence of the student in the classroom (Student participation = attendance) as visualized in Figure. 5.2.

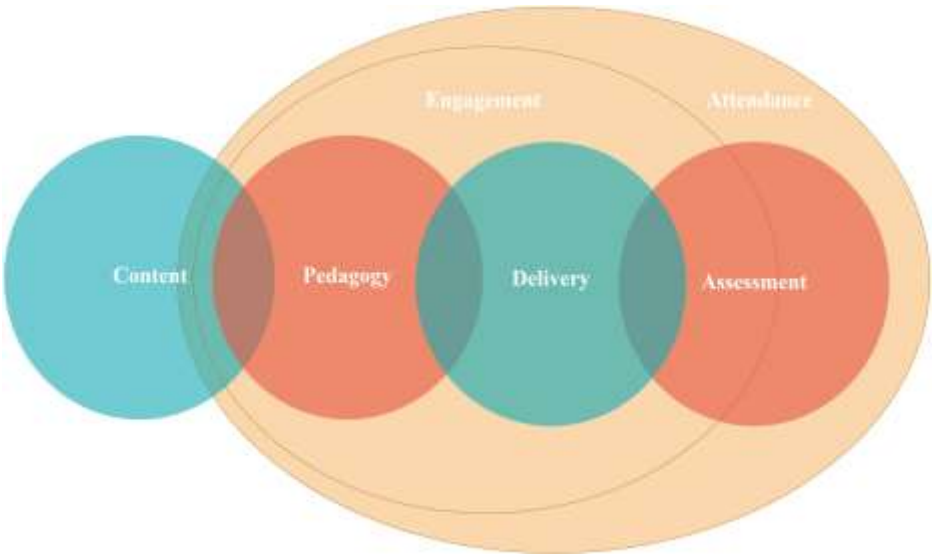


Figure 5.2: Aspects of classroom learning

Classroom learning is dependent on the methodology opted by the instructor that helps the student to involve in the learning process. In the era of the internet, the latest technologies are emerging very rapidly around the world, it is the concerned instructors who can bring the change by using the latest pedagogies with the keen interest of students in the class [91] this would directly increase the overall class engagement. The contextual factors influence the implementation of gamification that involves the instructor's skill, design elements, background knowledge of participants, and the use of the latest gamified concepts [131].

Completing the task by fun learning is significantly better than completing the task by enforced learning. Effective pedagogical tools [93] must comprise healthy interactivity sessions and the usage of 3-D video lectures. Furthermore, focusing on practical concepts rather than theoretical and significantly tutoring done by the instructor for a compound set of environments to make a session preeminent in every aspect.

5.3.2 Context of the Study

The designed gamified framework is not specific to any course or any particular scheme. It is built in such a manner that it can be incorporated with a different set of students belonging to diverse institutes. The gamified framework is being tested on more than 100 students on 6 different courses like oops, android, php, networking, web-designing; involving 2 different institute/college/university students of doaba region jalandhar. The teaching team is comprised of 10 faculties and each college/institute/university has one administrator to keep track of faculty implementing the successful gamified learning patterns. The informal consent has been taken from the faculty as well as students to practice the gamified framework. In the present scenario, teaching methods include PowerPoint presentation lectures, seminars, group discussions in the alternative week. There are well-documented lesson plans, assignments, evaluation criteria enforced on students that lead to low engagement and lack of interest in the classroom. The design process of gamification involves the evolution of gameful systems that leads to complex interactions between the elements defined [11].

5.3.3 Procedure

This section provides detailed information related to the process of acquiring rewards-oriented coins and badges that helps to enhance the motivation of the

students towards learning. The proposed gamified framework is designed by adding new elements in education such as coins, badges, leader boards, and reward systems. All these elements can be gained by students with the help of a Virtual coin-based attendance system, coin-based classroom discussion, flipped classroom challenge, game-based learning activities, online quizzes, organizing a class or group activities. The complete process is demonstrated in Figure. 5.3 defining the flow of the Gamified framework.

5.3.3.1 Virtual Coin-Based Attendance System

In the current education system, attendance is considered as one of the most imperative policy variables that define the scale of attention of the students towards their studies. The students with regular attendance are considered better performers. The increase in student regularity in the classes will enhance student classroom learning. In this gamified framework, the coins are associated with the attendance variable. Each student will be credited virtual Attendance Coins (ATT coins) (40 lectures = 4000 ATT coins).

Algorithm 5.1 Attendance-based coin distribution

1: SET $Studdent_{ATT\_coin} = 4000$

2: **if** $student_{status == ABSENT}$ **then**

3: $Student_{ATT\_coins=studentATT\_coins} -100$

4: **else if** $student_{status} == student_{DUTYLEAVE}$ **then**

5: $student_{ATT\_coins} = student_{ATT\_coins} +100$

6: **else if** $student_{status} == PRESENT$ then

7: $student_{ATT\_coins} = student_{ATT\_coins} +0$

8: **if** $student_{task} == COMPLETED$ OR $student_{answer} == CORRECT$ **then**

9: $student_{\_coins} = student_{ATT\_coins} + bonus\ coins$

10: **else**

11: $student_{ATT\_coins} = student_{ATT\_coins} +0$

12: **end if**

13: else

14: PRINT " wrong input"

15: end if

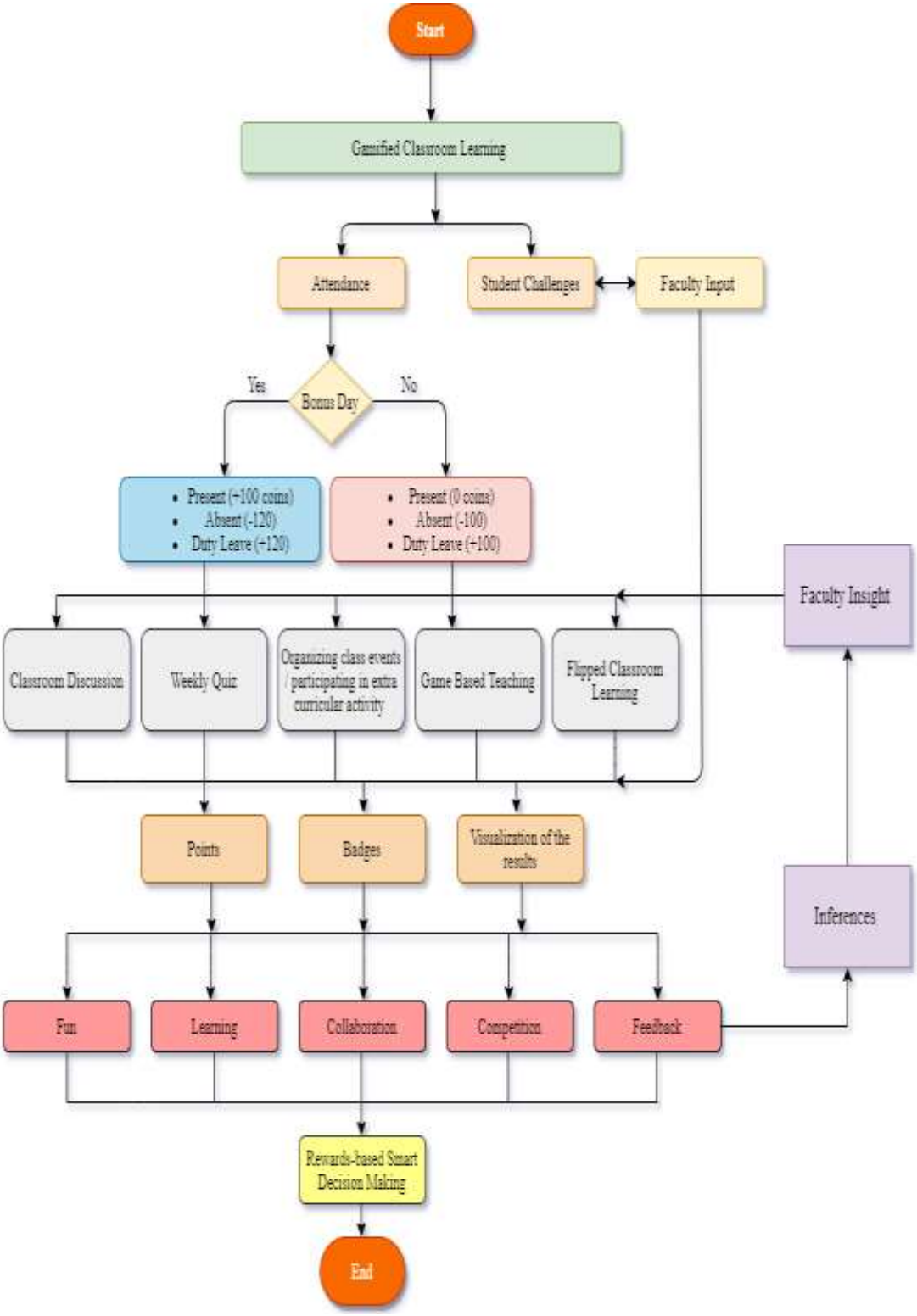


Figure 5.3: Flow chart of gamified classroom learning

There exist 3 situations either the student is present, absent, or not attending the class as he/she is involved in extra circular activity assigned by the faculty that can be termed as duty leave. If a student is absent in the class, 100 ATT coins are subtracted from the total acquired coins for eg. 4000 - 100 = 3900. A total of 100 coins per

lecture are credited to the accounts of those students who are on Duty leave. Duty leave is leave assigned to students for participating in extra circular activities. If a student is present in the class, ATT coins remain the same that are 4000 coins. The process of attendance-based coin distribution is explained in Algorithm 5.1.

5.3.3.2 Coin Based Classroom Discussions

The faculty should encourage classroom discussion that allows open interaction. Several doubts can be clarified and a quick revision can take place. This kind of environment leads to interactive teaching and engage students to think and explore the concepts that enhance speaking skills. The oral discussions or verbal questions asked during the lecture are not associated with any marks. Students evade answering or show insouciance to the classroom discussions.

To enhance student engagement each student who is more involved and has active participation will be awarded virtual coins, badges will be assigned weekly. Each faculty will have 100 ATT coins per lecture. The faculty has to allocate coins to students by asking verbal questions related to previous classes or current topics taught in the classroom. Each question will be of 10 ATT coins if the student answered correctly assigns 10 coins which are clearly explained in Algorithm 5.2. If the answer given by the student is incorrect no coins will be deducted as a gamified framework promotes positive mechanics.

Algorithm 5.2 Classroom discussion coin

1: Input: $student_{ATT\_coins}$, question
2: **if** question == correct **then**
3: $student_{ATT\_coins} = student_{ATT\_coins} + 10$
4: **else**
5: $student_{ATT\ coins} = student_{ATT\_coins}$
6: **end if**

5.3.3.3 Student Challenge

In a gamified framework not only faculty have the option to ask questions to students even students can ask the question to fellow friends related to the topics discussed in the classroom. The question will be verified by the faculty and the virtual coins will

be awarded for giving a challenge to his/her fellow friends. The student who will answer within the least login time will be awarded bonus coins. In classroom learning, we have observed the students are scared of asking questions to faculty due to fear or anxiety. Therefore, in this gamified framework, a student can ask doubt or questions through the application at any point in time and the complete process is explained in Algorithm 5.3.

Algorithm 5.3 Student involvement-based ATT distribution

1: Input: student challenge, bonus, $student_{ATT\_coins}$
2: **if** student challenge == APPROVED **then**
3: $student_{ATT\_coins} = student_{ATT\_coins}$+ bonus
4: **if** student result is in top1 **then**
5: $student_{ATT\_coins} = student_{ATT\_coins}$ + bonus coins
6: **else**
7: $student_{ATT\_coins} = student_{ATT\_coins}$
8: **end if**
9: **else if** student challenge == DECLINED **then**
10: **if** student challenge == ODD **then**
11: $student_{ATT\_coins} = student_{ATT\_coins} - 10$
12: **else**
13: $student_{ATT\_coins} = student_{ATT\_coins}$
14:**end if**
15: **end if**

5.3.3.4 Weekly Online Quiz

The weekly online quiz can help the faculty to check the level of understanding of the concept taught during the sessions. The quiz will be point-based and multiply options will be given to students. The top 5% of students who will have the maximum correct answers in the minimum period will be assigned double ATT coins and the rest of the students will be assigned ATT coins based on the correctly answered questions. The process of online quiz performance-based coin distribution is explained in Algorithm 5.4.

Algorithm 5.4 Online quiz performance-based coin distribution

1: Input: $student_{ATT\_coins}$, bonus

2: Read student list S List

3: **for** student in S List **do**

4: **if** student is in top 5 **then**

5: $student_{ATT\_coins} = student_{ATT\_coins} + correct\_ans \times bonus \times 2$

6: **else**

7: studentAT T coins = studentAT T coins + correct ans × bonus

8: **end if**

9: **end for**

5.3.3.5 Organizing Class Events/Participating In Extra Circular Activities

This would be one of the richest tiers in which the student can gain a lot of virtual coins according to the event or task planned by the students. If the student participates in international conferences or international events 500 ATT coins will be assigned. The national event participation will fetch 300 ATT coins, inter-university participants will gain 200 ATT coins, participation or organizing college or class events will gain 100 ATT coins. Student participation in extra circular activities is very important but it has been observed that they resist projecting their talent due to loss of attendance or due to pressure of studies.

5.3.3.6 Flipped Classroom

In classroom learning more focus is given to the completion of the curriculum. The teacher's focus is to explain the concept without any participation of students. On contrary to this, a weekly one-day concept of the flipped classroom will be implemented that incorporates independent pre-work through self or online learning. The complete session of the flipped classroom will be based on student active interaction and valuable discussions that can help the students to achieve knowledge beyond the books. The top-performing students will be assigned star performer badges.

5.3.3.7 Use Of Game-Based Methods

To make the session more interesting, fun-oriented game-based learning methods should be used. There is a major difference between game and gamification points are elaborated in Figure. 5.4. Game-based learning can be part of the gamified framework used to enhance the education system. Motivation is considered as a convincing medium to involve people for their active participation in Game playing. It has been identified that games engage students in a promising manner as compared to other mediums. They have also concluded that computer games are a significant part of youngster's life. Any game designed for learning purposes must have learning dynamics as well [132]. The traditional education system follows the learning by knowing approach. As technology is commanding, one should adopt the skills of learning by doing also. The traditional education system can be made practicable with the help of pedagogical elements like tasks, levels, etc. The games like a flashcard, chain reaction, out of box thinking can be incorporated in regular teaching to enhance student engagement.

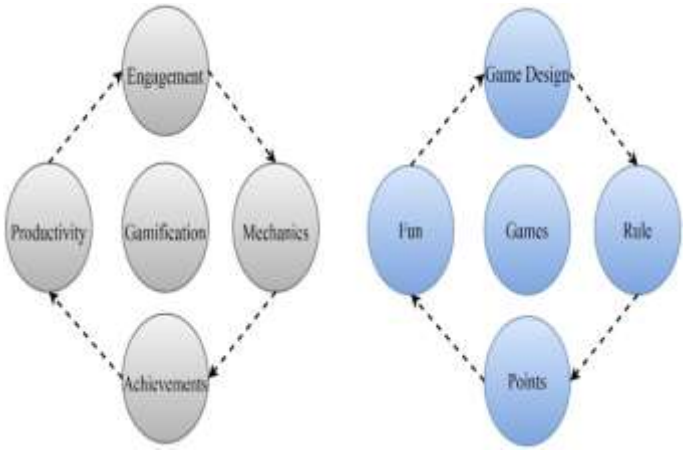


Figure 5.4: Difference between game and gamification

5.3.3.8 Visualizing the Real-Time Analysis

The real-time analysis can be done to check the student engagement with the number of virtual coins earned by the student based on attendance, knowledge, active participation. The number of virtual coins gained or lost can be viewed by the faculty as well as admin to keep a proper track of students' performance as depicted in Figure. 5.5.

Figure 5.5: Visualization of student's overall performance

5.3.4 Describing Players

Students and faculty will be active players. According to Amy jokim's 1 model Figure. 5.6 explores the model of gamified classroom learning.

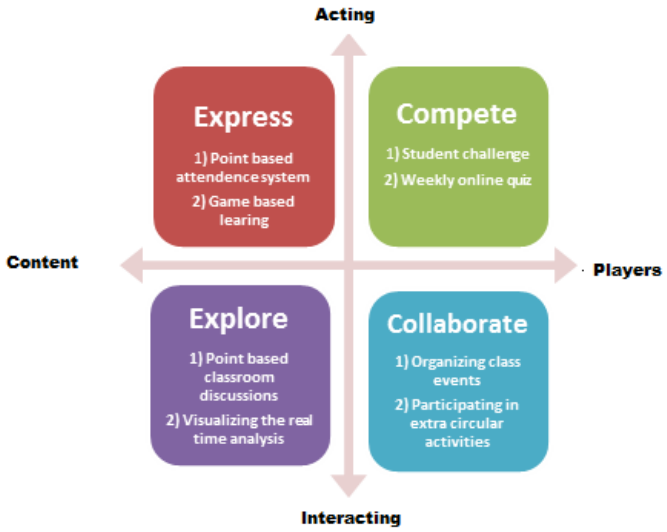


Figure 5.6: Amy Jo Kim's model for gamified classroom learning

5.3.5 Device Activity Loops

For gamified learning, we need to focus on two major aspects that are engagement and progression

5.3.5.1 Engagement Loop

It delineates the pathway that motivates the individual to do the particular task persistently. It keeps the process moving. ATT coins-based attendance system, coin-based classroom discussions, weekly quizzes are part of the engagement loop.

5.3.5.2 Progression Loop

The concept of randomness will be involved in the attendance module, on a particular day generated by the system the students will get bonus ATT coins for attending the particular lecture will be credited as per Algorithm 5. Similarly, the student who is absent on a particular day will Lose the ATT coins. Bonus day is different from normal attendance days as the student will gain the coins for being present in the class. If r=10, the present will gain 110 ATT coins, the absent student will lose 120 ATT coins and the student on duty leave will gain 120 ATT coins on the bonus day.

Game-based teaching activities, flipped classroom learning, participating in extra circular activities; providing a challenge to students make the teaching more effective and collaborative.

Algorithm 5.5 Bonus attendance-based coin distribution

```
READ ATT coins
r= Random (ATT coins)
if student == ABSENT then
  ATT_coins = ATT_coins − (100 + 2 × r)
else if student == DUTYLEAVE then
  ATT_coins = ATT_coins + (100 + 2 ∗r)
else if student == PRESENT then
  ATT_coins= ATT_coins + (100 + r)
else
PRINT “wrong input”
end if
```

5.3.6 Deployment Of Tools

5.3.6.1 Points/Coins

Points / Virtual coins will be earned through classroom discussion quiz, Student challenge, attending regular lectures, organizing events. Coins allocated to students motivate them to perform better.

5.3.6.2 Badges

The star performers will be awarded weekly badges that can be shared on social media. They are virtual symbols mentioned in Figure. 5.7 will be assigned to students for their various achievements.

Figure 5.7: Badges designed for gamified classroom learning

5.3.6.3 Leader Boards

The names of the top scorers will be displayed; this would create a zeal for healthy competition. One would lead to tangible rewards or intangible reward mechanisms. Topper's IDs are displayed on the leaderboard during the implementation as mentioned in Figure. 5.8.

Top 5 Students

#	Student Id	Coins
1	O7services_1632647	5545
2	O7services_1904	5510
3	O7services_17245828	5242
4	O7services_1724525	5230
5	O7services_1704216	5229

Figure 5.8: Topper's registration numbers on the leaderboard

5.3.6.4 Analytical Graphs

This would depict one’s progress of gaining coins through attendance, quizzes, organizing events, classroom discussions as mentioned in Figure 5.5. When Students win badges, points and their names are displayed on leader boards depicting student's classroom performance makes the concept of gamification a long-term concept in contrast to focal game activities that exist for a short period [114].

5.3.6.5 Rewards

The student who has more than Initial credited ATT COINS for the particular course code he/she can redeem those coins. Rule: For redemption, coins for a particular course should be > Initial ATT coins of course (eg > 4000). Rewards can be tangible or intangible according to the faculty and the institution's consent. Rewards are divided into three tiers.

Tier 1 consists of rewards that will be awarded to students who gained maximum coins through attendance.

Tier 2 rewards will be availed by students who gained maximum coins through the quiz.

Tier 3 rewards will be availed by students who gained maximum points through extra circular activities.

Rewards can be assigned to students on a weekly or monthly basis according to the decision of the institution administrator. Various decision-making mechanisms can be incorporated for assigning rewards. There is the existence of a complete barter system in which students earn virtual ATT coins and can redeem their earrings in various tiers as described in Figure. 5.9.

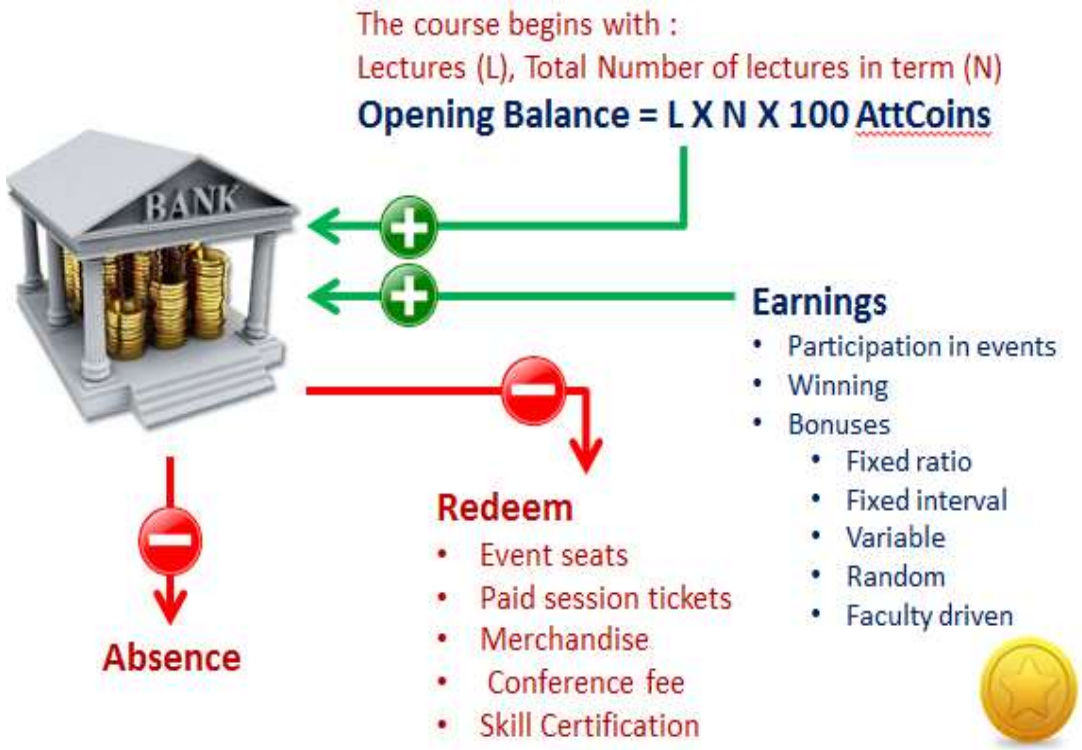


Figure 5.9: Barter system

5.3.7 Re-engineering of Reward-Based Decision Making

The interactive decision is a Module in the proposed model that helps the student to provide maximum permutation combinations concerning the earned badges gained through one of the most inspiring Decision algorithms of machine learning. For interactive decision making, the Adaptive Neuro Fuzzy Inference Systems (ANFIS) model is used to calculate the maximum combination of earned coins as presented in Figure. 5.10. The coding of the ANFIS method is done using software named PYTHON. The model is trained and the concept of backtracking algorithm is used for optimizing the weights of the model. Table 5.2 explained the range of selected parameters that are used to provide the input to the ANFIS model for decision making.

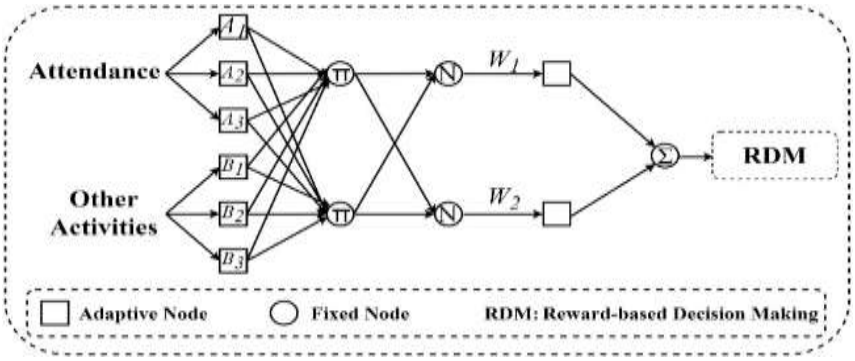


Figure 5.10: ANFIS-based smart decision making

Table 5.2. Pre-described range of selected parameter

Sr. no.	Range	Decisive factor
1.	< 50	Low
2.	50−120	Moderate
3.	> 120	High

The first step of the model involves input variables which are parental i.e. coins gained through attendance, coins gained through other activities that involve (Quiz, classroom discussion, challenges, etc.) for the prediction of rewards. The influential parameters are selected and listed:

- Member function output: linear;
- Type of member function: Gaussian;
- The method used for optimization: hybrid;
- Increase the rate of step six:

Layer 1(Fuzzification): -Adaptive nodes in the ANFIS architecture are denoted with square boxes. There is the existence of node I of the first layer that takes values as input in the form of labels that are linguistic like Low, Moderate, and High. The (X) helps to regulate the level of input and also signifies the node function. For instance

$$o_k^1 = \mu A_i\ (Attendence) \forall \text{ i}$$
$$= \{A_1 = \text{Low}, A_2 = Moderate, A_3 = High\} \quad (1)$$
$$o_k^1 = \mu B_i\ (\text{Other activities}) \forall \text{ i}$$
$$= \{A_1 = \text{Low}, A_2 = \text{Moderate}, A_3 = \text{H igh}\} \quad (2)$$

Table 5.3. Examples of 9 fuzzy rules

Rule no.	Attendance	Other activities	Decision making
1.	Low	Moderate	Decision_1
2.	Moderate	Moderate	Decision_2
3.	High	Low	Decision_3
4.	Low	Low	Decision_4
5.	Moderate	High	Decision_5
6.	High	High	Decision_6
7.	Low	High	Decision_7
8.	Moderate	Low	Decision_8
9.	Moderate	High	Decision_9

Layer 2(Product): - The next layer of the network signified as the second layer consists of fixed rule-based nodes. This layer is denoted by and is also known as the membership layer. The firing strength is known by each node's output *wi* that is marked as a rule. The following equations represent that calculated firing strength is done by utilizing the product rule.

$$O_k^2 = \mu A_i\ (Attendabce) * \mu B_i\ (OtherActivities) for\ i$$
$$= 1,2,\ldots.,9\ rules. \quad (3)$$
$$\mu A_i \forall \text{ i } = \{A_1, A_2, A_3\} = 3; \quad (4)$$
$$\mu B_i \forall \text{ i } = \{A_1, A_2, A_3\} = 3; \quad (5)$$

Layer 3 (Normalization): - The fixed nodes are defined in the third layer of the network. The firing strength ratio of the i_{th} rule is calculated through this rule. The following equation helps to perform firing strength normalization.

$$O_K^3 = \frac{W_i}{W_1 + W_2 + W_3 \ldots\ldots\ldots\ldots\ldots\ldots + W_n} = \bar{\mathrm{W}} \quad (6)$$

Layer 4(De-fuzzification): - The fourth layer known as de-fuzzification executes the task by the concept of multiplying fuzzy function with the output of previous nodes. By the following node functions, each node can be adjusted.

$$\mathrm{O}_k^4 = \bar{W}_i * f_i = W_i\,(a_i \mathrm{x} + b_i \mathrm{y} + \ldots\ldots + r_i) \quad (7)$$

Layer 5 (Output): - The ultimate composite probability is calculated through the 5th layer that is used to calculate the scale of susceptibility. The actual output is determined by considering all outputs of pervious nodes of layer 4 de-fuzzification and then applying weighted average summation operation.

$$\mathrm{O}_k^5 = \sum_k \overline{W_i} * f_i = \frac{\sum_k W_i * f_i}{\sum_k W_i} \quad (8)$$

5.4 Implementation

To extend the use of gamified framework beyond the existing contexts there is a need for systematic study keeping in mind the effects of different individuals and situational contexts [11]. The effect of gamified learning was analyzed with the help of three products.

5.4.1 Gamified learning management system

5.4.2 Gamified learning Application

5.4.3 Game-based application (Geeker's hub)

5.4.4 Interactive Reward-based Decision Making

5.4.1 Gamified Learning Management System

It is a repository used to store and track information on a timely basis. The gamified learning management system is divided into three main panels that include admin, school coordinator, and faculty. Admin creates an account for the department coordinator and further department coordinator assign students to particular faculty. All the tasks performed by faculty like registering students, assigning online ATT coins based on attendance, assigning classroom discussion coins, preparing online quiz, assigning badges, visualization of results is done through the designed platform.

5.4.2 Gamified Learning Application

It is a mobile-based application that is used by students to perform online quizzes, track the online coins gained daily, and redemption of coins in the form of rewards.

5.4.3 Game-Based Application (Geeker's Hub)

Various games are incorporated in this application that includes an online housie game used to test student's aptitude knowledge. Another game is designed in form of flashcards to judge students' knowledge of the c language. Games act as an intrinsic motivational factor for students.

Each product developed has a novel structure and consists of unique features Mentioned in Figure. 5.11. The use of new technologies like the internet, mobile phones, online activities has made a huge difference in the education system as well [133]. Implementation of the latest information systems makes an impact on individual learning and increases the motivation and engagement of students. The concept of gamification is trending [134]because of its relatable elements that include fun-based learning, performing the task step by step, challenges defined progressively.

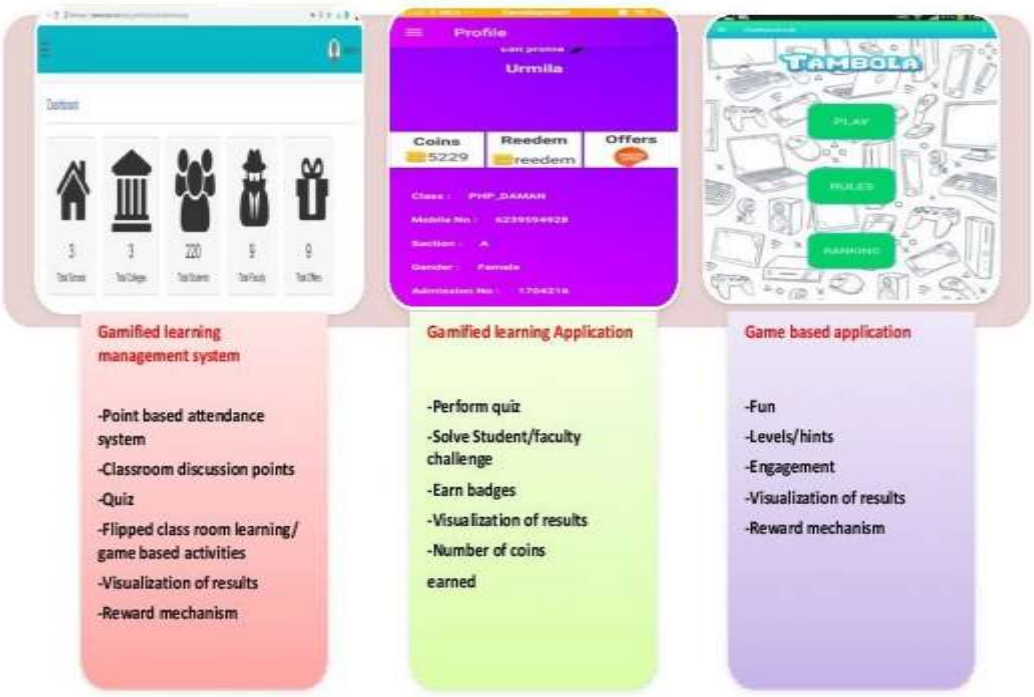


Figure 5.11. Features of the applications used for the implementation of the gamified framework

The quintessence of gamification does not only focus on technology, its diversity includes a better learning environment that increases student motivation and

engagement by involving the reward system. The gamified learning pattern is designed in such a manner which do not completely outstand the traditional learning techniques followed in the education system. Traditional education is enhanced by adding virtual ATT coins, badges, rewards, fun-based learning, game-based activities to have higher engagement among the students.

5.5 Results and Discussion

In the field of gamification, the concepts of high psychological ability are involved that demonstrate the dimensions of the individuals, design elements, and qualities that affect user engagement and experience. The concept of gamification is not only about assigning coins to students, but it should also involve student creativity, collaborative activities, gaming strategies, and creating a situation for the overall involvement of students [68]. Keeping in consideration all the above points mentioned the attendance-based gamified framework was implemented in two different institutes or Universities. There should be careful integration of gamified learning context [31]. The proposed framework is designed in such a manner that it is not specific to any particular course or university.

5.5.1 Students Engagement and Regularity Analysis

It was implemented in an institute where there was no attendance compulsion among the students. With the help of a gamified framework, students were intrinsically motivated to attend the classes that included a coin-based attendance system, fun-based learning, online quiz, verbal discussion. Enhancement in attendance can be examined in all six sections as presented in Figure. 5.12.

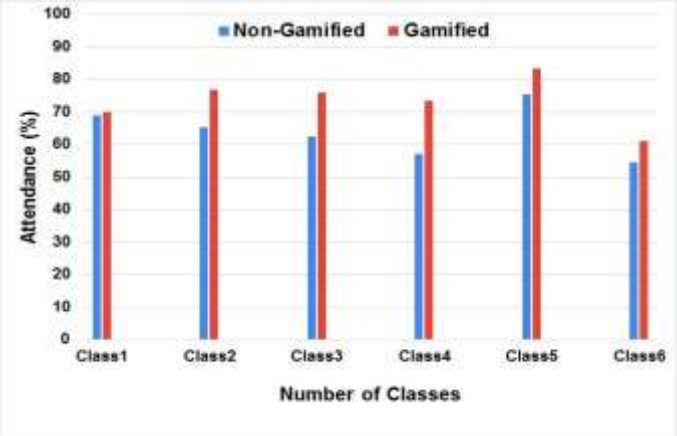


Figure 5.12: Attendance comparison of Non-Gamified vs Gamified classroom learning

Whereas the students of the university, 75% attendance is a mandatory change in the attendance is negligible as compared to previous months where the gamified framework was not applied. In the second class, it has been observed that a drop of 3% attendance as mentioned in Figure 5.13 gamified framework as compared to non-gamified. The point is taken into consideration that further analysis will be done to enhance the gamified framework in the future.

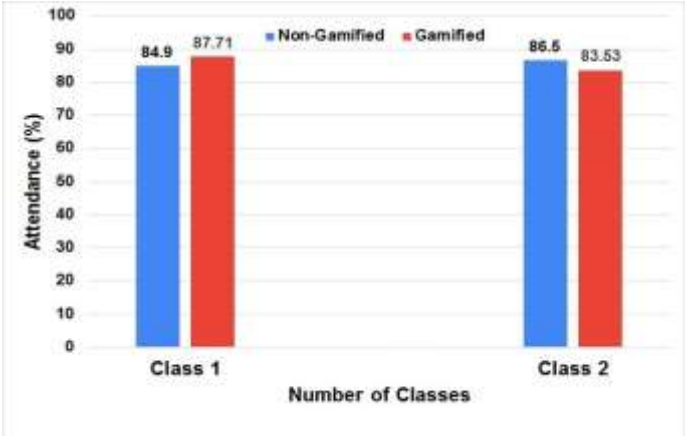


Figure 5.13: LPU Attendance comparison of Non-Gamified vs Gamified classroom learning

5.5.2 Overall Performance of Students in the Gamified Framework

In scenario 1, students performed all the activities and game-based learning sessions with high motivation and enhanced game mechanics and dynamics involved by gaining more and more ATT coins in their weekly performance. There was a gradual increase in the weekly points gained as illustrated in Figure 5. 14 for continuous three weeks and a drop in points gained can be seen. The calculated outcomes represent the enhancement in student engagement; however, more intrinsic learning methods can be incorporated.

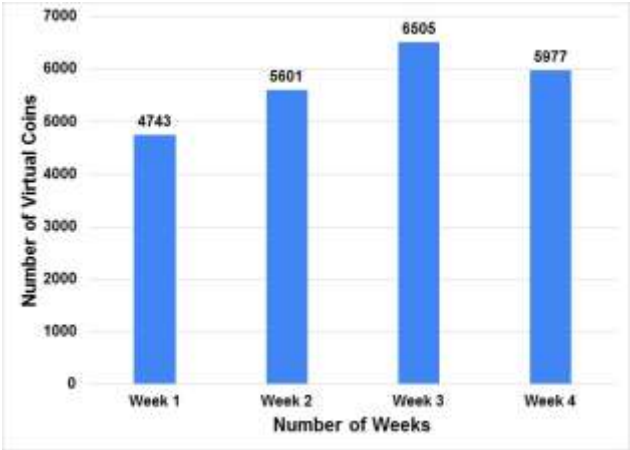


Figure 5.14: Scenario 1: Weekly performance of students

The coins gained in Scenario 2 by the institute, students showed remarkable results in the first and second week of experimentation. However, a drop in points gained has been analyzed in the third week as demonstrated in Figure. 5.15. Reasons were analyzed by the faculty members as it was a festive week and India's most popular festival was held this week.

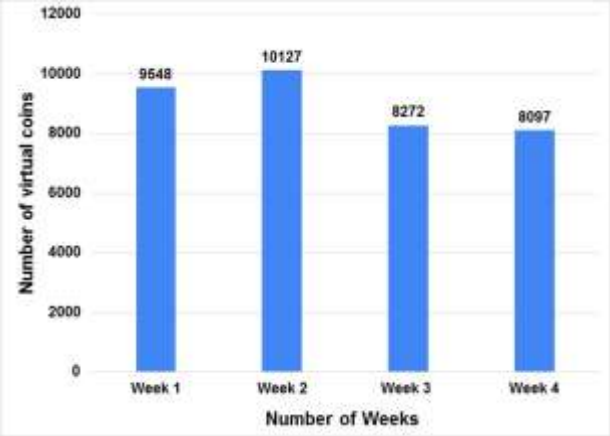


Figure 5.15: Scenario 2: Weekly performance of students

Faculty's Perception 1: Students have been experienced first-time fun-based learning through games that enhanced the student's creativity and classroom interaction.

Faculty's Perception 2: Students were highly motivated as they wanted to gain more attendance coins on the regular basis and performed the activities to the best of their capabilities.

5.5.3 Point-based Decision-Making Analysis

Attendance and in-class activities are considered as two parameters of the study which are used to evaluate the relationship of point-based decision making. ANFIS contains the data processing efficiency of the two most consistent algorithms of machine learning, ANN and Fuzzy logic, for relationship analysis. Table 5.3 defines the inference system with nonlinear functions. A total of 9 Fuzzy rules are used to calculate the compounded relationship vector to evaluate every possible relationship for attendance and other activity-based events.

A total 63 number of datasets are formed that contain more than 900 singular events. These singular events are related to attendance and other activities involved in the enhancement of student engagement. To fulfill the purpose of training and testing, 50 datasets are used for training and 13 remaining datasets are used to assess the performance of the system. The training and testing performance is represented in

(Table 5.4) of designated decision-making machine learning models. The various other performance assessment metrics are specificity, accuracy, sensitivity, and F-measure are intended for performance determination. Analysis based on Error rates such as Median Absolute Error (MEDAE), Root Mean Square Error (RMSE), and R^2 are statistical measurements that are calculated to categorize the proposed solution performance.

The performance showed by the ANFIS model gives better results than in comparison to Fuzzy Systems (FS) and Artificial Neural Network (ANN) after analyzing the results in Table 5.3. The comparative accuracy achieved by the ANFIS model for reward-based decision calculation is defined by 94.85% whereas prediction accuracy with ANN is 91.77% and accuracy by FS is led by 90.86%. The improvement in terms of specificity is calculated by 93.25% in comparison to predicted models ANN (91.14%) and FS (89.76%). The level of improvement showed by sensitivity and F-measure are the same. From the above-calculated values, it can be inferred that the ANFIS classifier is far more competent for complex and non-linear problems along with the fact it is more sensitive for multifactor-based relationship analysis.

After the evaluation of Table 5.5, it has been observed that the distribution value is much closer in comparison to predictive outcomes of FS and ANN-based predictive outcomes. The value of R^2 signifies that results are much closer to the regression line by attaining accuracy of 0.91 in comparison to accuracy attained by ANN (0.85) and FS (0.83). In comparison to Values Account For (VAF), RMSE, and MEDAE parameters for error calculation, it is evaluated that the present model produces low errors. It is concluded that the ANFIS model shows an acceptable error rate and has high selectivity and can be used for reward system mechanisms.

Table 5.4. Training and testing performance

Performance parameters	**FS**		**ANN**		**ANFIS**	
	Train	**Test**	**Train**	**Test**	**Train**	**Test**
Accuracy	94.26%	90.68%	98.23%	91.57%	97.62%	94.58%
Sensitivity	95.41%	92.76%	97.85%	93.28%	98.17%	95.41%
Specificity	94.78%	89.57%	97.13%	91.04%	97.82%	93.52%
F-measure	94.69%	91.45%	96.28%	92.58%	98.20%	94.43%

Table 5.5. A summary of the best ANFIS models conditions and their statistical criteria

Error Parameters	**FS**		**ANN**		**ANFIS**	
	Train	**Test**	**Train**	**Test**	**Train**	**Test**
RMSE	4.20%	3.84%	2.45%	1.77%	1.75%	1.30%
*R*2	0.89%	0.81%	0.87%	0.84%	0.92%	0.90%
VAF(%)	90.17	81.65	87.66	79.69	93.68	88.89
MEDAE	1.88	1.49	2.43	1.19	1.59	1.19

5.5.4 Predictor Stability Analysis

System stability is defined as a measure of occurrence which is used to analyze stability analysis over the period. The evaluation of system stability takes place for a limited period for Absolute Average Shift (AAS). The statistical measure value of AAS lies between 0 and 1. The 0 value depicts good stability whereas the 1 value depicts the low performance of the system over a given time. As mentioned, the register minimal AAS value to the proposed model is 0.18, AAS maximal value is 0.52 and the average value of the overall experiment is 0.29. The above results determine that the technique presented is quite stable to check the performance-oriented real-time decision-making.

5.6 Summary

Student engagement has been considered as one of the major concerns in classroom learning. The purpose of implementing a gamified framework for higher education is to increase student engagement and diverse learning methods. It helps to provide the opportunity for students to explore several learning methods through various activities. The mechanics and dynamics such as challenges, competition, rewards, progression, implementation, day to day analysis play an important role to achieve considerable results. Specifically, in this research (i) Students engagement and regularity to classes are examined through attendance in the gamified framework; (ii) The overall performance of students is evaluated in the gamified framework on weekly basis; (iii) A micro-level study has been conducted that elaborates the student's participation concerning different attributes of gamified framework; (iv) Machine learning-assisted decision-making solution is proposed for reward distribution to enhance the engagement of the student in the classroom. The activities

such as verbal maneuver, conducting fun-based learning define the high involvement of faculty that leads to the implementation of a successful gamified framework. The proposed gamified framework is validated by performing the comparative analysis. The calculated outcomes represented the high involvement of the students in the gamified framework and gained ATT coins in huge amounts.

CHAPTER 6

REENGINEERING THE GAMIFIED SYSTEM FOR THE OPTIMAL OUTCOME ON ENGAGEMENT AND LEARNING THROUGH ASSESSMENT

6.1 Introduction

In this chapter, an explorative study has been persuaded using a questionnaire-based methodology. This study aims to quantify the impact on the contemporary education system due to gamification, especially in the accelerated growth of the gamification concept due to covid induced digitalization in the education sector. The biggest challenge is the degree of engagement between the various stakeholders. Attendance is no longer an issue, but the level of engagement and human touch in education has become an issue. The outcome of this study shows there is an urgent need to employ gamification elements in the education process so that the teacher-student learning process becomes more productive.

Most educational institutions were not prepared to deal with such a situation. Many teachers and educators are first-time users of digital infrastructure for education, and the same is the issue with students. In addition, some educational organizations were passing through a phase of shifting from traditional chalkboards to smart classes more and suddenly due to covid the system required to think beyond smart board class teaching.

Education 4.0 [42] involves using the latest technologies such as iPads, tablets, and interactive videos to make the students more engaged and justify the outcome of education. Research shows that in addition to the digital gadgets, the education domain requires elements of gamification incorporated in the system. Gamification enhances the user's experience while implementing appropriate game mechanics engages them and ensures that the educational outcomes last longer [43]. The use of various game design elements such as levels, leader boards, badges, achievements, points, rewards, progress bar, feedback system, challenges, etc., is considered the better reinforcements for the learner's motivation and engagement. Rhetorical gamification [9] adds standard game elements such as those mentioned above with

not much attention paid towards the narrative and game design thinking. There are many aspects of gamification that require serious thought and careful planning to be successful in this time. Simply because digital-based education is not for everyone because all cannot afford the digital peripherals, and the internet has not reached all corners of the world. A respective learning process is required to design a gamification environment. The learning process provides a positive outcome in line with the game design elements and predicts the required learning response of the user incorporating the feedback mechanism [41]. The penetration of smartphones and other types of communication devices can support new modes of education, but it has its limitations in engagement between the stakeholders [138]. This implies the quality of education will remain questionable in times to come.

6.2 Literature Review

In this section, the various elements and basics of gamification in the context of education are discussed. Later on, the issues and challenges in using gamification as a solution to improve the various contexts of education and training in the present context during the covid era are elaborated.

The first solution to the present-day problems of education is acknowledging the problem and identifying the factors that have become a bottleneck in promoting engagement-based education [135]. The documentary evidence on this can be observed in the current literature. According to the author [136], it is abundantly clear that the stakeholders require a new set of skills to overcome the problem of less engagement in digital mode. This set of new skills includes the use of digital hardware and software that help the educator think beyond recording the students' attendance. The educators need to unlearn the traditional way of education and adopt new types of gaming elements to educate interesting and relevant. Contemporary research shows that the most frequently used gaming elements include: Grades, points, badges, levels, avatars, progress bars, leader boards, ranking, scores, quests, challenges, Unlockable Content, Collaboration, Feedback, and Competition. These gaming elements attempt to match the motivations and aspirational elements of the individuals and organizations in terms of productivity [41]. These elements inculcate different levels of learning elements as most of these are some kind of point system from which the stakeholder derive their emotional involvement in the education

process. There is an important feature of gaming elements that only specific game elements are required to engage or improve learning outcomes [141].Covid-19 pandemic has forever changed the gamification process used in learning due to changes in the business scenarios and educational models. This in turn brought attention to present learning methods resulting in the shift of conventional learning methods to online or e-learning mode. The study has shown the impact of the pandemic on study methods providing the infrastructure requirement of online classes for higher education. Further, the effect of online learning and the respective behaviour of users over the designed models have been compared in the study [137]. Now, there is an urgent need to motivate teachers, mentors, and educators to continue using the digitalized education model. The majority of them have adopted digital means of imparting lessons for the first time, which is true with the students. This implies a need to rethink and reassess the way the users are profiles for constructing gamification mechanisms [41]. Most of the recent research work in this context agrees that a highly customizable and adaptive gamification mechanism is the need of the hour. Hence, the use of self-learning algorithms for building recommendations or suggestive systems is common these days. Such technologies are part of the "persuasive technology systems" that recommend and motivate their targets to jump for the next level of their goals currently pursued. It can further be observed from the current literature that such "persuasive technologies" are rapidly in use for selling and cross-selling products or services. However, for persuading students to learn more and move up the level of their abilities and present level of performance, there is ample improvement in technology and adoption. This is because all those who have adopted have are professionally trained to be educators and are aware of the practices that gamification brings in. But, they are at different stages of their life and age. At the same time, they are teaching in different domains and fields, which may require different approaches in modelling the users for the gamification process [142].

Most importantly, a continuous research paradigm would help to identify groups of gaming elements that work suit a particular teaching and learning model. The challenge, however, is about finding the most appropriate gaming element concerning the aspirations of the stakeholders. For example, [140] proposed an automatic system that utilizes dynamic challenges generation and recommendations with tailored and

relative preferences. These preferences are based on the historical game performances and stats of the user. This approach can effectively gain the interest of user-friendly and create an active user-specific learning environment. Hence, in this article, a systematic review of the elements, gaming frameworks, and ideas are discussed to give insights into the psyche of teachers and students. The purpose is to gather a comparative view of the game elements that will be most suited for the education industry. This exploration was done by conducting a questionnaire-based survey from actual stakeholders. The questionnaire was built on the following hypothesis.

6.3 Problem and Formulation of Hypothesis

In this section, the formulation of the hypothesis has been done after studying the current literature, implementing the gamified system, and associated material in the context of impact on education methods due to COVID-19 induced digitalization in India. Care has been taken to formulate those hypotheses that are testable using questionnaires and direct questions from the target consumers in the education industry. The problem will revolve around selecting appropriate variables that can help infer the kind of games that would motivate people to be productive without extraordinary efforts from interacting parties. For this statistical analysis is performed.

1. H1: Hypothesis based on age, game element, kinds of games, and levels of Games: Do people, students of different ages, studying in different fields require different kinds and levels of games to remain motivated? How do gamification and different game elements narration, recorded lectures, point-based system affect people concerning their age and qualification? All this is assuming that gamification is an essential ingredient of education now. Is there some strong or weak relationship between the age /qualification concerning the kind of games he/she plays in the context of education?
2. H2: Hypothesis based on Behavioral Change: Do people, students transform in terms of their habits, key indicators of their productivity when they adopt games, rewards, Content delivery for educational purposes. Which key indicators of productivity change for the better?
3. H3: Hypothesis based on Engagement Levels: Does gamification increase or decrease engagement between the interacting parties in the field of education.

6.4 Research Gaps

There is no universal approach for teaching students. Art and science of teaching effectively have changed their dynamics significantly in recent times. Andragogy is a term used when an educator uses a self -a directed approach for navigating the learning process for his/her students. The result is the cultivation of a specific learning environment leading to the transformation of learners. This gamification plays an important role because self-directed and self-paced learning courses cannot be successful without technology and gamification processes. The term andragogy is applicable when the learners are adults and seek improvements in their self-esteem, confidence, and abilities. When learning is more critical than attaining certifications or degrees, this approach is known as Heutagogy. In this approach, there is a facilitator or guide that helps the learner do self-determination to achieve the goals of his or her education. Due to the Corona crisis, many students have been left to attain their education. In India, where a large population is first-time users of digital platforms feel out of place in education digital media. The only option they are left with is to learn at their pace and do a self-directed study. The current literature points out that the solution is to use gaming elements in the learning process to increase the participation of education stakeholders. However, the most challenging issue is choosing appropriate gaming elements for adopting gamification for educating adult learners or college-going students. There is an urgent need for research in this area to equip educators with better insights on gamification so that first-time digital educators can improve their pedagogy.

6.5 Research Objectives

The ultimate goal of this research initiative is to clarify thoughts and opinions about the type of gaming elements that are most relevant in the wake of the covid-19 pandemic forced digitization on the Indian education system. As many Indian educators are first-time digital medium users for educating their wards, they need to be equipped with the best possible strategies in terms of gamification for delivering education content.

6.5.1 Methods and Materials

Based on the hypothesis and problem formulated, the methodology was implemented. The first step was the design of the questionnaire and the second step was acquiring the primary data using survey tools. The last step is to analyze the collected data and draw inferences, insights from it.

6.5.1.1 Research Design and Approach

The research approach will be exploratory with conclusive inferences regarding gaming elements that an Indian educator may use to improve their adult students' strategy. The purpose is to identify groups of gaming elements that have strong linkages and associations to influence the behavior of the students.

1. **Variable Selection:**

   The research design starts with selecting the variables and measurement for sample size then formulation of the questionnaire. Collected the primary data from different categories of students based on the formulated hypothesis. And finally, perform data analysis, followed by validation. The order of the logical flow is as shown in Figure. 6.1 Flow Chart

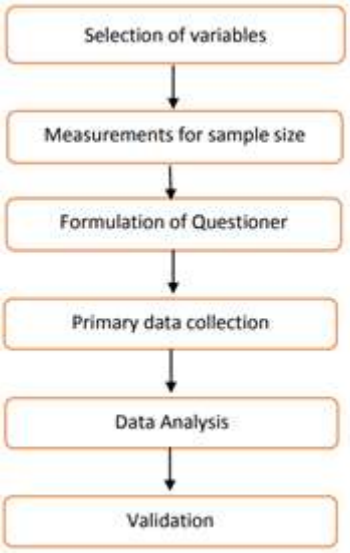


Figure 6.1: Flow chart of research design

2. **Sampling Plan and Size:**

   For this study, educators of Indian origin who are first-time users of digital mediums for education will be contacted. Secondly, they were asked only

to participate in the explorative survey if they had already used gamification elements as part of their pedagogy. For this, a pilot study was also conducted. The target sample size was 378, but after doing missing value treatment about 247 rows of data were realized.

3. Variables and Measurements

Multiple criteria were formulated for variable selection as mentioned in Figure 6.2-6.19. Situational variables have predominantly been considered and attention is not granted to variables that define individual behavior. It is a well-known fact that certain factors are necessarily co-founding since some of the conditions cannot be explicitly observed. The target participant's operational definition (a person who is under observation for this study) is as follows.

Q1) Are you training students above 18 years of age.

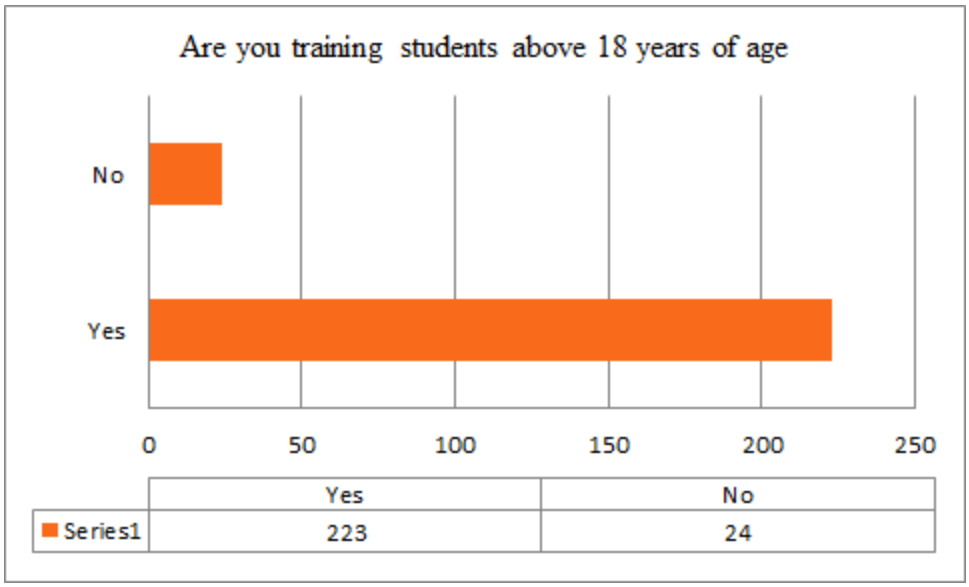


Figure 6.2: Students age above 18 years

This is a qualifying question; can observe that 90 percent of the people are taking courses meant for people above the age of 18 as shown in Figure. 6.2. This means they are undertaking undergraduate courses from various colleges. 247 Faculty from different colleges and universities have participated in the survey. The candidates who are teaching less than the age of 18 years survey ends there only. Further questions are asked from 223 faculty members.

Q2) What methods are you using for training students in wake of the Covid-19 pandemic?

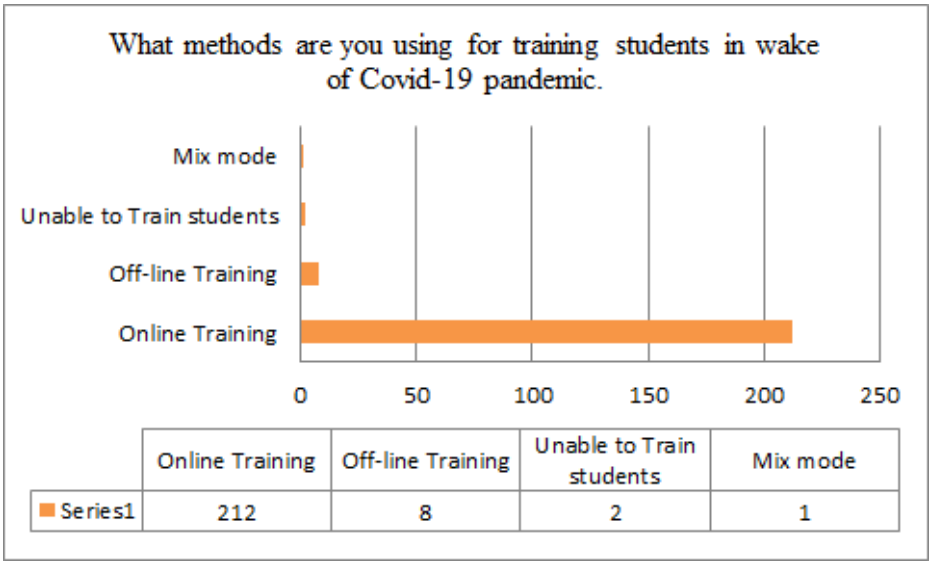


Figure 6.3: Training methods

From Figure. 6.3, it is apparent that many people have a keen interest in the digital mode of education. Secondly, this question is a qualifying factor for this survey. Hence, from the percentage (94.2%), it can be inferred that the sample data being collected is appropriate. Other observations that can be made from this are that just 1% of the respondents use mix mode of training for their wards.

Q3) Are you using Gamification/ Game-based learning in your teaching methodology? If we are not using game-based learning /gamification kindly select NO.

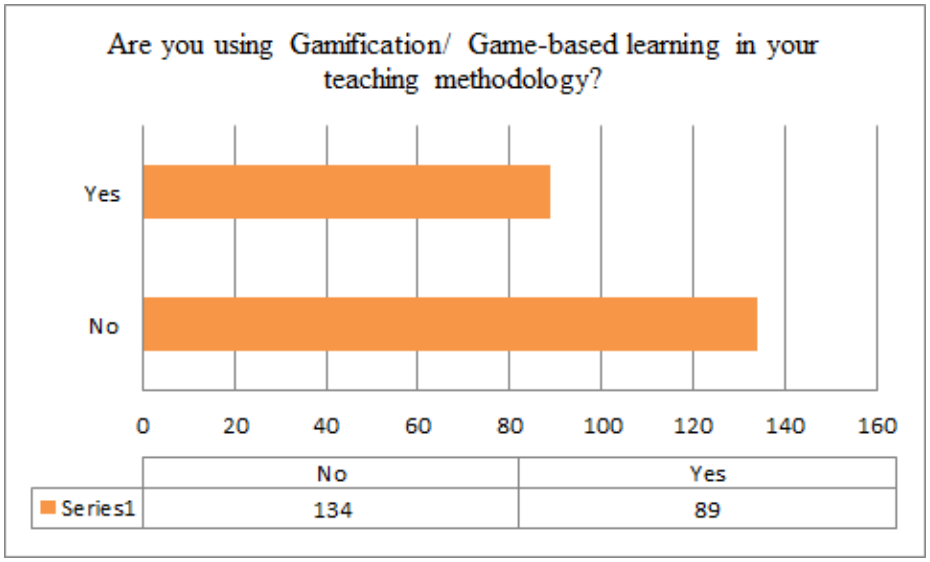


Figure 6.4: Gamification/Game-based learning

It can be observed in Figure. 6.4, that about 39.9% of people understand the value of Gamification and use games as tools for making people learn about various subjects and topics. Typically, in education, the gamification idea holds that students learn best when they are also having fun. Not only that, students learn best when they have goals, objectives, and accomplishments to strive towards, all of which are perceived as enjoyable by the learner. Due to the addictive qualities of video games that captivate youngsters (and adults), it is only logical that we observe similar levels of engagement when game-based aspects are incorporated into learning materials. Gamification in education is the process of utilizing game-based aspects such as teamwork, point scoring, score tables, and peer competition to enhance learner's engagement. It applies to academic subjects and is also frequently employed in self-teaching applications and courses, demonstrating that gamification impacts do not end when we reach adulthood.

Q4) Which Game Elements have you included in your teaching.

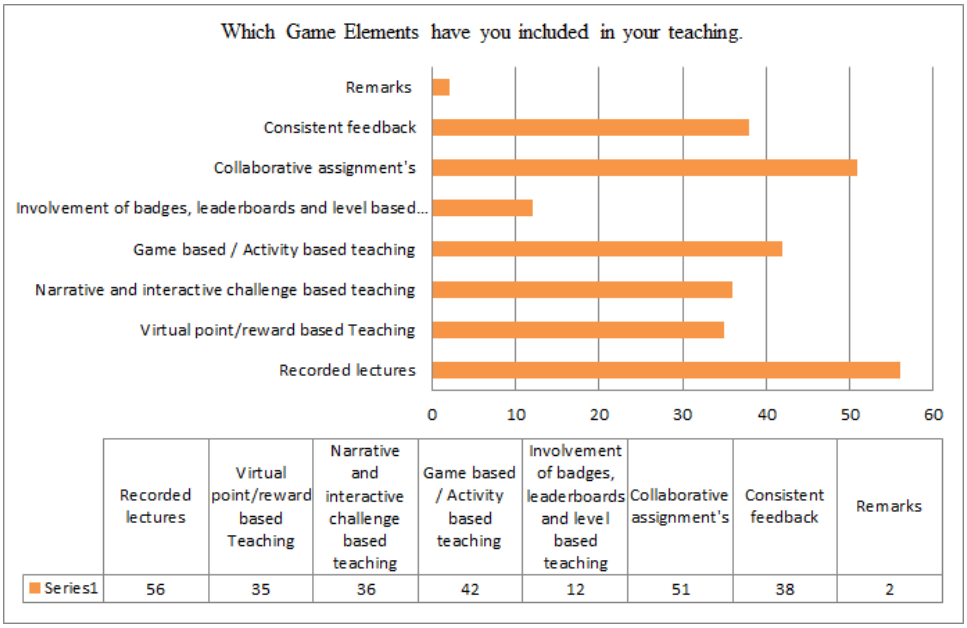


Figure 6.5: Game elements included in teaching

This factor tries to assess the kind of gaming elements used if the respondent uses the gamification process as a tool for educating his/her students. It can be seen that seven gaming elements have been asked in the survey. The statistics show that the highest value is given to the recorded lectures and collaborative assignments. It is a very challenging transition for all students when switching to online education. Students

can examine recorded lectures in this current scenario whenever they desire and often receive anything fresh from every following view. For example, the university can also use lectures by making the information available to distant students, who benefit from much greater engagement than paper ink (or text on screen). Consistent feedback plays a significant role in implementing the Game elements. At the same time, it was found that Interactive challenges along with Activity-based learning are quite important for trainers as gaming elements.

Q5) As an Online Trainer, Do you think your level of engagement increased with the help of the gamification process.

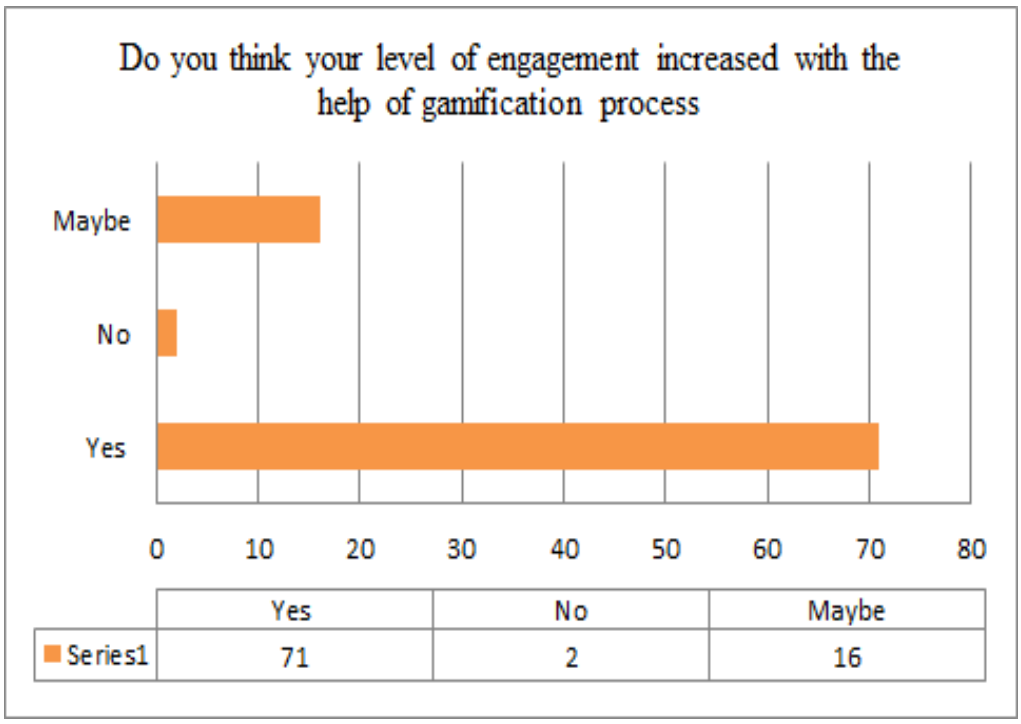
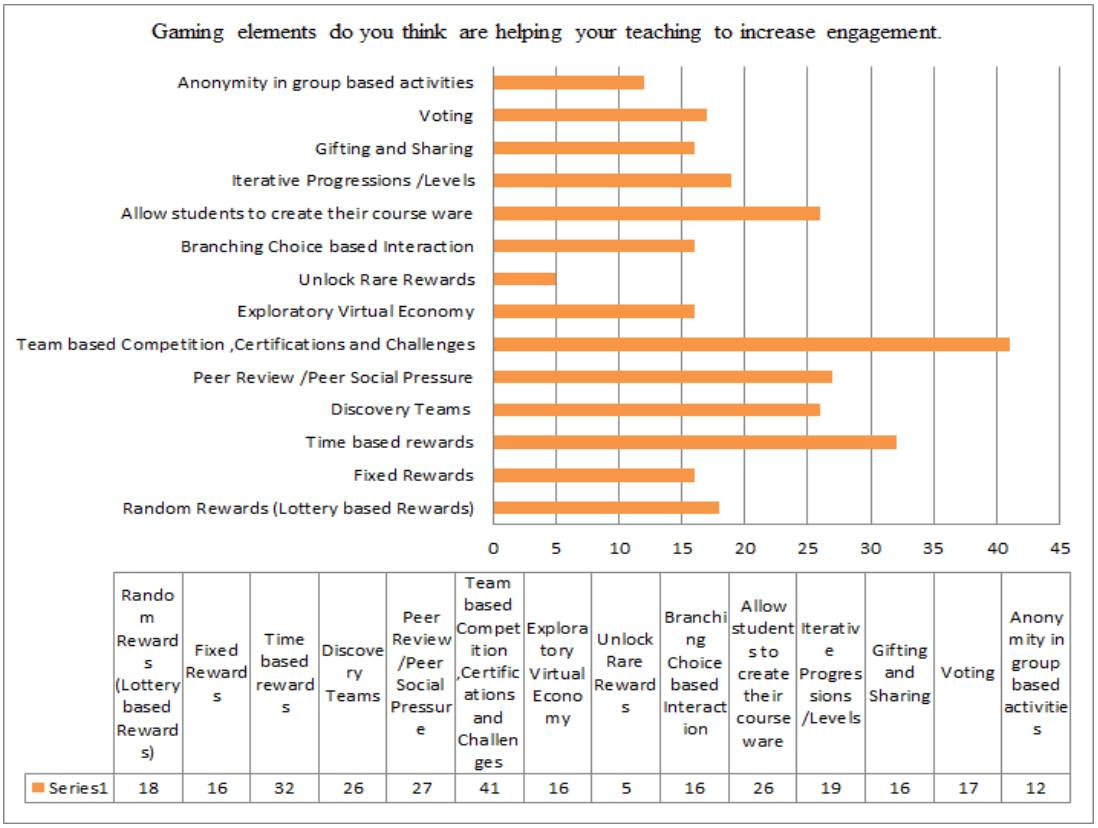


Figure 6.6: Level of engagement

A small percentage of educators think that the gamification process does not help improve the engagement levels between the participants. On the other hand, 68.5 % think gaming is useful, and about one-fourth are not sure about the benefits of gamification during the current context of time and situations mentioned in Figure. 6.6. This may be attributed to the fact that for some trainers, the concept of gamification is news, as many of these trainers are first-time digital platform users.

Q6) What kind of gaming elements do you think are helping your teaching to increase engagement?



	Random Rewards (Lottery based Rewards)	Fixed Rewards	Time based rewards	Discovery Teams	Peer Review /Peer Social Pressure	Team based Competition ,Certifications and Challenges	Exploratory Virtual Economy	Unlock Rare Rewards	Branching Choice based Interaction	Allow students to create their course ware	Iterative Progressions /Levels	Gifting and Sharing	Voting	Anonymity in group based activities
Series1	18	16	32	26	27	41	16	5	16	26	19	16	17	12

Figure 6.7: Game elements to increase engagement

Figure 6.7, data reveals that modern educators emphasize team-based competitions when selecting games for their classrooms. Closed groups and teams played on a virtual system could include games for virtual teams run on the internet and individual group gameplay, such as games among co-workers who have created a virtual system. Additionally, the current findings note that peer feedback and social pressure play an essential role in strengthening the interactions between participants. Of the 27 participants, the study found that most individuals place social and peer pressure among the most significant motivational elements for the wider school population. Games are also excellent teaching tools for time management since they make this possible. According to these results, more than 32 participants have learned that "time" is a resource that can be utilized as a gaming element for boosting the participant's involvement.

Furthermore, without a combined effort from all team members, the development will not be achieved. It can also be noticed that it is not just teamwork that contributes to success; nevertheless, team-based efforts and gift-sharing, and the distribution of resources to students increase engagement and motivation among the students. While there is certainly much debate over the topic of reward schemes, it can be shown that only five persons think introducing "rare rewards/awards" stimulates pupils. Nonetheless, lottery- or chance-based awards have proven quite effective in keeping pupils engaged toward their goals and objectives. Also, researchers found a significant number of students who will require a paradigm shift to overcome their current psychological condition to do better in their course of education. When students are given anonymity when they are put in an engaging and inspiring setting where they are anonymous, and, as a result, their well-being and performance improve. However, twelve participants have chosen this option. It follows, therefore, that a broader range of options will engage more of those students to do better in their academics if those options are around their level of interest or ability.

This study done on educators discovered that voting and branching-based choice game components were significant for at least 32 instructors (16 for each). To further increase the number of options to voters, voting systems that expand on exploration-based procedures that bring forth the exploration economy should be developed. Among the 16 people, here too, it can be seen that many people are interested in this particular game element. The study also discovered that the people who work to develop and discover their teams are just as significant as those who make natural or strategic choices when developing or discovering their teams for 26 persons in the survey. Rewards are valued by sixteen participants as long as they remain constant.

Q7) What kind of gaming elements do you think are helping your teaching to increase your level of Motivation?

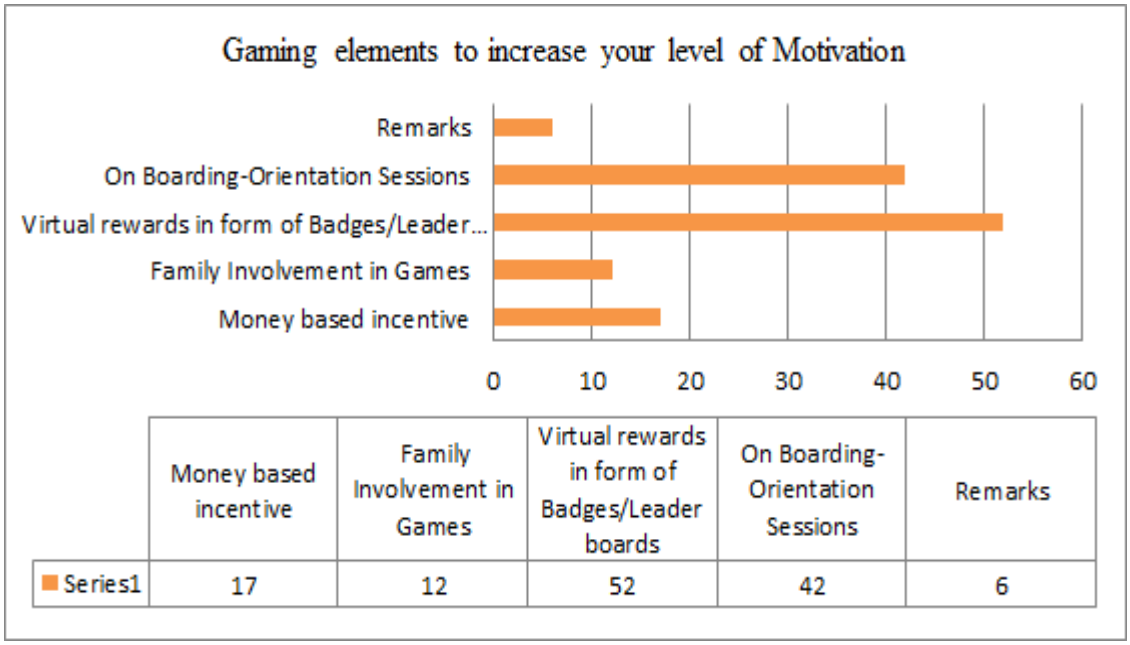


Figure 6.8: Increase level of motivation

Figure .6.8, it can be observed that virtual communities, a virtual way of life, are gradually making their way into the physical world, notably in the area of education. The above claim is phrased to attract students who can remain motivated, as 52 individuals have noted that virtual forms of rewards are an effective technique for encouraging that group of students to remain motivated. As this statement receives agreement from the 42—frequency value of the Onboarding Orientation session, it also receives a higher degree of agreement. There have only been 17 people who responded well to utilize money as a method of motivation, and a lot of individuals are avoiding using money-based incentives. Only 12 persons believe that family involvement will increase the students' motivation levels; this may be ascribed to the fact that educators either do not comprehend the modus operandi of including families in the education process or have made up their minds that it would not work.

Q8) What kind of gaming elements do you think are helping your teaching to increase the practical aspect of (Theory to Practice) of the online training.

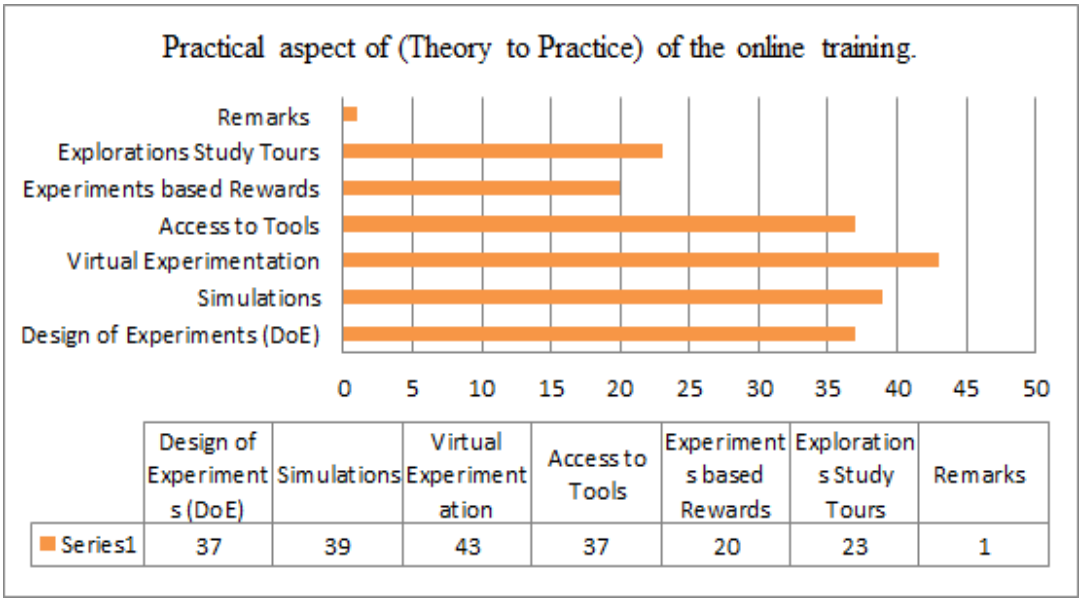


Figure 6.9: Theory of practice

By posing this question in the poll, it was to find out how much difference is there between online education and on-campus education. Actually, due to the limitations of online education, studies may be hindered in many ways, including students being unable to participate in more hands-on activities than theoretical studies. In this question, the survey contributors were enquired to consider six aspects. The readily observable fact from Figure. 6.9. data is that many respondents, even if they have used simulations or virtual environments as their only modes of testing, insist on treating experimentation as critical, even if they evaluate an application within a simulated environment. However, while 37 participants believe that a good design and planned experimentation are necessary, they also agree that insufficient planning and design is a problem. Only 23 people regard exploratory visits to be part of their job requirement.

More options mean more room for error, allowing students to absorb concepts and techniques without suffering a considerable gap between the theory and practice. For this aspect, 37 people view Q8 data as telling them that it is essential for 37 people.

Q9) What kind of gaming elements do you think are helping your teaching to increase the level of creativity in your students.

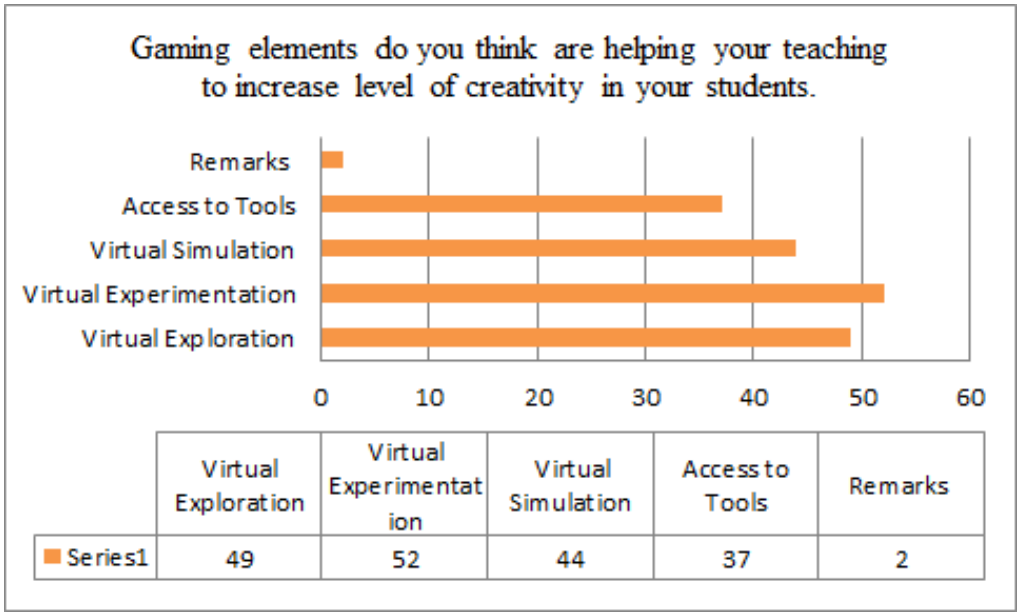


Figure 6.10: Increase level of creativity

The majority of the 49 participants agree that virtual experimenting is the most incredible technique to raise the degree of creativity. To get to this, however, the technology will have to be tested and refined extensively, and simulation tools and different approaches will be required. All of these studies require simulation software, which is why simulation software is also crucial.

The observation from Figure. 6.10, data may be made as shown below that increasing access to different tools provides a positive result on students' creativity. This results in a "Do it Yourself" DIY resolution that features higher levels of creativity.

Q10) What kind of gaming elements do you think are helping your teaching to increase Healthy Competitiveness among students.

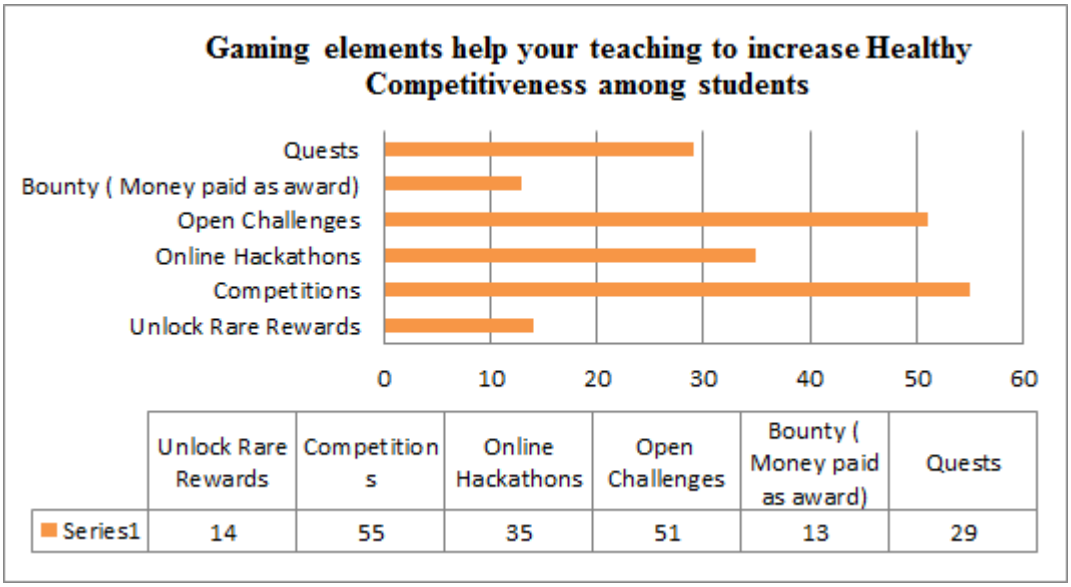


Figure 6.11: Game elements to increase competitiveness

Figure. 6.11 elate that competitions and open challenges are important gaming elements to create the zeal among students to participate and perform better.

Q11) What kind of gaming elements do you think are helping your teaching to increase Habitual Transformation in students.

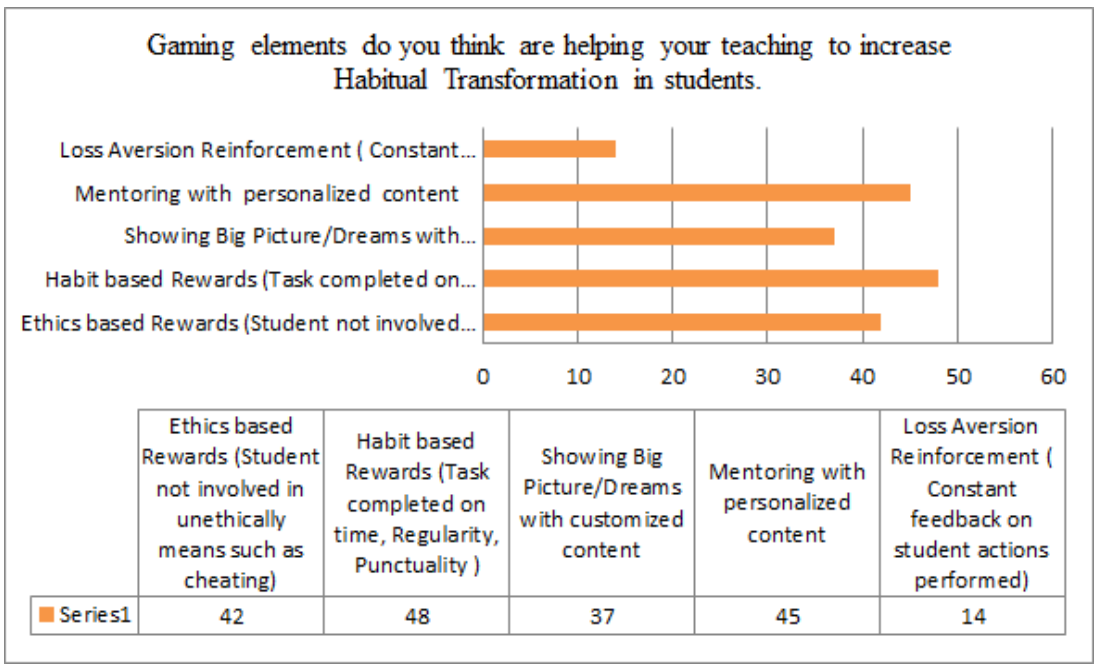


Figure 6.12: Increase habitual transformation in students

A habitual behavior consists of a sequence of simple choices and activities that are performed every day. Based on a study conducted by Duke University experts, it has been discovered that approximately 40% of one's daily behavior is due to habitual behavior. Because of this, this variable was found to be critical in this survey. Figure .6.12. states that including habit-based rewards into the curriculum can dramatically impact the habits of pupils. Also, rewarding ethics and morality is an excellent alternative, but providing personalized materials for students and assessing their learning progress with evaluation criteria is unparalleled in the sense that it combats loss aversion. In the long run, the student's behavior will be modified by their learning habits being reinforced, leading to long-term behavioral changes. It can be concluded from data that 48 survey respondents feel that ethics-based rewards are important in decreasing unethical behavior.

Q12) What kind of gaming elements do you think are helping your teaching to increase the self-confidence/self-esteem of students.

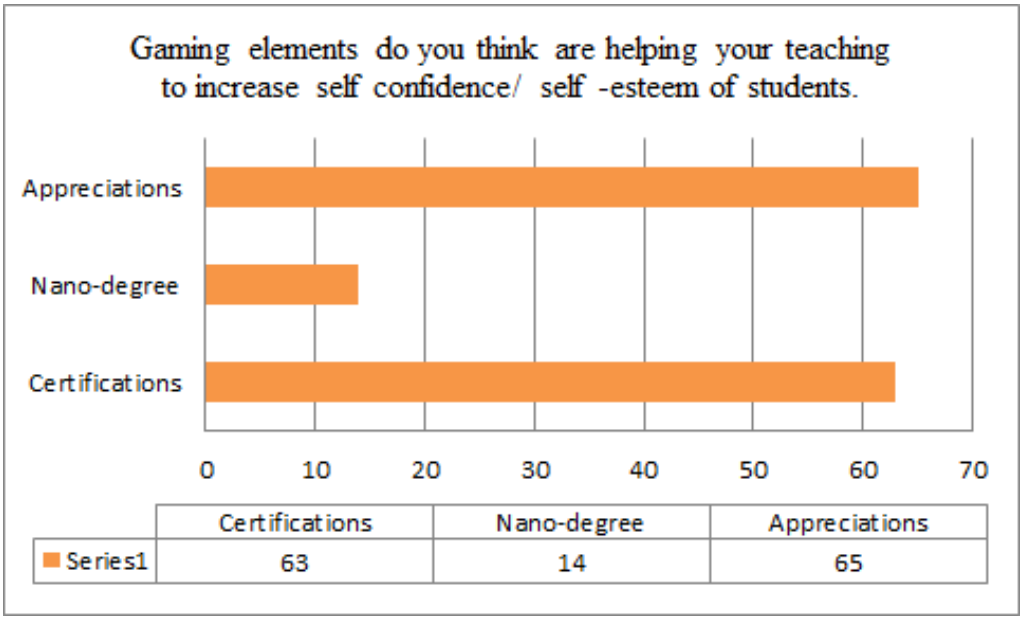


Figure 6.13: Increase self-confidence

Appreciation acknowledges the size, significance, value, or quality of objects or people. Appreciation is a primary incentive for any employee in any job, including education. Appreciation motivates employees/trainers to work more diligently and with more outstanding commitment. According to research, words of gratitude correlate with job satisfaction and happiness at work. According to multiple studies,

more than 70% of workers acknowledge that they are encouraged to work honestly when their superiors express thanks for their achievements. It can be observed from the data that a maximum number of people (65) value appreciation for improving the self-confidence of the students.

A desire for continuous enhancement in the knowledge level is of utmost importance in building meaningful teaching-learning practices. Although this continuous improvement clubbed with various certifications requires time and resources, they provide the students with recognition at various levels and help them grow in their career path. Hence, this aspect was considered for analysis in this study as well. Because of this reason, it appears that certifications and nano-degrees are valued by 63 and 14 participants respectively.

Q13) What kind of gaming elements do you think are helping your teaching to increase learning and memory in students?

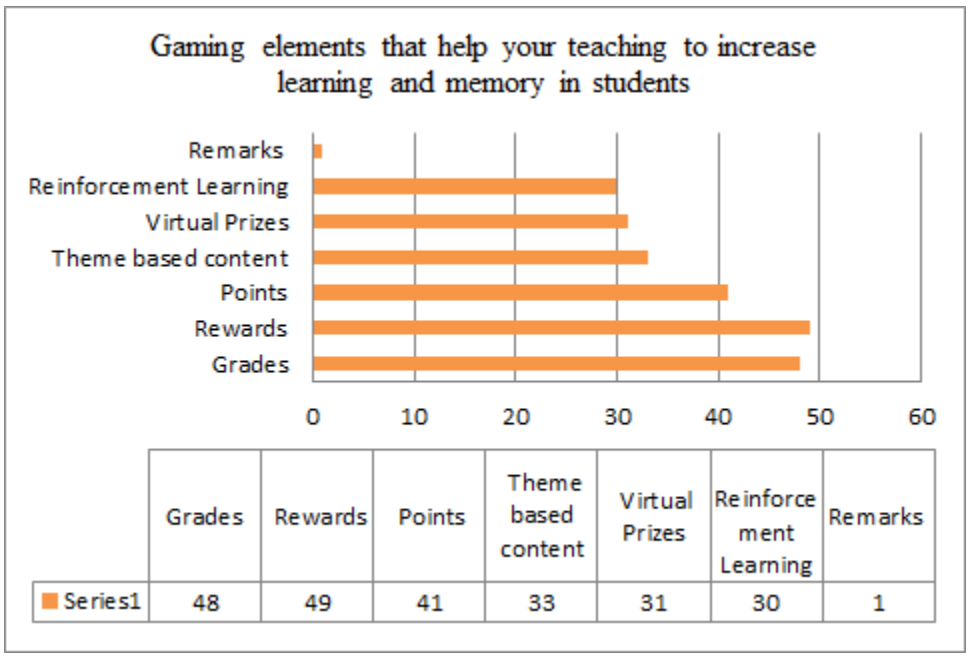


Figure 6.14: Increased learning and memory

For improving memory, educators typically employ reinforcement, i.e. ask students to repeat and practice small tasks until they learn and memorize the piece of assignment. However, Figure .6.14 shows that giving rewards and grades seems to be the best way for current educators to increase the students' learning and memory abilities. A form of quantifying the performance is giving points to students. Forty-one participants

agree that the point system of giving credits to students' work is the best way to improve their learning capacity. Thirty-three people consider that theme-based content, when delivered rightly, will increase the students' memory retention level. Virtual prizes are also considered a suitable method of giving the students incentive to improve their memory as per this data.

Q14) What kind of gaming elements do you think are helping your teaching to increase voluntary self-determination in studies?

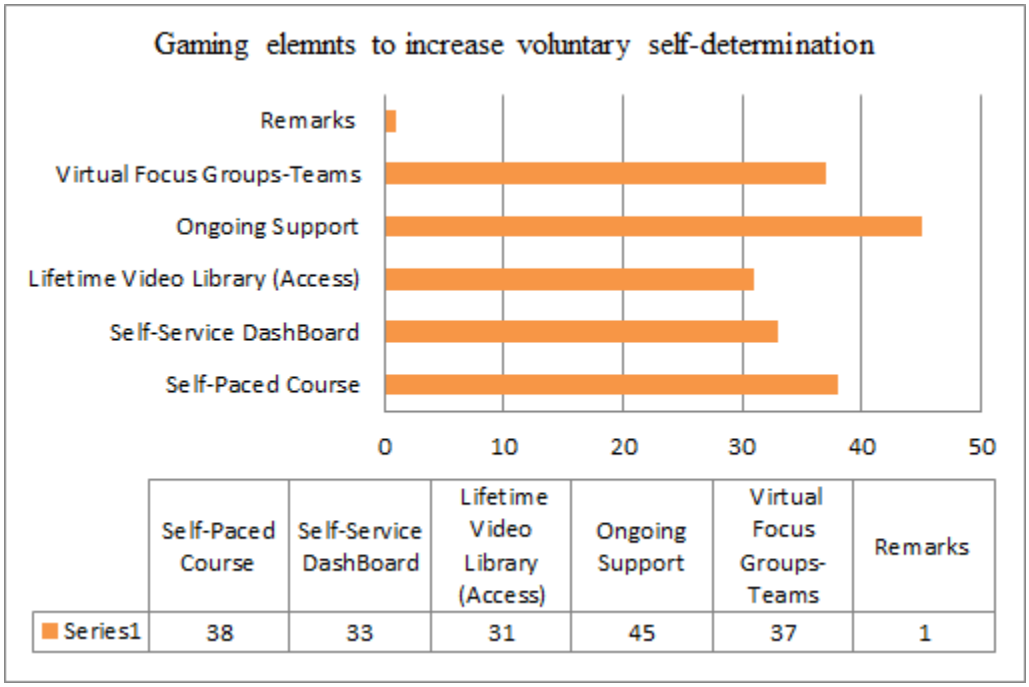


Figure 6.15: Increase self-determination

Self-study is the best way for self-motivated students. Providing such a facility requires special care and effort from the education policymakers and conductors in a virtual environment. These days software-driven education is a trend. Hence, many educational organizations have implemented software-based facilities that support self-determination these days. Figure. 6.15. depicts the participants understood the concerns during teaching online, hence giving their stamp on the "on-going support "factor maximum. At the same time, it can be observed that self-paced courses with self-service dashboards hold significant reckoning in this education value change. Thirty-seven people consider the virtual focus groups technique to help build a feeling of self-determination in students' minds.

Q15) What kind of gaming elements do you think are helping your teaching to decrease digital distraction from studies.

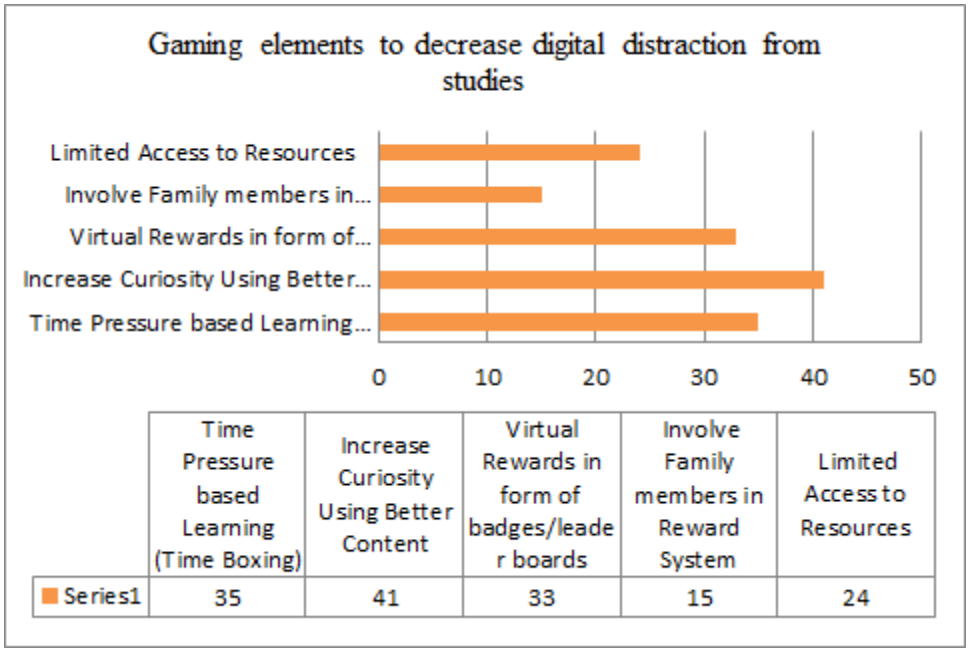


Figure 6.16: Decrease digital distraction

The research indicates that educators think the solution to this problem is using multiple methods such as time boxing, increasing curiosity, giving virtual rewards, involving family members, and giving limited access to resources. Most of the educators, as per data in Figure. 6.16, feel that this can be done by increasing their curiosity levels and by giving them time-bound assignments and work. At the same time, thirty-three participants feel the virtual rewards will also help. Creating artificial scarcity (limited access to resources) is also considered a good factor by 24 people who participated in this survey and stud

Q16) What gaming elements do you use in your teaching for making positive behavior change an attractive option for students.

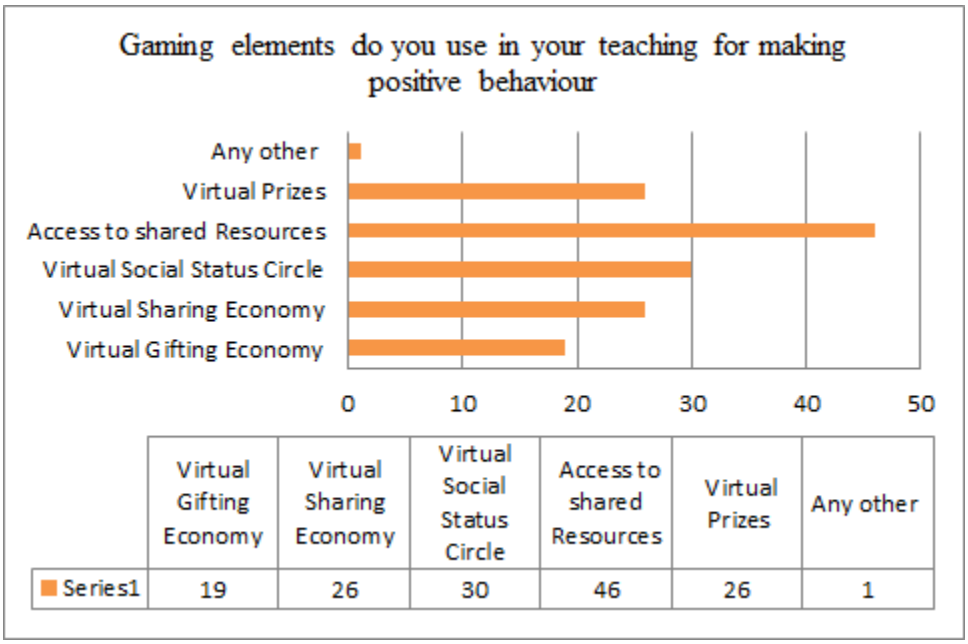


Figure 6.17: Positive behaviour

Positive behavior strategies are based on evidence to change challenging student behavior. For example, pre-correction, encouragement, and non-verbal messages are positive behavior methods. From Figure.6.17, it can be inferred that many of the educators who participated in this survey believe that sharing of things will make positive change, and at the same time giving rewards will further help in building a positive culture.

Q17) What gaming elements do you use in your teaching for getting outcome-based learning accelerated.

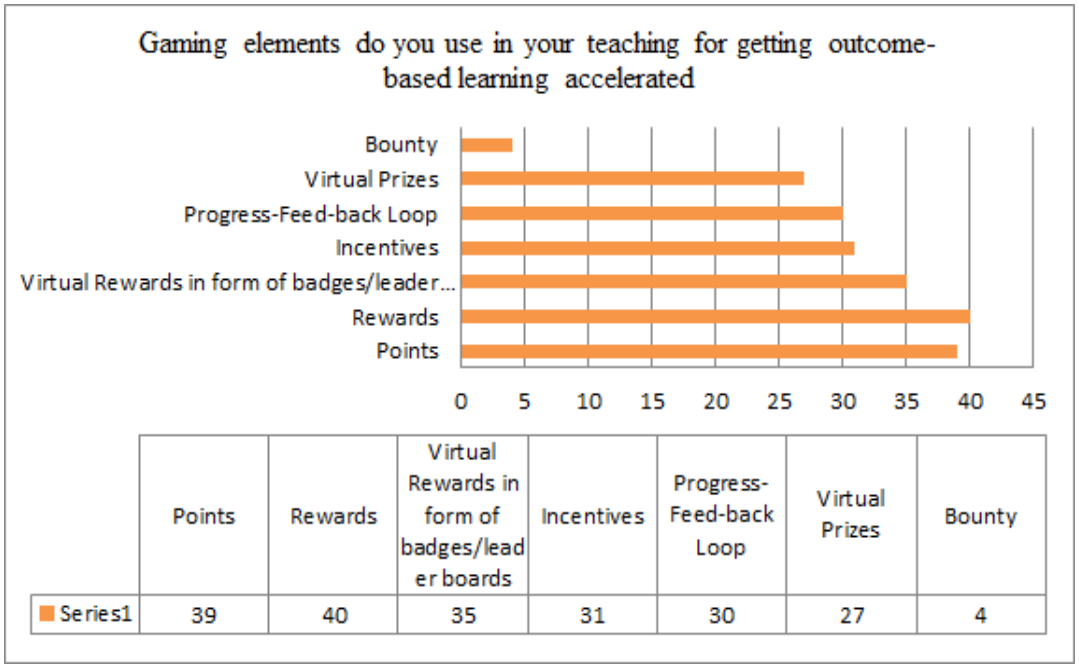


Figure 6.18: Outcome-based learning

In terms of training/teaching, the result is slightly different from the training or learning goal or outcome-based learning, albeit the results define the training goal. Just as the commander's intention communicates the broader aim of the action, a result offers a broader purpose in education or training. Outcomes include intangible (objectively) compelling measuring activities, but more experienced observers, such as trainers and teachers, can easily observe them in practice. Whereas learning goals depend on and require action-oriented language to design evaluations for objective measurement, the results are broader and more militant. It can be observed from the Figure. 6.18 rewards (physical and virtual) and point systems are the best methods for attaining outcome-based learning goals. Few believe that the concept of Bounty will work, but it is better to give incentives and prizes to the students for implementing outcome-based learning

Q18) What gaming elements do you use in your teaching for getting evidence-based learning?

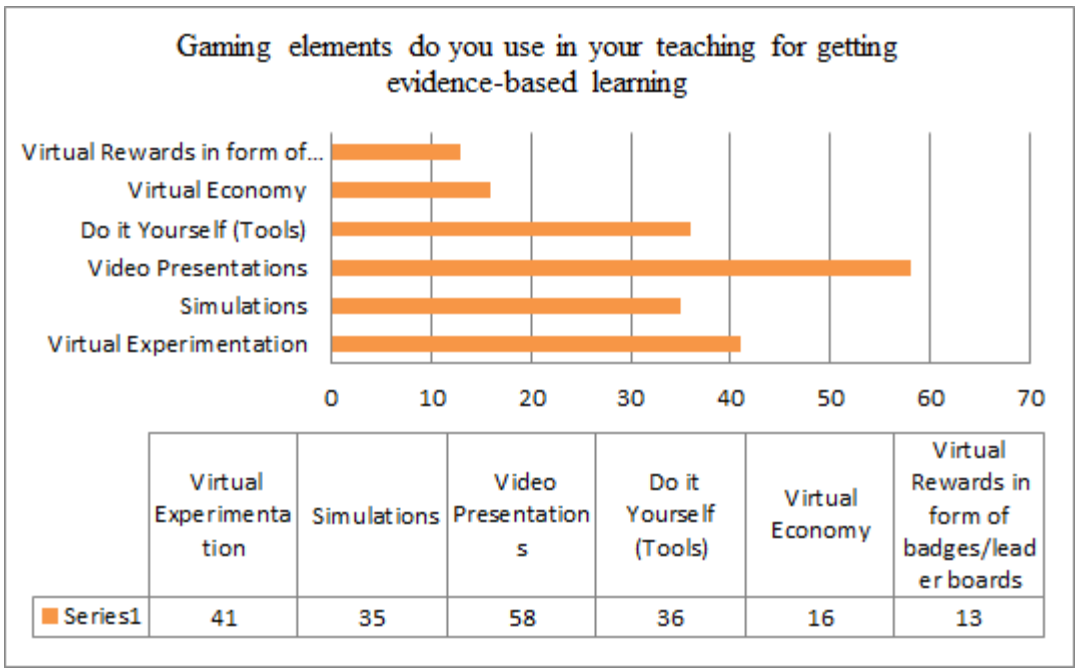


Figure 6.19: Evidence-based learning

Learning is a lifetime process and the proof of what makes "excellent learning" is the focus of both individuals and organizations. Evidence-driven learning describes a class of empirically established methodologies, methods, and techniques to create learning results. It is another possible meaning of "proof of learning" that believes learning can be quantified. Figure.6.19, depicts virtual experiments that are considered extremely useful by 41 people in this survey. 58 people consider video presentation will help in getting proof of the concept that the person has learned something valuable. Simulations along with DIY tools will also help in this area. Rewards again find weightage for this factor as well in this study.

6.6 Results

After analyzing all the variables in the individual gaming questionnaires, it has been observed that the most critical ten variables, as shown in Table 6.1, are identified using cross tabs for outcome-based teaching. These variables are selected based on their highest frequency in the gaming question. Figure. 6.20, shows that Appreciations have the highest impact of 73%. The statistical information from the survey shows that the variable "appreciation" has the highest impact on student's motivation towards teaching-learning. It can be observed from the graph that the other two variables, i.e.

video presentation and recorded lectures, have more than 60% impact on the students' learning. All the other variables contribute more than 50% except curiosity, i.e. 46.1%, and this is true because to inculcate curiosity in the students, one has to make the lecture more interesting for students by inculcating stories and games. The following statements can be validated against the hypothesis taken while undertaking this endeavor.

Table 6.1. Selected variables based on a high frequency of occurrence

S.No.	Selected Variables	Percentage of Contribution
1	Appreciations	73
2	Video Presentation	65.2
3	Recorded Lecture	62.9
4	Collaborative Assignment	57.3
5	Competitions	53.95
6	Grades	53.93
7	Virtual Experimentation	53.35
8	Rewards	53.07
9	Ongoing Supports	50.6
10	Curiosity	46.1

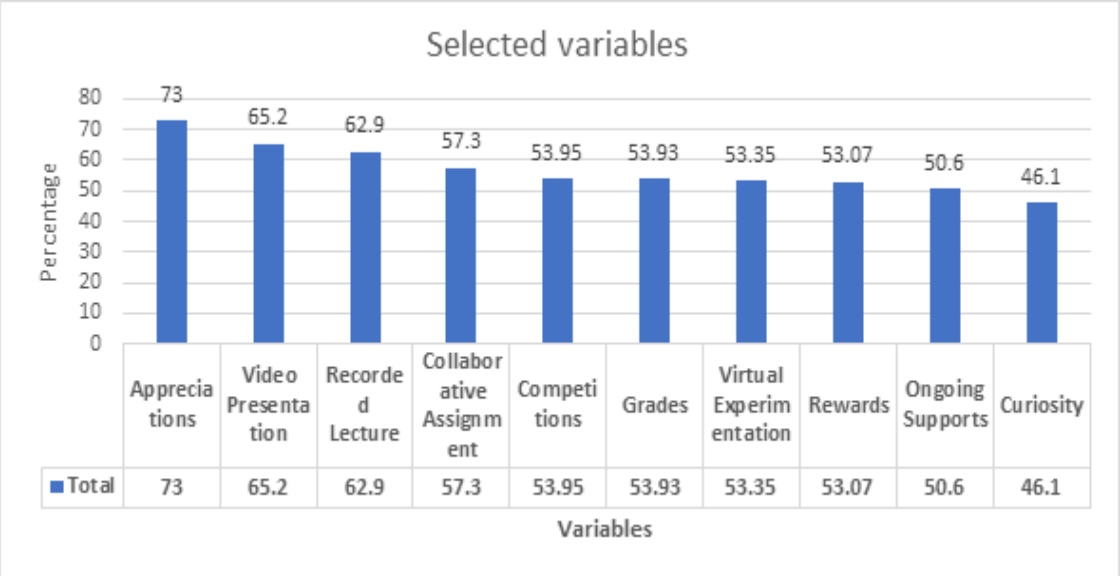


Figure 6.20: Graph showing contribution of selected variable for outcome-based teaching

6.6.1 Hypothesis Validation

For validating research presumptions regarding the gaming element, especially in the context of accelerated digitalization in the present scenario, the seven-step strategy was chalked down as followed

1. *Brainstormed Questions, Axioms, and Assumptions the initial pilot study and questions were framed.*
2. *Reframe assumptions as "hypotheses": Based on the feedback and pilot study, questions were reframed so that these questions align with the hypothesis.*
3. *Rank them in order of importance: Questions were ordered using a logical workflow based on the importance of the question /factor to be analyzed.*
4. *Design appropriate tests Using descriptive statistical analysis, the responses from the survey were ranked as per the frequency value of each response.*
5. *Conduct the tests: Valuation of the results was done, and multiple factors were put to the test using descriptive statistical functions.*
6. *Interpretation, Validation, and Synthesization of learnings from the findings of the survey.*
7. *Act and design a future course of action for the future in the context of gamification.*

H1: Hypothesis based on age, game element, kinds of games, and levels of Games: Do people, students of different ages, and studying in different fields require different kinds and levels of games to remain motivated? How do gamification and different game elements narration, recorded lectures, and point-based systems affect people regarding their age and qualification? Assuming that gamification is an essential ingredient of education now. Relationship between the age /qualification of a student concerning the kind of games he/she plays in the context of education?

Validation: This survey's mathematics clearly shows that contemporary educators are deeply interested in gamification. But, they are not clear about which element is best suited to bring education transition and transformation from the current model of delivering their sessions. The results show that recorded lectures are the best gaming element in the current scenario. Implying that the H1 hypothesis is true. There is a relationship between how the students think and educators think, especially when they are adults. Different gaming elements make a difference for engaging, motivating, and

keeping them away from distractions. Rewards and Point system-based credits help and it can be concluded that a mix of at least 10 gaming elements makes a real difference in transforming the education system.

H2: Hypothesis based on Behavioral Change: Do people, students transform in terms of their habits, key indicators of their productivity when they adopt games, rewards, Content delivery for educational purposes. Which key indicators of productivity change for the better?

Validation: There were 250 responses to this survey, out of which 90 people believed in the gaming elements presented to them through various types of questions. Implying that 90/250*100 (a substantial proportion of people) percent of people are considering or have adopted gamification. The top ten gaming elements by frequency also indicate clear productivity in the education field. Thus, from all these factors, it can be concluded that H2 is a valid statement.

H3: Hypothesis based on Engagement Levels: Does gamification increase or decrease engagement between the interacting parties in education.

Validation: The results statistically show that gaming elements that increase or decrease engagement in the students have found themselves in the top 10. From this, it can be inferred that these elements are crucial for improving the student's engagement in the current scenario and context. Hence, H3 is also valid, Figure. 6.6 states that gamification increases the level of engagement.

6.7 Summary

Gamification in education refers to a process in which various game-based elements such as point scoring, peer competition, collaboration/teamwork, and score tables to increase student engagement level help increase the students' grasping level and motivation level. To make the Gamified framework more competent and reliable various other game elements are explored due to drastic changes in the present education system. According to the statistics, the recorded lectures and collaborative assignments are the most valuable. Switching to online education is a difficult transition for all students as well as faculty members. In this scenario, students can review recorded lectures whenever they want and often learn something new from each subsequent view. The development will not be realized unless all team members

work together to achieve it. It is not only teamwork that contributes to success; however, team-based efforts, gift-sharing, and the distribution of resources to students increase student engagement and motivation. Researchers discovered a significant number of students who will need a paradigm shift to overcome their current psychological condition to perform better in their educational courses. When students are given anonymity and placed in an engaging and inspiring environment where they are anonymous, their academic well-being and performance improve. The implementation of 10 game elements, including appreciation, video presentations, recorded lectures, collaborative assignments, competitions, grades, virtual experimentation, rewards, ongoing support, and curiosity, will enhance the engagement among students.

CHAPTER 7

CONCLUSION AND FUTURE SCOPE

7.1 Conclusion

Gamification use design elements in a non-gaming environment to engage contestants and encourage the behavior towards the desired result. Gamification theory involves the mechanics of the game and varied design techniques to engage and motivate people to achieve their objectives. The major goal of gamification and gamified learning is to make monotonous class sessions more interesting and beneficial by introducing a Gamified environment. This can be made meaningful by introducing innovative mechanisms or mannerisms while constructing games based teaching techniques.

The study is elaborated to answer four research questions:

1. To access and evaluate various methods and means for self-motivated engagement and learning of students for various disciplines.

2. To develop the game elements, mechanics, and dynamics for engagement and higher-level learning of different categories of students studying in different disciplines.

3. Implementation of the Gamified system on the selected set of students and evaluation of the outcome thereafter.

4. Reengineering the Gamified system for optimal outcome based on comparative metrics on engagement and learning.

The first aim was to find self-motivated means of engagement and learning among students. As a part of the learning process, fun helps to execute engagement, passion, motivation and builds inventive learning modes while performing the activities. The more interactive game environment creates better engagement while considering the enjoyment in the learning environment. Just as the conventional learning methods promote learning as fun, various methods, tricks, and activities are required, which is reliable to create a joyful atmosphere implementable to the different age groups. Integrating the latest technologies in the education system inculcates interest and enhances the student enticement to perform a particular task. The use of mobile/ tabs in the form of quizzes or

puzzles acts as an intrinsic motivator. Integrating gamification with such technology requires a lot of effort and complex mechanisms for better results. Implementation of game-based learning act as a powerful means of self-motivated engagement and learning. Game-based learning and gamification are entirely two different concepts.

The second aim was to define game elements, mechanics, and dynamics to formulate the system. According to the result of the analysis conducted on faculty members, a novel model of hope enabler is presented, which is the next level of motivation to boost the engagement and enticement of the learner. The continuous engagement and enticement of the scholar are not only based on extrinsic rewards (points, levels, badges, verbal appreciation, etc.); it also incorporates microelements of engagement like (1) Faculty conduct, (2) Teaching methodology, (3) Environment (4) Rewards. These elements are obtained by applying factor analysis to the survey results. Gamification primarily focuses on extrinsic factors of motivation. The real concept of gamification in education revolves around the intrinsic motivational factors which include interactive, fun-based learning (Faculty conduct), the narration of concepts (Teaching methodology), challenging environment, and rewards in the form of verbal appreciation, grades, marks, etc. Commonly used game elements include achievement, behavioral contrast, fixed interval reward schedules, and loyalty. Gamification provides motivational, playful experiences through the use of interactive technologies. Gamification elements should be used extensively to increase user engagement and user participation in assigned tasks. Gamification, games, and game elements are different terminologies and make a huge difference in the education system.

The third aim is to implement a Gamified framework for higher education irrespective of the subject, course type, and content. The framework is formulated by analyzing the above-discussed self-motivated means of motivation, game elements, mechanics, and dynamics. A novel Gamification technology-oriented education framework is proposed to motivate the students for their enhanced learning. Gamified application is only complete when it has its well-defined components, mechanics, and dynamics. A complete element-based pyramid of

classroom learning is presented in Figure. 5.1. The primary factors such as valuable structure, meaningful choices, and quantifiable metrics are also included in the gamified framework to complete the process of Gamified Educational System (GES). In recent years, machine learning has shown remarkable development in terms of analyzing data and predictions. The major objective of Gamified learning is to make monotonous sessions more thought-provoking and interactive. The concept of flipped classroom learning can make the education system a new outlook in which the complete session will be based on discussion rather than a lecture-oriented session. Gamified learning is completely different from game-based learning. Gamified online education comprises of varied rudiments of games, however, the concepts of gamified learning are entirely intended to create a sense of gratification and ease of learning through the new medium by discovering new methodologies which can make the student more engaged. To make the learning goal-oriented and enrich student commitment through teaching, there is an ardent desire to emphasize various events which include planning, monitoring, and implementation of well-defined levels or strategies.

The covid-19 has completely transformed the education system all over the world. The complete education system is online and now engagement among the students is more challenging. The Gamified system developed is highly efficient to can be implemented in online teaching including all components, mechanics, and dynamics. Taking the current situation into consideration reengineering of the Gamified system to enhance engagement and learning was assessed. Outcome-based learning has a broader application in education or training. The best methods for achieving learning objectives are rewards (both physical and virtual) and point systems. Appreciation has the greatest impact, accounting for 73% of the total contribution. Video presentations and recorded lectures have a greater than 60% impact on student learning. Learning is a lifelong process, and demonstrating what constitutes "excellent learning" is the focus of both individuals and organizations. Another possible interpretation of "proof of learning" is that learning can be quantified.

7.2 Future Scope

In the future, this study can be conducted on various age groups, including

different interest groups, instead of focusing on higher education. The proposal for the same is formulated to high schools of a smart city and soon will be experimented with school students in the large group. The Covid-19 has changed the complete framework of teaching and learning among all groups of learners. The ten-game elements identified will be considered and thoroughly examined while giving players a gameplay experience. The Gamified platform concept can be elaborated, and continuous up-gradation will generate better results. Enhancing the engagement factors and including various concepts of virtual reality augmented reality solutions, and skill-based learning can bring a revolutionary shift from traditional learning to the online education system. The gamified platform including the new game elements which have been found due to change in education system due to covid era can be elaborated and implemented in primary and secondary education system. Adaptive gamification can be one of the major scope of future work and would help in crafting game mechanics and dynamics based on the acceptability of individual learners. In future, it is also possible to analyze implementation of gamification model that consists of game based learning and also flipped classroom learning with efficient use of various game elements.

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LIST OF PUBLICATIONS

- *Kavisha Duggal, Lovi Raj Gupta, and Parminder Singh.* "Gamification and Machine Learning Inspired Approach for Classroom Engagement and Learning." Mathematical Problems in Engineering 2021 (2021). (SCIE)

- *Kavisha Duggal, Parminder Singh, Lovi Raj Gupta.* "Intrinsic and Extrinsic Motivation for Online Teaching in COVID-19: Applications, Issues, and Solution." Emerging Technologies for Battling Covid-19: Applications and Innovations (2021): 327-349.(Scopus)

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- *Kavisha Duggal, Parminder Singh, Lovi Raj Gupta.* "Accessing various means for Classroom Engagement to justify the need of Gamification" Communicated to referred journal.

- Awarded "*Best Smart Education Award*" from Smart City- Empowering India Awards in association with Ministry of Housing and Urban Affairs, Government of India in Feb 2020.