

# CLUSTERING STUDENTS THROUGH DATA MINING AND GAMIFIED LEARNING

Abhishek Bhave<sup>1</sup>, Mayank Mirani<sup>2</sup>, Kedar Mane<sup>3</sup>, Prof. Deepali Nayak<sup>4</sup>

<sup>1, 2, 3</sup> Final year (B.E) students, Department of Information Technology, Vidyalkar Institute of Technology (Affiliated to Mumbai University) Mumbai, India

<sup>4</sup> Assistant Professor, Department of Information Technology, Vidyalkar Institute of Technology (Affiliated to Mumbai University) Mumbai, India

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**Abstract** - Gamified learning is an educational approach to motivate students to learn by using game design and game elements in learning environments and to maximize engagement through capturing the interest of learners and inspire them to continue learning. Gaming is a popular pastime and 40% of Indian teenagers tend to play for more than 6 hours per week. Currently, less than 10 % of Indian corporates use gamification actively and fewer than 3 % education institutes make use of gamification. However, it is a domain that is readily sought after, and much scope is present in this sector. E-learning industry is growing rapidly and will continue to do so in the next 10-20 years [1]. Educational data mining [EDM] is one of the solutions to improving learning and grasping power of students on a broader scale rather than being confined to an individual student's level. Analysis on learner's behaviour, prediction on future results, cognitive learning and level of fundamental knowledge acquired are some of the major analysis done on E-learning data. This project aims to create a game for students which they play and thus faculty get the appropriate data about student's skill, weak and strong areas so as to personalize learning for every student and to improve learning experience.

**Key Words:** Gamification; personalization; education; evaluation; analysis; student; faculty; game engine; game; data mining; clustering

## 1. INTRODUCTION

The gamification of learning is an educational approach to motivate students to learn by using online web-based games in learning environments. The main intention of the project is to maximize enjoyment and engagement through capturing the interest of learners and inspiring them to continue learning.

We plan to cluster the students on the basis of the score they generate taking help of a fun game and simultaneously analyze them based on their performance and provide suitable recommendations. [2]

This paper contains a systematic approach of clustering with help of educational data mining, learning analytics and gamified learning.

## 1.1 AIM & OBJECTIVE

- The aim of our project is to improve learning and motivation of students through fun games / game-based environment and interactive sessions.
- We also aim to create an innovative teaching - learning methodology. With focus strengths and weaknesses of students to give one-to-one attention during a course
- The approach will also help for overall analysis of student potential on a concept by using data clustering/ mining algorithms and providing the students feedback on their knowledge of the subject.
- The objective is to streamline manual data generated in the educational sector and extract meaningful patterns for process improvement
- The expected outcome is to provide recommendations to the students and faculties to personalize teaching-learning process and reap maximum benefits.

## 2. PROBLEM STATEMENT & SCOPE

Data in educational sector is readily available but there has not been enough analysis done on that available data. There is a dearth of student teacher interaction and motivation for learning. Improving student teacher interaction and thereby introducing new teaching methodologies and ideas. Learning experience and personalized learning is the future of education. Existing applications have not been able to integrate data mining analytics with gamification in learning. Also, many projects have tried to achieve common integration in gamification with data mining. Also, all existing educational data mining applications and systems are rudimentary in nature and not capable to achieve appropriate evaluation and gamification. Improving learning experience and personalization in learning requires innovative solutions and gamification is one such solution. This project will mainly involve students who are to be taught and teachers in a supervisory role.

The scope of this project mainly revolves around:

1. Data Analysis

This project aims to do clustering of data that is generated from gamification. As a result of clustering, we hope to establish baseline clusters to evaluate performance of students on the game.

2. Evaluation

One of the goals of this project is to evaluate the standard or skills of a student with the use of gamification. Here the student is asked to complete a game depending on the course that is taught and on the basis of that clustering is done. [6]

3. Recommendation

In this system, once the clustering of students is done according to the score of the game, recommendation will be given to the students as per their score.

**3. PROPOSED SYSTEM**

The proposed system will be a web-based application which will have different modules for students to play as part of gamification. The application essentially has 3 main blocks or components. They are student, faculty and lastly the game aspect of the application. The game component of the application involves game architecture, game design as well as the game engines to be used. This will be the framework which will run the game as is essentially the most important part of the application.

The other blocks or components of the web-based system are the student and the faculty. The student will be first required to register using credentials and then select the appropriate module he/she is studying. The student will then play and complete the game after which scores will be generated using weights and clustering of students will be done according to appropriate score. Once evaluation and clustering has been completed, the student will be given the appropriate resources to study and improve their skill.

The block diagram contains the following information:

1. Student: - The student block contains register, select module, play game, cluster the students, student analysis.

1a. Register: - Every student must register in order to play the game.

1b. Select Module: - Student must select the module based on which the game will be played.

1c. Play game: - This will redirect to the Game block where the game will be played, and result will be stored.

d. Cluster the Students: - The students with similar score will be clustered together.

1e. Student analysis: - Students will be analyzed based on their score and suitable recommendations will be given on the aspects of the module.

2. Faculty: - The faculty receives the clustered data from the students' performance based on the way they play the game and the faculty also provides with feedback.

2a. Forecasting prediction as per analysis: - Here the clustered data of students is provided to the faculty which can be easily analyzed.

2b. Feedback: - The Faculty then can provide with suitable feedback to an individual based on their performance and motivate them to excel in the module. Assignments/ evaluations can be customized as per the potential of students i.e. posing challenging questions to students with high score and giving extra attention to students with a low score [4]

3. Game: - This contains the game design and the game engine which connects the students with the game.

3a. Game: - The game should be such that catches the eye of the students that are eventually going to play it. To deal with games means the game design should be spot on hence we plan to use interactive and entertaining games like puzzles, crosswords, pictorials, etc. to help students inculcate with the game and us to cluster them properly and provide suitable feedback

3b. Game Engine: - The game engine needs to very fast and responsive hence we are planning to use pixi.js and Babylon.js for game rendering and gamesalad.com as the prime user interface of the game application.

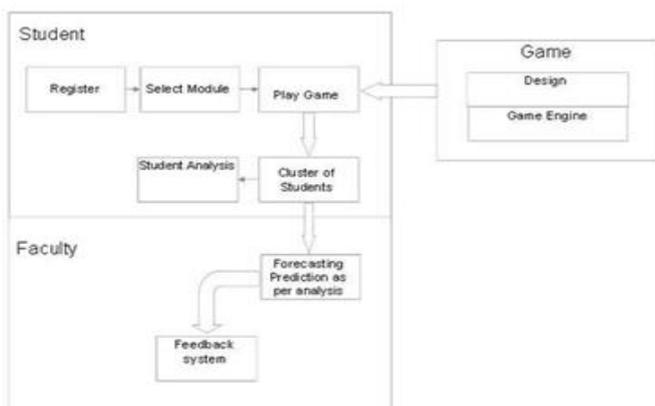


Figure 1: Block diagram of system

Game Level	Type of Questions
Easy	Prerequisites of the Module.
Medium	Based on introduction and early understanding of the module
Hard	Questions based on the whole module

Iterative approach is to be followed during the course of the completion of the project. These iterations can be briefly explained as: -

#### Iteration 1 -Data Collection using Gamification

In this step, the score is generated by answering all the questions in the game and that data along with the ID of the student will be used as the input in the next iteration.

#### Iteration 2- Data preprocessing and Analysis

Here, data preprocessing will take place. Noisy data, inconsistent data will be standardized, and clustering will take place using data mining tool. Clusters of students with similar characteristics will be generated and displayed using Tableau tool.

#### Iteration 3 - Faculty Feedback system after clustering

In this step, as soon as the scores are generated, and clustering is done, there will be input taken from the faculty from the improving the learning or knowledge of the chapter for different variety of students.

### 4. PROPOSED TECHNOLOGY USAGE

1. Gamification Project will be a Web Based application. 2D game engines like pixi.js and babylon.js will be used for game rendering. These game engines are suitable for rendering games on web applications. Also, gamesalad.com will be used for making the user interface of the game as a web application.
2. Content management service like Drupal to be used because of its open source nature and the fact that it is customizable as per our requirements and custom APIs can be modelled.
3. Tableau data mining tool to be used as it has enhanced visualization features.
4. Data Preparatory software to be used for data preprocessing.

5. JavaScript API plugin to display result of Tableau in web browser.
6. Amazon web services will be used to host our project as they offer hosting at miniscule costs and also offer wide variety of features like servers and database support.

### 5. CONCLUSIONS

Impact of Gamified Learning in today's education sector especially in the STEM (Science Technology Engineering and Mathematics) subjects has been observed to grow exponentially. With the online educational data growing day by day, the education industry is moving towards a Big Data explosion. New technologies and extensive research in this domain will help enhance the education experience for learners.

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