Personalizing Education through Gamified Learning

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Abstract : **E-learning industry is growing rapidly as more and more data is published online. Analysis on learner's behaviour, prediction on future results, cognitive learning and level of fundamental knowledge/ skill acquired are some of the major analysis done on E-learning data. This paper focuses on 1) the distinction between Game-based learning, Gamification, PBL and Simulation [2] and 2) How the above three work together for Educational Data Mining and Learning Analytics for personalizing educational experience for learners.**

Keywords— E-learning, Gamification

I. INTRODUCTION

Over several years there has been extensive research in improving the way knowledge is conveyed in an efficient manner. A combination of visual responsiveness, analytical skills etc can be captured through a game based environment. Game based learning has seen an increase in market adoption over the years.

1) Expected market growth: The market growth of gamified learning is expected to grow exponentially from $1,7
2) 07 billion in 2015 to 5,500 billion in 2018 [3].

3) Market players: Most of the developed countries such as North America and Europe are widely using this strategy of e-learning whereas the developing economies such as India and China are huge markets with untapped potential.

4) Expected Demand: Gartner in their analysis have projected that around 50% of education industry is going to be engaged in learning through games [5].

4) Expected revenue: Revenue for organizations selling game based learning and simulation products will increase by atleast 23% by 2017 [4].

II. ARCHITECHTURE

Various factors are considered for overall knowledge attainment and analysis of the user. The overall process flow for e-learning environment can be viewed as below
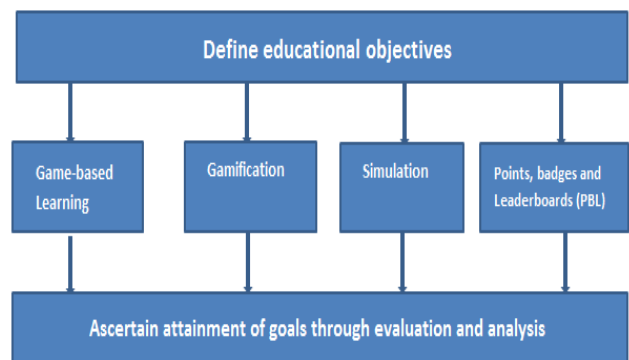

Fig. 1 Process flow for E-learning using Gamified approaches

III. EDUCATIONAL OBJECTIVES

The educator must be clear about the objectives for the learner and what can he/ she gain from the use of Gamified Learning. The objectives can be stated as [6]

i) Create a student model to infer and reason about learners' emotions based on behavior patterns to make classroom sessions more effective and interactive

ii) Analyze student responses and feedback that maximize students' learning, understanding and motivation and enables educators to evolve teaching methodologies.

iii) Audit/ review evaluation mechanisms for effectiveness.

IV. Mediums of Gamified learning

There are varied mediums through which the above mentioned objectives can be achieved. *Table 1* provides a comprehensive summary of tools used in Gamified learning.

Table 1: Comprehensive summary of tools used in Gamified learning

	Concept	Objective	Medium	Technique	Skills honed
Game-based learning	Using Games to meet Learning outcomes	Fun–based learning; Breaking the ice amongst divergent learner groups	Games in areas where games can be implemented easily and widely used.	Learning comes from playing the game	Fast paced learning; memorization
Gamification	Adding game inspired elements to the course	Making theoretical concepts more visual	Games developed especially for non-game environments	Progressing to different levels; Reward programs; Role plays	boosts student engagement; sharpens core fundamentals
Simulation	Scenario-based interaction with multiple-choice, branching decisions as the primary activity	Practical approach to problem solving; Learning by doing	Real time decision making about a particular problem; learning through istakes	Evaluating real time choices and choosing optimum option based on concepts learned in classroom	Problem solving; critical thinking; evaluates risks in decision making; strategic learning
PBL	Points: encourage people to do things by collecting them Badges: visual representation of some achievement Leaderboards: Performance tracking relative to peers	Motivation to learners	Points; Scorecards; star badges; leaderboards	Learner Feedback; improved overall assessment technique	Competitive spirit amongst learners; motivation to excel; team building

IV. Ascertain Attainment Of Goal Trough Evaluation

Traditional tools used for assessment of learner performance take inspiration from Bloom's Taxonomy and are as stated below:

i) Written tests on subject matter- Recall facts and basic concepts

ii) Pop quiz- Hones critical thinking and explains ideas or

iii) Mini projects- Apply theoretical information in new situations; design and create new applications

iv) Beyond Syllabus Learning- Analyze and draw connections among ideas and varied industry domains

v) Assignments- enable understanding of ideas and concepts in greater detail. The nature of assignments can be varied such as Video assignments, Poster Creations, Application oriented and thought provoking assignments

Multiple questions arise when we review our traditional methods of assessment:

- Are these evaluation techniques good enough measures to weigh the performance of learners?
- How can educators be certain that the problem of biasness has been addressed?
- How accurate will the assessment be, considering the all-round development of the learner?
- How can educators identify precisely the needs of individual learners?
- Which parameters can be observed to classify learners in pre-defined categories such interested learners, fast learners, distracted learners, practical-oriented learners, below par learners and so on.
- How can education be personalized to meet the needs of individual learners?

V. ASERTAIN ATTAINMENT OF GOAL TROUGH ANALYSIS

In order to address the above questions, two methods of analysis are used for assessment of learner performance namely Educational Data Mining and Learning Analytics. Both these areas are concerned with the collection, analysis, and interpretation of educational data [7]. Both are used to advance the educational environment and reflect on learning processes [8].

Table 2: Difference between Educational Data Mining and Learning Analytics

Educational Data Mining	Learning Analytics
Develops new tools and algorithms for discovering data patterns.	Applies tools and techniques to answer big picture questions in the education sector.
Analytical thinking required to better understand educational data, retrieve patterns, predict learner performance, identify outliers in student data and forecast learner behaviour	Ability required to evaluate tools and choose the right one as well as suggest actionable measures to uplift learner performance

The iterative process flow derived on our understanding of gamified learning tools and its impact on EDM/ LA is as shown in Figure 2.
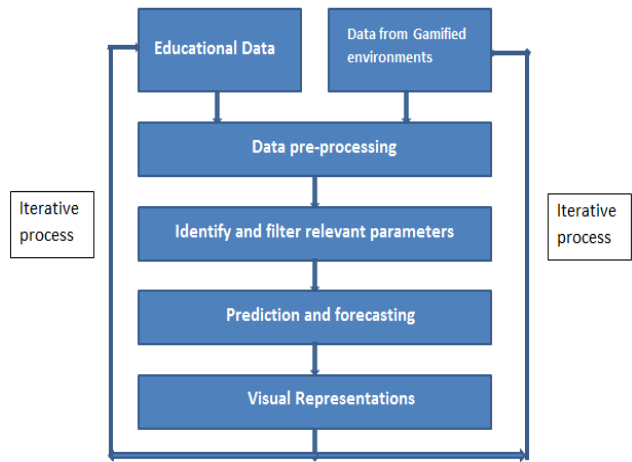

Fig. 2 Process flow for Personalising Education through Gamified Learning

1) Data sources:

i) Educational Data can be obtained from empirical student data available with the college. These may include factual data such as examination results, attendance history, placement records, and affiliation with technical student organizations etc.
ii) Data from Gamified environments tap on the intangible attributes associated with each student such as learning potential, strengths and weaknesses, pace of learning, learning methodology adopted etc. These are oriented towards collecting data from game-based learning, gamification, simulation and PBL.

2) Data pre-processing: Techniques such as handling missing values, noisy data and repetitive data is a pre-requisite to obtaining accurate result set.

3) Identify and filter relevant parameters: Classification classifies learners in pre-defined categories such interested learners, fast learners, distracted learners, practical-oriented learners, below par learners and so on. Clustering groups similar performing students and students with shared interests. It also helps in coming up with recommender systems for learners. Classification and Clustering algorithms can be used to identify relevant data and mine meaningful and useful data patterns.

4) Prediction and forecasting: Based on factual empirical data, prediction can be done for already existing sample of learners whereas real time continuously evolving gamified learning data can be used for forecasting new categories of learners.

5) Visual Representations: Dashboards, progress charts, alerts are some of the visual mechanisms used to represent mined data. This gives personalized interpretations of results and targeted actions for different learners.

V. Conclusion

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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