Evaluation of Classroom Gamification in Higher Education

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Abstract—Using games for teaching-Learning include features that engage the learners. Gamified instruction builds learning for the better in many ways. First, it empowers students to be responsible for their learning. Well-designed games are particularly effective at keeping reluctant learners engaged because they keep the learner close to but not over their capacity threshold. Second, gamified methods help students maintain a skillful mindset when encountering new obstacles. Moreover finally, gamified instructional techniques build on the ways games boost a player to survive in the face of challenges to help students better overcome hurdles in their learning environment. Engagement of the students in teaching-learning activities plays an important role, but only engaging the students and fun are insufficient, or it could not be the aim. The accomplishment of learning objectives is significant. So games should also be associated with the skill to be evaluated, and evaluation patterns decided by the teacher. During or after the conduction of the game, the teacher should collect the pieces of evidence; must interpret them to get a value with a view to action.

Keywords: games, teaching-learning, evaluation, improvement, digital games.

INTRODUCTION

We love playing games, and games are an external part our lives. Kids learn many things through games. Despite less knowledge about language, they quickly pick up gamified instructions and perform. Games have strong pedagogical properties for learning. Also, educational games have positive effects on students' mental health. That is why the gaming pedagogy was introduced in school education to make learning more interesting for students. With similar expectations, the games also become a part of higher education. We experienced that we CANNOT enhance the students' cognitive skills only with traditional teaching-learning methods. Cognitive skills are the brain's core skills to think, read, learn, remember, reason, and pay attention. They take incoming information and move it into the bank of knowledge we use every day at school, at work, and in life[1]. Cognitive learning is a style of learning that encourages students to use their brains more effectively—the focus of higher education institutions in preparing future professionals

[2]. Innovative teaching methods, including games and simulations, are often deployed to achieve the same. In this era, digital games are stealing the spotlight. Students quickly get attracted to digital games. It is an exciting way to make the students learn with maximum concentration. As games have a definite goal, students keep trying to reach the goal. Fun Games also have a time limit to complete the tasks, so goals are supposed to be achieved in stipulated time. So while playing games, learning happens in quest of reaching the goal. This interesting factor is responsible for the extensive inclusion of gaming pedagogy into higher education.

I. LITERATURE REVIEW

All of us are well convinced that the introduction of the games in the teaching-learning process always motivates the students to learn. Nishant Doshi (2020) explained various games like crossword, find the word, Scrambled word, Kahoot, etc., and he has emphases on using these digital games to make the learning fun for the students [1]. Mr. Plato Kapranos (2013) stated a quote by Mr. Albert Einstein "Lack of creativity and innovation leads to the routine which gives a sense of security and stability, that in turn leads to stagnation, decay and eventual death!" which undoubtedly pointed toward the problem which may arise if we teachers do not change the style of teaching[2]. V. Srivani et al. have proposed quantitative research stating the impact of education 4.0 methodology for improving the English learning capability of the students from the rural areas in India. Also, students have shown a constructive, positive approach to Education 4.0, which is getting proven to be the call for the day for teachers

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[3]. Many digital games are already available to help to teach learning processes like online quizzes, Jigsaw puzzles, picture perception, etc. Website www.wordwall.net has many such games Random cards, Match up, find the match, missing word, games how quiz, labeled diagram, word magnets, etc. Games can be created in minutes just by using the drag and drop approach.

II. CONTINUES EVALUATION

A continuous evaluation is emphasized nowadays. However, previously written examinations were a significant mode of evaluating students' performance. A student who can write the answers on the answer sheet and has a good remembering capacity gain good scores. Continuous evaluation provides day-to-day feedback about the learning and teaching process. Evaluation can reinforce the efficacy of teaching and learning, and it also encourages the understanding of teaching as a formative process that evolves with feedback and input from students. Instead of evaluating the students directly at the end of the semester or year, it is better to evaluate them frequently. Each evaluation cycle will develop an outcome that helps check students' understanding and behavioral patterns. Based on his evaluation result, the student can be given feedback. Not only feedback but also a plan for improvements could be created. More frequent evaluation cycles will surely help to improve the students' understanding of the respective subject. But if the teacher adapts only traditional ways, including class tests, sometimes open book tests, etc., it will add boredom to the teaching-learning process. Students may lose their learning interest. Hence the activity-based and game-based evaluation strategies are preferred over the traditional teaching-learning. But evaluating gaming activity is a little complicated compared to written tests and quizzes.

III. POSSIBLE HURDLES IN EVALUATING ACADEMIC GAMES

As discussed in the previous section, the traditional way of evaluation is more straightforward to execute than game-based activity evaluation. Following are some hurdles in considering game-based activities to evaluate students' performance.

1. Time constraint- Game-based activities need time to complete execution. And the classroom hour may not be sufficient to end the game. Hence it isn't easy to reach up to some definite conclusion. In turn, it cannot help to evaluate.
2. Space constraint- Some gaming activities like the Jig-Saw puzzle, group quizzes, etc., need reorganizing the students' groups within the class. The traditional class arrangement does not allow such a type of class reorganization. So it is challenging to prepare a classroom environment suitable for the target audience for digital or physical games.

3. Evaluation parameters: When some game is being played for fun, we focus on playing it up to our maximum capacity. In this scenario, there is no one judging the participants. But suppose we want to use some game as an ongoing evaluation strategy. In that case, we need to decide the proper evaluation parameters based on which the teacher can do the desired evaluation. We need to collect information from Game play to fulfill the formative evaluation process.
4. Technical Knowledge: If I am interested in using digital games, it is mandatory to know about the technical nohows of the game, which includes specialized equipment required, if any. Operating procedures etc. Preparing the technology infrastructure for setting up digital games is often challenging.
5. Managing the diverse preferences and proficiencies among students
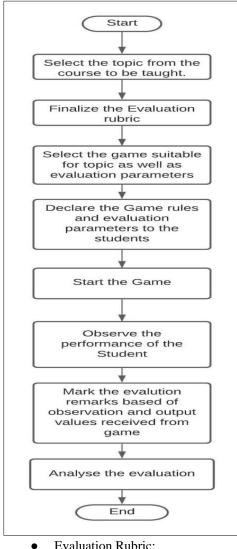6. Contextualizing game content in the taught subject matter.

IV. PLAN OF ACTION FOR CONDUCTION OF THE GAMES WITH EVALUATION:

Figure 1 shows the steps for setting up any game for evaluation. First, we must select the topic taught and the evaluation parameters. Then the same should be declared to the students. Start the game. Observe the performance of the students as per the evaluation parameters. The Rubric must be filled in per the students' observed performance. The evaluation must get completed during the game itself. Teachers must analyze the students' performance and give the appropriate feedback to the students.

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V. EXAMPLE OF A CLASSROOM GAME

A. *Spin the wheel*

- Topic: Basic important terminologies in Machine Learning.

- Evaluation Rubric:

Component	Marks	Proficient (100%)	Acceptable (65%)	Needs Improvements (30%)
Initiation	5	Student Voluntarily, willingly answers.	The student responds after calling their name	The student did not answer even after reaching their name.
Oral Presentation	5	Students are audible and fluent on their response, and do not rely on notes to present or respond. Students respond accurately and appropriately.	Speakers are primarily audible and fluent on their topic and require minimal referral to notes. Speakers respond to most questions accurately and appropriately.	Speakers are often inaudible or hesitant, often speaking in incomplete sentences. Speakers rely heavily on notes. Speakers have difficulty responding clearly and accurately to audience questions.
Understanding and interpreting technical details.	5	Students can give the correct answer.	Students can give partially correct answers.	The student is not able to answer.

Table 1: Evaluation Rubric for Spin the wheel game.

- Selection of Game: To check the students' confidence and understanding about basic concepts of Machine Learning. Following games can be used.
  - Spin the wheel of ML terminologies
  - Random cards
  - Open the Box
  - Snake and Ladder puzzle etc.For this topic, Spin, the wheel is the most suitable game[4].

- Declare the Game Rules:

  The Wheel of Basic ML Terminologies will get Spin; it will stop at some random terminology. Students are supposed to explain the terminology correctly. One vocabulary will be asked by calling student names sequentially, and another will be asked. Marks will be given as per the Rubric.
- Start the Game

Figure 4 Wheel in action

- Evaluate the answers given by students
- Analyze the Evaluation

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Performance Analysis of "Spin the Wheel" game:

This game was played in the classroom and attempted by 45 students. Number of students marked in the categories specified in the Rubric presented in Table No. 1

	Proficient	Acceptable	Needs Improvement
Initiation	20	15	10
Oral Presentation	13	20	12
Understanding and interpreting technical details.	22	13	10

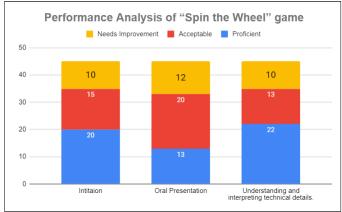Table 2: Number of students in various evaluation categories.

Figure 5 Performance Analysis Chart

The above-shown performance sheet is created just after the classroom session. Then during the tutorial hour, the same topic was discussed with identified students. This discussion and query handling session helped improve students' understanding and hence their interest in machine learning.
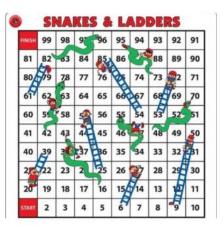

Figure 6 Discussion and query handling session with students

The evaluation helped me identify the students who need remedial guidance for their improvement.

B. Snake and Ladder puzzle.

Snake and ladder is a well-known game. It has 100 squares. The player has to roll the dice, and the pawn moves ahead accordingly. If you land on a snake's head, slide down the snake to the space at the tail. Play continues clockwise until one player first reaches the last square on the board and wins!

Instead of rolling a dice, this game is converted into a quiz game. Students have been provided with multiple-choice questions and fill-in-the-blanks-type questions.

- Pawn Moves as per the Number of letters in the answer word.
- If the answer is a number, then the pawn moves those many steps ahead.
- Here also, if you land on the head of the snake, the student has to slide down at the snake's tail.
- Spaces and dash are not to be counted.
  For example: If the answer is 'Deep mind,' the Number of letters in the answer is 8, so the pawn will move eight positions ahead.

The answer sheet is to be filled as follows:

Question No.	Answer	No of letters	Pawn position
1	Minimum	7	7
2	-∞	2	9 (ladder to 50)
3	Utility	7	57

Figure 7 Sample Answersheet

Sample Questions:

Course: Artificial Intelligence   Class: TYCSE 2019-20 SEM II
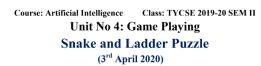
Unit No 4: Game Playing
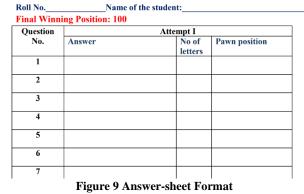**Snake and Ladder Puzzle**
(3rd April 2020)

Questions:

1. Competitive environments, in which the agents' goals are in conflict, giving rise to _____ search.
2. Max player will only update the value of _____.
3. A _____ tree is a tree where the nodes are game states and the edges are moves
4. If one player wins a game of chess, the other player necessarily loses. It is this opposition between the agents' _____ functions that makes the situation adversarial.
5. Alpha: The best (highest-value) choice we have found so far at any point along the path of _____

Figure 8 Sample Questions

Answer sheet:

Figure 9 Answer-sheet Format

This game can be conducted in online mode and the classroom.

If every question given to the students is along with Bloom's taxonomy level, it is easy to analyze the students' performance. If this game is played in the classroom, the accuracy of the answers and the time taken to complete the puzzle will be the evaluation parameters.

I have conducted this game during online teaching mode, and it helped make the students revise the whole unit to find the answers to the questions.

This game can be modified per the subject's requirement or the selected topic. If we have less time to conduct this activity or fewer questions, we can change the finish position accordingly. This game is easy to evaluate and enjoyable to keep the students engaged.

Following are some sample answer sheets submitted by the students.
https://drive.google.com/file/d/1mKZRnMKdHVWnemNY hyJdpKi2uB8kHA-s/view?usp=sharing

VI. CONCLUSION

Inclusion of educational games into the teaching-learning process helps achieve a higher order of focus and motivation for critical thinking. But it could be used for continuous evaluation only if we add the evaluation strategy to these games. So that students can have fun along with the critical analysis of their performance.

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