GAMIFICATION IN EDUCATION - LEARN COMPUTER PROGRAMMING WITH FUN

Balraj Kumar
Department of Computer Applications
Lovely Professional University, Punjab

Parul Khurana
Department of Computer Applications
Lovely Professional University, Punjab

Abstract

Today the IT industry provides a stimulating and robust career start to logic developers, but even then majority of the students pursuing higher education in computing field are not coming ahead with full competence and capabilities to meet the industry expectations. It has been observed that such students are not much focused on computer programming during regular study. Here the main point of concern is how to train, engage and make them learn to build real life applications in a better way by doing extensive programming in a computer language especially when there are big opportunities available in the market from the employment perspective in the form of software development, web development and most importantly mobile application development. The main reason of disinterest in programming is identified as the lack of motivation and engagement of students in learning the programming concepts. This paper proposes a solution that is the induction of gamification in teaching practices; since games can be used to create a motivating classroom environment where students are engaged in learning. This would improve the teaching/learning process in totality. In support of this fact, student engagement and motivation to learn programming was measured using a survey based on a questionnaire in which 207 students of post graduate programme participated. The result of the survey and questionnaire indicated a strong preference for the use of gamification in imparting the programming knowledge.

Keywords: Gamification, Gamification in education, Computer Programming, Pedagogy Tools.

1. INTRODUCTION

Education is the backbone of any developed country in the world. More educated people means more opportunities for the country to grow [22]. Today, the use of technology is becoming more and more popular as a one of the teaching aids for imparting the knowledge of any field or area of education. It has become an integral part of teaching pedagogies being used in education. Almost all modern pedagogies make use of these technologies in one or the other form to convert the education into quality education [21]. The main aspect of technology is to play a vital role in education [11] as it can really shape learning in the future with innovative methods.

Whenever we talk about innovative learning tools; games always come first into the picture as these are the most exciting and motivating means with the educators that help to make the teaching-learning process more effective. The major benefit of games implementation is that they do not require any kind of reason to play on. Actually, game rudiments are the essential part of our daily life [19]. Social networking sites, television sets, smart phones, iPod’s, iPhones, operating systems; all come bundled with certain games [20]. The main idea of incorporating games into our daily life applications is that they provide the meaningful way to engage users. It does not matter if you are a kid, teenager or an old age person; you will always love to play games. Playing games and involving large number of users is often called as engagement and this is what gamification is all about. It is a kind of framework in which games are built for non-game systems [23]. Generally, most of the students, while learning a programming course, face difficulties in grasping the concepts and their applications in the real world. In this paper, a gamification methodology is being proposed which would help students to learn programming concept efficiently and effectively and that is too with fun.

2. PROBLEM WITH TEACHING-LEARNING PROCESS

The field of computer science offers a large pool of opportunities to the students and that’s why a student who is pursuing his degree in computers always carries a spark in his eyes. Under its umbrella, computer science provides a number of domains which a student can opt for his career like programming, networking, database management, etc. Getting specialization in any of these is itself a challenging task. Education sector provides different courses with the duration in weeks, months and undoubtedly in years to enhance the passion of the person about these mechanisms. Programming techniques can be sliced into Procedural/Object Oriented techniques, Algorithm and
Analysis and Web Programming techniques. These techniques expect an application of mind from all the learners which plays a vital role later on. Developing and applying logics into the problems often requires a kind of skill set and to build such a skill set it is often mandatory to put consistent and strategic effort in the classes. Student engagement in the classes is always a serious issue in the academic institutions. It’s really rare to find the students with self-motivated spark in the classes. Good strength in a class may be because of the attendance compulsion, the difficulty level of the course or due to the seriousness of students towards their career. Motivated student’s in the class means more success in terms of grasping the knowledge with an application bent of mind as well as good career growth in the future [3]. Teaching a programming course is a big challenge in itself. Its’ success depends heavily on many factors like programming experience of the instructor, his teaching skills and the kind of pedagogy he uses in the classes. Common pedagogical tools which are available with the instructor are white boards, PowerPoint presentations, simulations and multimedia content like audios/videos, animations etc. So now many questions arise like how can we engage students in classes in a better way? How can we prepare and make them ready to face the future challenges? This is really a big job in the hands of teaching community.

3. LITERATURE SURVEY

Lee and Hammer [1] identified three key areas in which gamification can serve as an involvement and an important aspect into the student’s career and can play a major motivational role with the help of fulfilling mental, sensitive and public needs of the students. Motivation is none other than a best remedy of user engagement in any activity. It has been said by Monique [2] in his publication “Motivation to Learn” that the teacher always plays a major role in the student’s career by motivation and interaction.

If the teacher is good in that then it can really help students to make a most from it. So a good instructor must look at the behaviour of the students in the class like when they feel encouraged or discouraged, what they like or dislike and more importantly what they find interesting and obviously boring too in the class. Feedback is very important when instructor is interacting with the students in the class. As new technologies are emerging very rapidly these days, it is the responsibility of the instructors to use latest pedagogies with the keen interest of students in the class [3], this would really help increase the class engagement.

Completing the task by serious learning and completing the task by fun learning is significantly better. Effective pedagogical tool [4] must include a variety of media, stages of interactivity, learning aspects and more importantly tutoring done by instructor for compound set of environments to make a session best in all aspects.

Experience and Learning [5] are the two factors which move side by side. People who want to solve a future aspects of the problem they must make a maximum use of this mechanism. This concept is completely applicable in games. A game can be considered as an efficient and a full of learning if it contains a kind of experiences which a player can learn during his involvement in game playing. One can define the gamification as a playful interaction design [9] which can really help students to learn difficult concepts of programming in quite easy and fun loving manner. Microsoft [10] is a very popular brand name in this scenario, company has explored that how gaming convention can transmute the understanding from one interface to another.

4. RESEARCH APPROACH

To understand the depth of the teaching-learning problem, a questionnaire was designed to take the feedback wherein total 207 students (of post graduate programme in computer applications) were participated. The data collected was then compiled and analysed primarily on three parameters:

i. Identification of the problem among students with the current pedagogy system
ii. Students’ behaviour towards games and fun activities
iii. Willingness towards change in pedagogies and other factors

Students’ response was sought on the scale of three options largely; irrespective of the questions which require only yes-no or agree-disagree kind of response. Table-I (given below) indicates the students’ response in percentages against 10 questions:

Table-I: Compiled Data of Students’ Feedback

<table>
<thead>
<tr>
<th>Questionnaire</th>
<th>Students’ Response (In Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1. Select the basic reason to attend the classes for the particular course of your Programme:</td>
<td></td>
</tr>
<tr>
<td>Question</td>
<td>Option 1</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Q2. Which is the best and effective pedagogy tool according to you?</td>
<td>1 – 16%</td>
</tr>
<tr>
<td>Q3. Which type of programming concepts do you think are the most difficult to understand and learn?</td>
<td>1 – 29%</td>
</tr>
<tr>
<td>Q4. Which is the best way to kill boredom and spending a time?</td>
<td>1 – 20%</td>
</tr>
<tr>
<td>Q5. Would you like the instructor to indulge you into the game oriented pedagogies in the classes by porting serious learning into a fun learning?</td>
<td>1 – 86%</td>
</tr>
<tr>
<td>Q6. Would you like the instructor to evaluate your performance with the help of game levels instead of assignments, mini projects/term-papers, class tests etc.?</td>
<td>1 – 67%</td>
</tr>
<tr>
<td>Q7. Fun learning in classes will increase the quality of the classes and will make students comfortable with the courses of which they are scared off:</td>
<td>1 – 94%</td>
</tr>
<tr>
<td>Q8. Why we get the games bundled with TV sets, mobile phones, operating systems and on websites also?</td>
<td>1 – 47%</td>
</tr>
<tr>
<td>Q9. Will you be comfortable if new game oriented pedagogies will be used in the classes instead of ppts, videos or whiteboard?</td>
<td>1 – 87%</td>
</tr>
<tr>
<td>Q10. Which is the best way to engage students in the classes?</td>
<td>1 – 46%</td>
</tr>
</tbody>
</table>

The resultant data of questionnaire really supports the introduction of gamification in the current system. Students are looking for the new innovations in education which can really help them to robust their career in the field of programming.

5. RESULT ANALYSIS

Out of 207, 45% students are really concerned about their placement and career. They are still looking for the innovative and effective pedagogical tools for effective and quality learning. In answer to question number 5, 6, 7 and 10, majority of students have shown their interest towards gamified approach in regular learning process. Motivation factor is undoubtedly the driving force behind the students’ encouragement for study. This is the only factor that can drastically change their behaviour in the classes.
Facts compiled in the survey show the need for transition from the current pedagogy to game oriented pedagogies in the classrooms. The following figure-1 displays the summary of questionnaire responses percentage wise:

![Figure 1: Column Chart for Questionnaire Responses Summary](image)

6. **GAMIFIED APPROACH TO LEARN PROGRAMMING**

In order to enhance the current pedagogy system in education, can we gamify it to increase class engagement? Can we upgrade our teaching aids to fulfill the expectations of students? Answer is yes. Game designs well equipped with the experience of professional instructors can prove to be a better pedagogical tool in the teaching of programming concepts. In the regular study pattern, if any student gets a fail grade, he feels very demotivated and sometimes even disturbed in the life also. But what happens when he undergoes for the same learning with gamified approach. Instead of feeling demotivated or disturbed, he thinks about an idea/mechanism to move or to clear those gaming levels efficiently in the next attempt. It means inclusion of games in regular study itself embeds a kind of motivational factor in it and even after the failures, design motivates to progress further in the game. This factor needs to be considered and introduced with high impact level when we are designing the games as a replacement of regular pedagogical tools.

Now a student, who is looking for a career in the programming domain, must be pursuing his degree in the field of computer science or applications with a full-fledged knowledge and skill set in the programming languages like C, C++, C# or Java. To start learning these languages as a beginner or an advanced, one needs to follow certain books and tutorials available on internet. In the gamification process, without reading much from a book, students can gain the complete understanding of the concepts while playing games specifically designed for this purpose only by the instructor. Figure 2(a) shows the transition from traditional to gamified approach and figure 2(b) shows the nomenclature equivalency between both.

![Figure 2(a): Transition from Traditional to Gamified Approach](image)
To evaluate student players on the basis of what concepts they have learnt, instructor can set the points as well as difficulty modes for every level. Difficult modes can be beginner, intermediate, advanced or expert [24]. Grades will be autocalculated based on the efficiency, scores, modes, time taken to complete the levels etc.

As an encouragement factor, an interface can be designed in the game so that student player would be able to share his scores with other class fellows learning the same course. Certain badges can be designed as a motivational factor to increase the user engagement in playing educational games. Game mechanics like achievements, bonuses etc. can be added for better implementation [16]. This could attract and involve student’s attention into the course material which generally lacks otherwise. Moreover games will give students a kind of self-expressiveness and more confidence which is not possible through traditional pedagogical tools due to shyness and lack of knowledge [27].

7. PROPOSED GAME DESIGN METHODOLOGY

Following model is being suggested that can be used for game designing; it contains two phases; Phase – I and Phase - II. Phase-I will focus on lecture delivery and Phase – II will focus on evaluation process.

Phase – I: Gamified Lecture Delivery - Full of Self-Motivation

While teaching any programming course, the main emphasis must be on developing logic building skills amongst the students which depend upon many factors as described in the following figure-3. Successful implementation of these factors can yield the outcome given below:

Figure 3: Representation of proposed Teaching – Learning Model
In support of this model, following stage wise interface shown in figure 4 could be used for the effective design of the game:

![Stage wise game interface](image)

**Figure 4:** Stage wise game interface

From the game interface given in figure 4, student will select the stage to play. Once the stage is selected, next screen will be displayed with details of all the levels. After this step, student clicks the respective level of his choice as shown in figure 5 and then game will begin.

![Level interfaces for Stage - 1](image)

**Figure 5:** Level interfaces for Stage - 1

Details of the level will include the respective content of the course, which user must understand in the interactive manner to proceed further in the game. The detailed view is given in figure 6:

![Desktop Interface of Level – 1](image)

**Figure 6:** Desktop Interface of Level – 1

With the help of above proposed model, instructor would be able to use a gamified environment in his class which will help him to get the better student engagement in the class.

**Phase – II : Gamified Evaluation – Immediate Results**

Students’ performance is generally evaluated by methodology adopted by the teacher during teaching/learning process. Gamified approach could also be used for regular evaluation of students for their sessionals. Evaluation can be done on the completion of the game or it can be done stage by stage. For the academic components like assignments, tests or homework’s, evaluation of student is required after certain intervals. In the traditional approach, students are given a programming task as a test to execute. On the basis of the code written and compiled by the students they are going to get marks and grades later on. But in the gamified approach [25], instructor can design one gaming environment in the class and can ask all the students to take a part in that activity to get the points or rewards for it. So instructor can divide the complete class into clusters and can allocate the programming tasks in

### Control Statements
- Stage - 1

### Functions
- Stage - 2

### Arrays
- Stage - 3
the form of clusters. Every cluster is going to solve those programming problems together with every member solving a particular part of same problem. Following figure-8 is displaying the proposed execution plan for gamified evaluation and figure-9 is displaying the details of every segment available for each cluster in evaluation.

8. CONCLUSION

Any activity which involves fun will indulge into user engagement automatically. It is the general tendency of humans that they love to play fun involved activities. So when we are gamifying education sector, it is very important that root purpose of implementing and indulging games as a pedagogical tools must be achieved. At the end it must not become fun loving activity only but it must solve the purpose for which the level of the game has been designed. If the student is not able to understand the concept after reading few odd pages written by the author of the book then purpose of reading as well as writing that book will become null and void in all means. So it is very important that games must be designed smartly and by keeping one factor in mind that the outcome after playing that game must be learning with fun. Further the gamified approach in programming itself will encourage and motivate students and help making the learning process simpler, easier and effective. According to the survey conducted in this interest, students have shown seriousness about their placement and career. If the gamified pedagogy is followed seriously and effectively while teaching programming concepts, then definitely it will help students to solve real life problems by exploiting the features of a programming language especially when there are large number of opportunities available in the market for software development, web development and most importantly mobile application development.
9. REFERENCES

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