

Employ Gamification to Make “I&CS” more interesting

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Abstract: The world of internet includes lot of viruses and hackers, eavesdropping and electronic fraud. So, there is a need of security to information and cyber data. The requirement is not only of secrecy but the authenticity of information is also equally important. The requirements of security and authenticity within an organization are on a boom now which has undergone lots of changes over the decades. Information and Cyber Security Course tries to provide both the principles and practice of cryptography and network security. The awareness and study of security issues is required. It plays major role in the industry and organization. Hence the course of Information & Cyber Security is a must for students to learn especially for Computer Science and Information Technology students. To create interest in learning this course, the fun learning activity like gamification is implemented. According to the Merriam-Webster dictionary, a game is “an activity engaged in for diversion or amusement”. Gamification in general speaking is a fun activity to engage the student, to meet learning objective. The Study proposes Gamification which provides a smart

way of teaching to make learner active. The paper focuses on involvement and engagement of the learner with Gamification.

The experiment is conducted for the final year Computer Science and Engineering students for the course of Information and Cyber Security. The results show that the ability of problem-solving among students increased effectively with more understanding level. The effectiveness of the experiment is verified by the survey from students and the university results.

Keyword : Gamification, Information & Cyber Security, Active learner, Fun learning.

1. Introduction

Information & Cyber Security is a Final Year eighth semester course for the Computer Science and Engineering programme. The mindset of final Year student is usually different than other engineering students. The scenario of this class varies from some are already placed, some are not placed, some are busy with higher study preparation , and as usual, some students are in dilemma, what to do??? as they are not clear with their future plan. Students pay more attention towards project completion, placement or higher study preparation. They show very less interest in attending theory classes and Those attending are just like passive entity.[1,6]

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What's the importance of I & CS?

- It is about handling risk.
- It focuses on computer vulnerabilities.
- More mathematical than theoretical which includes discrete logs, factors etc.
- Job opportunities in multi-disciplinary areas like forensic sciences, public policy, and law etc.
- It does not require a high-level programming knowledge or setting up a high-performance network.

In Traditional blackboard teaching method, the teacher writes some notes or algorithm or mathematical questions on the blackboard and student note it in their notebook and then teacher explains the concept with the clarifications and gives assignment problem accordingly.

As mentioned earlier, usually a class room consists of students of different level of understanding and mentality. So major problems faced by the teacher raises many challenges like:

- How to create interest among them?
- How to make whole class active?
- How to clear doubts of students?
- How to meet learning objective?

Students live in the world of gadgets where change is the only constant thing. Active participation of students involves deep learning which is useful for lifelong experience and learning too. Information and Cyber Security is a mathematical subject focusing on problem-solving so traditional method is also important. To cope up with the above challenges, the combined approach of traditional method and Gamification is applied to increase student's level of engagement.

According to Lee*, "Gamification can motivate students to engage in the classroom, give teachers better tools to guide and reward students, and get students to bring their full selves to the pursuit of

learning."

Characteristic of Gamification [7]

1. It is easier and cheaper.
2. Contents are not changing; it only improves the way of learning.
3. It simply involves step by step by execution.
4. Unlike other Games, no chances of loosing, only concept will be cleared as it relate with riddle, example, story etc.

Figure 1 depicts the flow for different steps of gamification which starts with, knowing student's capabilities and nature of the course.



Fig. 1 Steps of Gamification

It also points towards type of methodology and where it will take place (individuals, groups, class size, face to face, online). Identification of points that create obstacle will help the instructor to define learning objectives and structure the placement of gamification in the course. Then, identification of an exiting game or defining new one takes place. Finally, implementation of gamification happens.

The experiment is conducted for the Final year Computer Science and Engineering undergraduate students for the course of Information and Cyber Security.

1. Literature Review

Games in day to day life are not only entertaining users but also modelling their behaviour. Dynamism and engagement of user can be increased with e-learning application [2].

Gamification promotes desired learning behaviour. It also positively enhances learning for problem solving in a social way. It tries to understand intrinsic and extrinsic behaviour of user. To create

ideal gamification instruction, it is necessary to understand learners behaviour.[3] It is the use of game attribute to affect the learning behaviour & attitude of learner.[4] Gamification is not the application, it is the thinking. It provides better learning experience & environment with instant feedback. It points behavioural changes. The strategies also includes rewards for the successful completion.[5] It motivates learners during the process of learning . It also improves user's skills and maximizes skills [6,8].

3. Activity 1 Implementation

Information and Cyber Security is a final year subject having three theory and 2 Practical Lab hour sessions during a week, as per university curriculum structure .Two activities were conducted for the same course: one during theory session and another one during practical lab session.

First Activity “Stories /Examples turns into Concept” is conducted during theory session in the Classroom.

During In-Semester Assessment (ISA) for the practical lab session, second activity is conducted i.e.”What is hidden, lets decrypt it???”

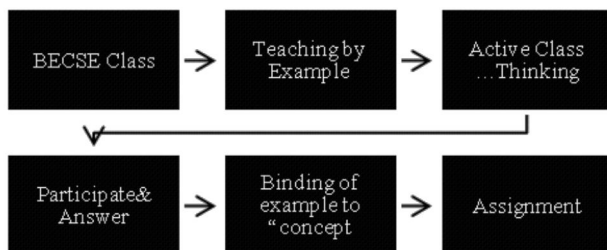


Fig. 2 Activity 1: Stories/Examples turn into concept

First activity as shown in above figure 2 is conducted during regular theory classes. In general teaching strategy: teacher starts his/her teaching with some background and the concept explanation. Instead, start with example or stories i.e. Teaching by example which is related to concept. Whenever something interesting happens in the class, naturally student start paying attention and become active. They start thinking, try to relate stories with the concept. They start thinking and try to give answers of questions raised by the teacher. Later, teacher correlates the example and the concept. Students can easily relate and remember the concept. And it is a

general fact that, we never forget stories and concepts.

While teaching Information & Cyber Security course, Few examples and stories are used.

To explain the concept of Real cryptosystem concept, Zero knowledge proof example is used as shown in figure 3.

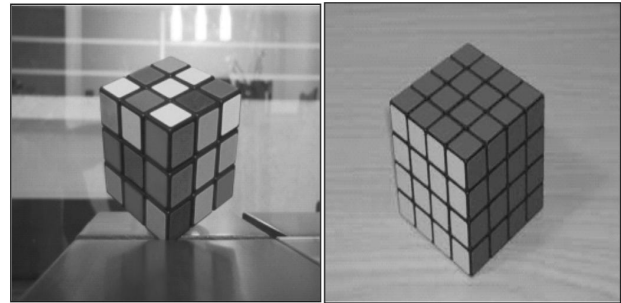


Fig. 3 Example1: Zero Knowledge proof

Alice wants to prove to Bob that she knows how to solve cube without actually solving. Can I convince someone validity of something without revealing the proof. Sender wants to prove that he/she is authorized sender without sending key.

Second example of “Rock, Paper, and Scissor” (depicted in figure 4) is used to teach Cryptographic protocol concept.

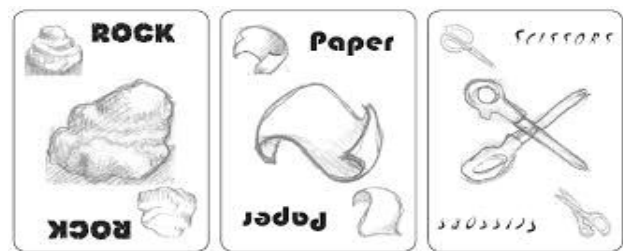


Fig. 4 Example2: Rock, Paper, Scissor



Fig. 5 Example3: Sharing of Dosa

Among all nodes present in the network, who will start communication? Concept is explained with the help of Rock, Paper, and Scissor game.

Third example is sharing of Dosa is used to explain the concept of Trusted party.

All should get equal share of Dosa: example is used to explain concept of trusted third party. All should get equal share of dosa, no envy factor. Same way trusted Third Party monitor Distribution of keys concept is related with this example.

Another Example: Glass of water is used to explain Dos Attack



Fig. 6 Example4: DoS Attack

Suddenly many customers come to a restaurant and order a glass of water. The waiter becomes overwhelmed with the quality of request. As more customers enter the restaurant the waiter is unable to attend them.

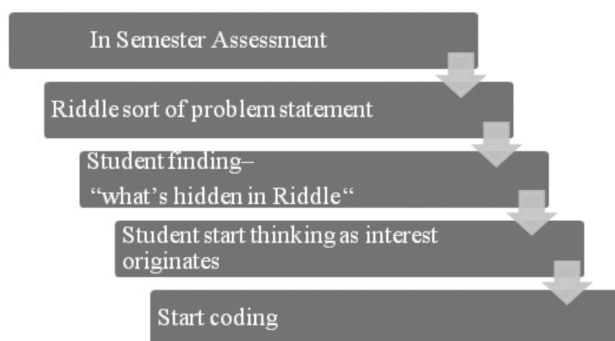


Fig. 6 Example4: DoS Attack

4. Activity 2 Implementation

Activity 2: "What is hidden, Lets decrypt it" is carried out for In Semester Assessment. For In Semester Assessment, Practical performance is

conducted for each student separately to practise them for End Semester Assessment. Instead of problem statement, Riddle is given to them. Riddle contains some input .It is basic tendency of any person, whenever there is game, they got attracted like the same for student. Riddle form of problem statement creates interest in student and they start thinking and trying to find out "what is hidden" in the Riddle, trying to decrypt it means trying to solve it.

The two examples of Riddles are given:

Example 1: Traditional way to define problem statement

Implement Playfair Cipher Riddle

Example 2: Implement Ceaser Cipher Riddle

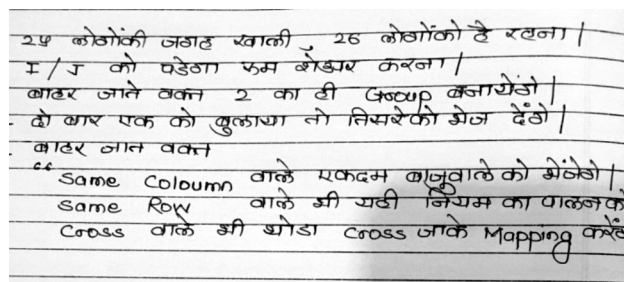


Fig. 8 Playfair Cipher Riddle

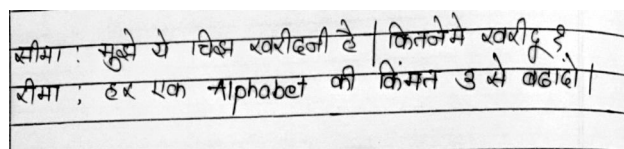


Fig. 9 Ceaser Cipher Riddle

5. Experiment & Result

As per university syllabus, the course Information and Cyber Security is included in the curriculum of Final Year Computer Science & Engineering Second semester. The course is scheduled as 3 hours theory sessions and Practical Session of 2 hours weekly. The results are observed by student's university results.

Two academic years 2015-16 and 2016-17 results are compared for this experiment. It is observed that students in 2016-17 scored more than the previous year students. The 2015-16 year students have

undergone through traditional teaching and learning methodology and for students of academic year 2016-17 Gamification is used. A remarkable improvement among the students is observed. The following Table 1 shows results observed in year 2015-16 and 2016-17. The analysis is done based on their marks range for

Table 1. Result Analysis of University Marks

Marks Range	No. of Students 2016-2017	No. of Students 2015-2016
41-50	5	20
51-60	10	40
61-70	30	20
71-80	30	2
81-90	3	1

University Exam.

It has been observed that the marks range is increased by around 20% to 30% with the use of Gamification. The following Figure 6 shows graphical

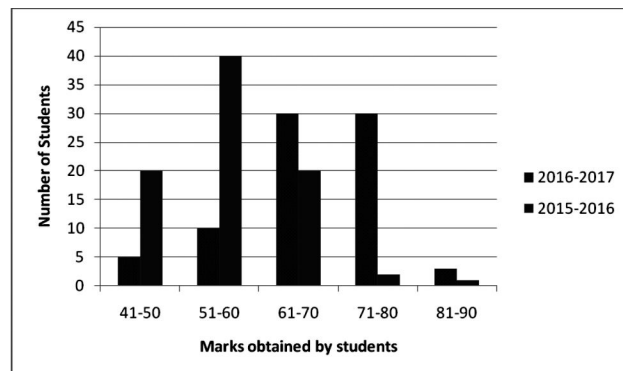


Fig. 10 the graphical representation of student marks

representation of result analysis. This scoring more than 70 is increased drastically.

For Activity 2, In Semester Assessment Marks of academic year are compared .2015-16 and 2016-17. It is observed that ,more than 60% students are able to

Table 2. In-semester Status of Student

Coding Status	2016-17	2015-16
Student Complete Execution	60%	50%
Student Execute upto 70%	30%	15%
Student not Understand Concept	10%	35%

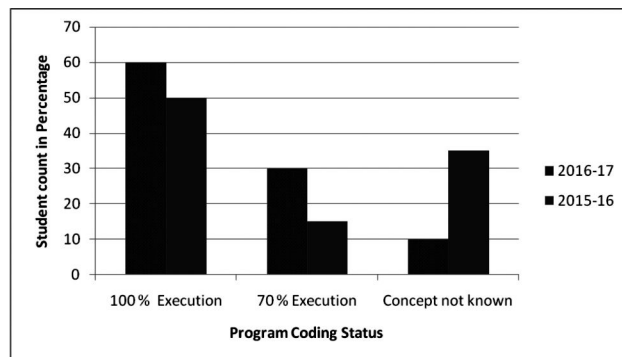


Fig. 11 In-Semester Program Coding Status

execute successfully which is good as compared to last year .This year only 10% students are not able to

		5	4	3	2	1
1	The teacher explains important concepts/ideas in ways that I can understand	40%	30%	10%	10%	10%
2	The teacher stimulates my interest in the subject	30%	30%	30%	10%	0%
3	The teacher demonstrates enthusiasm in teaching the unit	20%	40%	20%	10%	10%
4	Appropriate teaching techniques are used by the teacher to enhance my learning	30%	30%	30%	10%	0%
5	All Students of class actively participate in Gamification	47%	30%	10%	10%	3%
6	It is useful to meet learning objectives	30%	30%	20%	10%	10%

Fig. 12 Activity 1 Survey Form

code program but they are able to analyze it.

Not only marks but Students survey forms are also collected and they show a positive response for the use

	Questions	5	4	3	2	1
1	Riddle language and suspense in problem definition	55%	25%	20%	0%	0%
2	The teacher stimulates my interest thinking according to riddle	45%	35%	10%	10%	0%
3	As data is present in riddle , I obtained input , so I started solving	20%	40%	20%	10%	10%
4	Appropriate teaching techniques (Gamification) are used by the teacher to enhance my learning ,thinking during In semester Continuous Assessment	30%	30%	30%	10%	0%
5	It will be beneficial during End Sem Assessment	40%	30%	10%	10%	10%
6	It is useful to meet learning objectives	30%	30%	20%	10%	10%

Fig. 13 Activity 2 Survey Form

of Gamification in the classroom

From the survey form it is clear that more than 70% student agree that with the help of with the help of gamification teacher explains the concept more interestly and helps to understand. It helps to enhancing learning and to meet learning objective.

Same survey is collected for Activity 2.

From the Activity Survey form it is analyzed that Riddle Language create interest in thinking and it helps to get input and start thinking which is beneficial during End Semester Assessment.

5. Conclusion

Through this experiment it is observed that for a subject like Information & Cyber Security which is combination of Theoretical and Mathematical Subject more than 80% students found these activities are appropriate and useful for course Blending of gamification increase students interest in the class. For a student general attention span is @ 12-20 minutes, blend of traditional teaching and gamification increase students engagement and attention span It allow students to learn at a deeper level

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