

## **GamEd - Learning Data Structure Algorithm using Computer Game**

Nazneen Ansari<sup>1</sup>, Noopur Parikh<sup>2</sup>, Anagha Narvekar<sup>3</sup>, Manjiri Phatapekar<sup>4</sup>,  
Anita Yadav<sup>5</sup>

<sup>1</sup>Information Technology, St. Francis Institute of Technology, Mumbai University, India.

<sup>2</sup>Information Technology, St. Francis Institute of Technology, Mumbai University, India.

<sup>3</sup>Information Technology, St. Francis Institute of Technology, Mumbai University, India.

<sup>4</sup>Information Technology, St. Francis Institute of Technology, Mumbai University, India.

<sup>5</sup>Information Technology, St. Francis Institute of Technology, Mumbai University, India.

**ABSTRACT:** Games have been used throughout time as an instrument of instruction for all different aspects of life. Games provide a fun learning environment in which students can approach abstract topics in a visual manner. Learning should be fun. When a student is doing something that he deems as fun, he is able to grasp its concepts much more effectively. There isn't a student in the world that would object to homework if it were a fun experience; instead they would yearn for more. Thus, we are building a game that will teach sorting algorithms (BFS and DFS) from the I.T. and Computer engineering students' syllabus as well as provide a good gaming experience. Data Structures is a very important topic in the curriculum of Information Technology and Computer Engineering students. It forms as the basis for their course and is taught in the second year of their four year course. This game will allow students to enhance their knowledge and gain better understanding of the subject without them losing interest in the subject.

**Keywords -**Computer Games, Data Structures, Learning, Teaching, Undergraduate Engineering

### **I. INTRODUCTION**

Gaming is a genre which is always used as a medium of instruction. Puzzles to learn logic, mathematical games to enhance basic math skills, and even reading games to increase reading ability have all been used successfully to teach children the basic skills that they will need in life<sup>[1]</sup>. The traditional teaching methods include teacher centered, routine teaching, archaic. Examples are lecturing, dictation, drill, teacher led discussion, explanation, resource people, case study, group discussion, brainstorming, buzz groups, and field trip. The newer teaching methodologies include learning through presentations by speaker, workshops, and seminars<sup>[2]</sup>. Personal computer games are played on the personal computer with standard computer interface devices such as the keyboard and mouse, or a joystick or gamepad<sup>[3]</sup>.

As you know, education has many goals, and there is a huge amount of research and practitioner knowledge about teaching and learning. We all know that gaming has been a good source of entertainment from last few decades. But there is another aspect to gaming i.e. education. Learning some concepts sometimes becomes tedious and time consuming. Also students lose interest in learning them because the learning process becomes complicated. But when combined with gaming,

learning becomes fun and engaging. However such games have only been developed for children in pre-primary and primary schools, that is, for the age groups of 2-5 years and 6-10 years<sup>[4]</sup>.

## II. LITERATURE SURVEY

This is the research done in the gaming field for learning through games:

Table 1- Survey

Author	Year	Genre	Subject	Result
Feng& Caleo	(2000)	-	Spelling and math	Children that played computergames learned better than peersnot using computer games, mostly in spelling.
Rosas et al.	(2003)	Action	Reading and mathematics	Computer games increase motivation, and there is a transfer of competence in technology from using the computer game.
Squire et al.	(2004)	Simulation	Physics	Physics Students using the simulation game performed better compared to the control group.
Mary Jo Dondli-nger [5]	(2007)	Video Game	Educational Video Game for Literature	Students that played these specifically designed video games mastered the literature better than their peers not using computer video games, mostly in vocabulary and pronunciation.
Lu Yan	(2009)		Program	Students have experiences with computer game, wordprocessing software, search engine, social networking site and instant messenger.
Rose W. Mwangi	(2011)		Educational Computer Game for teaching Functions in Undergraduate Mathematics	Thisapproach has been found to be highly beneficial to mathematics in general, and asa result, the complex functions, formulae and theorems now utilize some form of Computer games.
Colin A Depra-dine	(2011)		Using Gaming to Improve Advanced	Thisapproach has been found to be highly beneficial to programming in

[6]			Programming Skills	general, and as a result, the most popular programming languages and development environments now utilize some form of object-oriented programming methodology.
Jason R. Stewart & Arvin Agah	(2012)		Teaching a software engineering course on developing video games: a Unified Process versus Extreme Programming	It presents the results of an empirical study on the comparison of these models for teaching the software engineering of video games to undergraduate students in computer science and computer engineering.

### III. RESEARCH METHODOLOGY

#### 3.1 Case Study Method

Our approach to this research is a case study. Case study helps understand the subject deeply. This in turn boosts your knowledge about the subject and helps you in designing the game in a better way.

Case study research excels at bringing us to an understanding of a complex issue or object and can extend experience or add strength to what is already known through previous research. Case studies emphasize detailed contextual analysis of a limited number of events or conditions and their relationships.

Case method is one of the methods of investigation. The peculiarities of each 'case' are known as well as the generalities of all the cases together. The cause-effect relationship is established & exceptions are noted down.

#### 3.2 Need of Educational Game

Data Structures is a very important topic in the curriculum of Information Technology and Computer Engineering students. It forms as the basis for their course and is taught in the second year of their four year course.

This topic is also a very difficult topic to learn especially if the base is not clear.

Hence we are going to take searching algorithms – BFS and DFS of the subject Data Structures and help students to learn it in an easy way through a game.

#### 3.3 Design of a Game

##### 3.3.1 Story Overview

The gamer plays the role of Orea, a mountain goat who lives in a valley at the foot of the Himalayas with her son, Ivar. One day they went to roam in the mountains when suddenly the climate turned cloudy and a thunderstorm started. Immediately they started running for a safe place. Amidst this Orea and Ivar got separated. The next morning Orea finds herself on the top of a barren mountain and her son, Ivar is nowhere to be seen. Now, Orea has not only got to search for her son but also to save herself from dying of hunger.


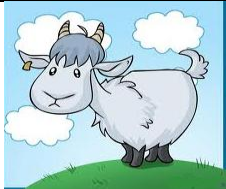


##### 3.3.2 Background / Plot Summary

Orea (the user) will have to find the correct path and jump to the correct ledges to find food for herself using BFS and DFS algorithms considering each ledge as a node of the Data Structure - tree. The main goal is to find her son- Ivar.

At the top of the screen there are a score display, energy level display, and time remaining. These displays are positioned such that they would not interfere with the view of the game in action.

If you lose the game "Game Over" will appear over top of the game view. If the user is successful, a screen congratulating the player will appear.

Table 2 – Game Elements

Sr. No.	Element	Description
1		Grass to boost energy
2		Main character- mother goat, Orea
3		Ivar, baby goat
4		Eagle, the enemy

### 3.3.3 Technologies to be used

- HTML5 & CSS3

HTML5 is a markup language used for structuring and presenting content for the World Wide Web and a core technology of the Internet. It is the fifth revision of the HTML standard.

A cascading style sheet (CSS) is a Web page derived from multiple sources with a defined order of precedence where the definitions of any style element conflict.

- JavaScript

JavaScript (JS) is an interpreted computer programming language. As part of web browsers, implementations allow client-side scripts to interact with the user, control the browser, communicate asynchronously, and alter the document content that is displayed.

- Collision detection

Collision detection is a four-step process, one step being the actual detection of collisions:

1. Iterate over the game's sprites
2. Disqualify sprites that are not candidates for collision detection
3. Detect collisions between candidate sprites
4. Process collisions

- Breadth First Search (BFS)

Breadth-first search (BFS) is a strategy for searching in a graph when search is limited to essentially two operations: (a) visit and inspect a node of a graph; (b) gain access to visit the nodes that neighbor the currently visited node. The BFS begins at a root node and inspects all the neighboring nodes.

```
listnodes_to_visit = {root};

while(nodes_to_visit isn't empty ) {

currentnode = nodes_to_visit.first();

nodes_to_visit.append(currentnode.children );

//do something

}
```

- Depth First Search (DFS)

Depth-first search (DFS) is an algorithm for traversing or searching tree or graph data structures. One starts at the root (selecting some node as the root in the graph case) and explores as far as possible along each branch before backtracking.

```
listnodes_to_visit = {root};

while(nodes_to_visit isn't empty ) {

currentnode = nodes_to_visit.first();

nodes_to_visit.prepend(currentnode.children );
```

```
//do something
```

```
}
```

#### IV. CONCLUSION

Educational computer games provide personalized learning opportunities, an environment for authentic and relevant assessment, and teach 21st century skills. But still there are some issues which need to be addressed before educational games can be used effectively on a large scale as a part of the curriculum. First and foremost issue is to remove the perception that games provide only fun and entertainment. Also educational games must be made fun, interactive and engaging while maintaining the basic purpose of the game i.e. learning.

Thus we would be developing a game that not only entertains the students or the players but also help them gain knowledge.

This game can be extended to teaching all the algorithms of searching, sorting, and also to the entire subject of Data Structures.

#### REFERENCES

- [1] Jason R. Stewart & Arvin Agah, "Teaching a software engineering course on developing video games: a Unified Process versus Extreme Programming", Kansas, United States of America, *Vol.10, No.1, 2012*.
- [2] Lu Yan, "Teaching Object-Oriented Programming with Games", *Hertfordshire AL10 9AB, UK, 2009*
- [3] Dave Moursund, "Introduction to Using Games in Education: A Guide for Teachers and Parents", University of Oregon, June 2007
- [4] Rose W. Mwangi, Ronald Waweru, Cecila W. Mwathi, "Integrating ICT with Education: Designing an Educational Computer Game for teaching Functions in Undergraduate Mathematics, Islamabad, Pakistan , April 15, 2011
- [5] Mary Jo Dondlinger, "Educational Video Game Design: A Review of the Literature", North Texas, USA, April 2007
- [5] Colin A Depradine, "Using Gaming to Improve Advanced Programming Skills", *Cave Hill, Barbados, November 2011*