

Impact of custom built videogame simulators on learning in Pakistan using Universal Design for Learning

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Abstract-With the conception of modern technology that rose with 4th industrial revolution, conventional methods of teaching are getting obsolete and the impact of this revolution carves deeply into the current generation of students. Two of the few most effected subjects in education are mathematics and physics as it is harder for a student to visualize the abstract concepts taught in these subjects and students are unable to link those concepts to real life scenario. This study focuses on measuring the effectiveness of the customized based videogame stimulator on teaching and learning using universal designed principals. For this purpose, quasi experimental designed was employed with a comparison on determining students' performance was measured between traditional and proposed approach. Since, Unity 5 has advanced physics in game-mode which is a huge opportunity for teachers to teach their students the abstract concepts in their own creative ways. Therefore, video game simulator was considered as it engages the students in the topic for a longer time. In-addition, all three areas of UDL principles that are representation, action and expression was implemented. Finding of the study revealed that proposed approach facilitated students in bossing a positive reinforcement and sense of achievement among learners.

Index Terms- Projectile, motion, gamification, teaching, comparative analysis, Universal Design for Learning.

I. INTRODUCTION

Video games are a huge part of life for common individuals these days. Particular, it caught attention of many scholars around the world. However, the emphasis was merely given to social part of videogames. The trends on integrating video-games in educational sector drastically increased in early 2020. According to statistical evidence it was revealed that the number of gamers were about 2.6 billion users globally. Consequently the sales of video games crossed the record range. Pandemic outbreak was the core reason in bring out such scenario. Since the virtual and distance learning environment was started where the fundamental requirement for teachers was to create innovative and engagement working environment to boost psychological well-being of the learner. Despite the facts challenges were also observed including spending time of a learner in playing video game that getting insight into thumb of rule in understating the knowledge being embedded through the means of educational games [1-2]. Additionally, apart from

digital interactive ways, instructors also need to make sure to maintain motivation and enthusiasm among learners towards specific learning task [3]. The aftermath of hybrid approach of gamification in education sector is categorized and perceived into dual way. The associated benefit of usage if video games are facilitation towards problem solving skills, cognitive abilities and improvement in social skills on the other hand research has also encountered the disadvantages including increased level of anger, lack of patience, aggression, anxiety and stressful reactions. Turned out be a bad impact of usage of videogames because of the violent storyline structures it has [3-4]. Regardless the fact, that educational games facilitated learners to cope with challenging life-experience during COVID-19 crisis including maintain social distancing, reducing the level of anxiety, social isolation and hence mentioned the progression in acquiring knowledge. As a result, videogame industry pushed harder to become a mature industry.

Perception towards considering the implementation of video games in educational section varies around the globe. Even though, it has gained popularity. However, in general, the prevailing practices being observed underdeveloped countries including Pakistan is; there is still a lot of space to cover and the literacy rate is very low. One of the observed reason on ignorance is much emphasis is given on the expansion of educational institutes rather than focusing on the targeted skillset and revised curriculum required for the global market [5]. Such issue can be resolved by introducing the concept of STEM (adding concepts of science, technology, engineering and mathematics) education in revised course curriculum. The advantage it has over the other ways is that it is easier to implement and is more viable so instead of making a change in the entire system, tweaking in a few new concepts will work at almost the same effectiveness [6]. It is well known to many students and teachers alike that videogames are getting a part of almost everyone in the world because of the easy access of devices as well as the internet. Many researchers across the globe believe that videogame simulators can have a huge impact on learning efficiency and exposure related to the topic learnt. Most of the teachers that use simulators for teaching use them as a supporting material so that it does not affect the conventional methods of teaching and learning [5]. These days there is nothing that can stop anyone from learning tools it is because of the availability of many tool related tutorials on the internet so we can easily get that a teacher can learn something like unity to build videogame simulators that is perfectly align with the topic

taught in a school. This can have some incredible results and the students will feel at home when they start learning these topics. The abstraction of many concepts will scatter and students will have more control with clear vision about the minor details. The problem we are facing in our basic and advanced education is association in our brain because of a lack in good, trendy and practical examples we are unable to translate even the simple problems into a working example and that effects learning process because there is no link between the things we are taught and the things we already know.

At the moment there are multiple projects and researchers that are working stem-based solutions that can actually make a huge difference in the society. One of these examples is project pals that help students in learning. The main goal is to give students a student centric environment that can help them in learning without being worried about the stress of multiple books and quizzes. Every part of it revolves around the student. It makes a visible virtual database of their ideas that helps them in organizing and collaborating with their friends [7]. While some of these applications directly focus on stem-based education others are there to be explored by the teachers like online websites that host games that are very impactful for developing the creativity in the mind of a student. The libraries are infinite in this area but the problem related to this arises while choosing between these games [8]. A team of Vietnamese researchers looked for solutions to improve vocabulary as their kids lacked a few key skills related to learning as these kids were only dependent upon the explanation that the teacher provided. When they introduced video games into the learning experience all of the students started learning on an advanced level of interest. The results of the students spiked upwards and interestingly the same thing happened for the teachers as well they learnt new things as well. Experience is one of the key solutions for learning if we give students good experience, they will learn a lot more and they will remember it for a longer time period. So, the way students perceive things is very important since it also describes the way they perceive their environment. A group of researchers advised a new way of detecting perception style. They achieved that just by observing computer engineering students while they are solving a puzzle game and they got their results just by simply observing the information these students extracted. The experiment was based on 47 computer engineering students and the results acquired were 85 percent accurate. After getting good results the researchers were sure that games are a promising environment where we can extract the perception styles that these students possess [9]. Some Malaysian researchers conducted an experiment that focused on the impact of video games on a challenging subject like programing. According to this experiment, video games have improved student's motivation, attitude, cognitive development, interface and expectations of the subject with 24 items. After this more students were motivated to learn programing and they had an encouraging positive attitude. It also enriched the knowledge of students about the targeted topic [10-11]. All of the above applications and researches are very important and useful but almost all of them do not use a direct approach towards a specific type of learning. It is a huge problem as these apps and researches can be fixed in some topics but they won't fit in as good as a custom-built application. One of the most important

questions asked from a researcher is what the most effective way is.

II. MATERIALS AND METHODS

The study aims to develop a new method to teach students abstract concept using custom-built video game simulator. For this purpose, the development phase was divided into four steps namely firstly use of specific tools, secondly the progressive development and implementation of proposed approached approach, thirdly and last step was verification of the measured values. The details on each developmental phase are given below:

A. Tools

The four specific tools namely unity, tinker card, visual studio editor, and Photoshop were used. Unity is a game development application that helps users in learning and creating free games. Unity application can use 3d models and manipulate these models using C# programing. The compiler is linked to visual studio and it uses the libraries in them. Tinker card is used to make 3d models for different purposes like 3d printing and models for videogames etc. In this project tinker cad is used for getting .obj files that can run on unity. These files can also be animated using unity's built-in features. Visual studio editor is an intelligent tool for editing and writing a C# code this is a very useful to write code quickly and efficiently. Photoshop is a photo editing and enhancing tool that is used primarily in making textures and enhancing them to look more realistic.

B. Development procedure of proposed approached approach

The study was aimed at developing a built-in simple game with minimalistic graphics and animations in physics. For this purpose, a widely used free application was considered. Study aims at measuring the effective and convenient usage of the custom-built video game simulator. It is also aimed to determine how a trained teacher can further modified a specific topic on the proposed approach. Consequently, how efficient the approach is for learner to keep them engaging towards achieving desired learning goals. The application is build using Unity 3D. The core purpose for considering this specific build-in application was it can also be used by non-technical and novice teachers. The selected topic was projectile motion. To make it a working framework, specific issue was address to make a cannon game in which the player aims at an object. The aim was achieved using four steps. These steps are sequentially illustrated in Figures given below. For instance, a box just by using the arrow keys the up and down buttons adjusts the angle of the cannon [step 1-See Figure 1].



Figure 1 Change in angle using up and down arrow keys

The velocity of the cannon ball is controlled using the left and right arrow keys (Figure 2).

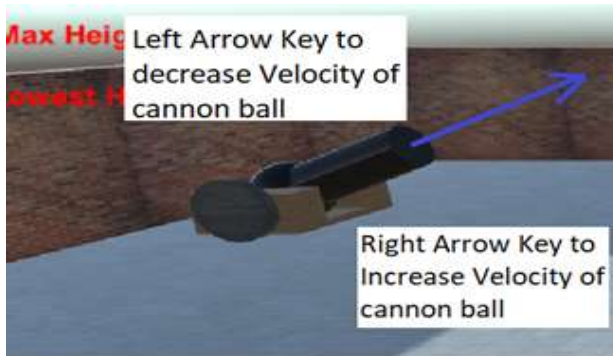


Figure 2 Change in velocity of cannon ball using left and right arrow keys.

By pressing the space bar, the cannon shoot a cannon ball (Figure 3).

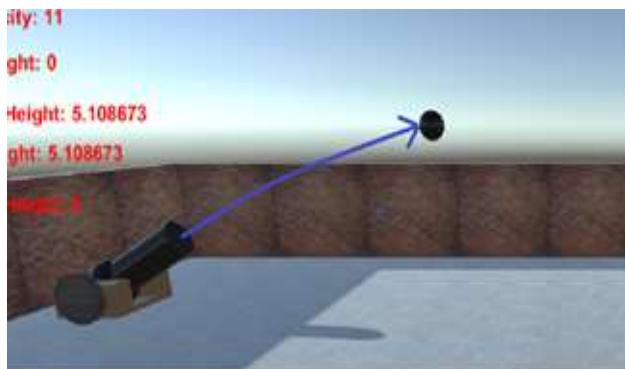


Figure 3 Shoot a cannon ball using a space bar.

In order to complete the task, the player has to shoot the target box.

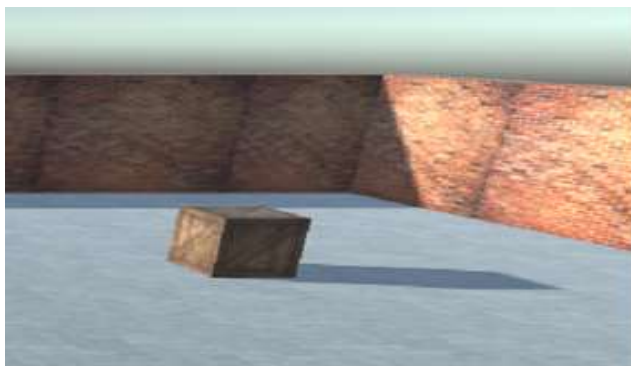


Figure 4 Hit the target (box)

The player is required to hit the target which is box using cannon ball (Figure 4). Even, though it seems, simple as easy. However, the unpinning pedagogical approach is required. A technical domain-specific knowledge on pre-defined physics with only a few lines of codes was used.

C. Verification of the measured values

A simple approach was used to determine that the applied values are correct. This was tested using a simple problem i.e:

If a body is thrown at velocity 4m/s with an angle of 45° so its initial velocity at y axis would be

$$v_{y0} = v \sin \theta \tag{i}$$

given data:

$$v = 4\text{m/s}$$

$$\theta = 42^\circ$$

so, putting the values in equation one

$$v_{y0} = 4 \sin 42^\circ$$

$$v_{y0} = 2.68\text{m/s}$$

its final velocity at y axis would be zero

$$v_f(y) = 0\text{m/s}$$

now the x component of velocity would be

$$v_{x0} = v \cos \theta$$

$$v_{x0} = 4 \cos 42^\circ$$

$$v_{x0} = 2.9\text{m/s}$$

now let's calculate time, As we known that $v_f(y) = v_{y0} + at$

$$v_f(y) - v_{y0} = at \tag{ii}$$

Putting values in equation 2 we have

$$0 - 2.68 / -9.8 = t = 0.273\text{sec} \tag{ii}$$

let's calculate the distance, prior to that we need calculate vertical distance first

$$v_f(y)^2 - v_{y0}^2 = 2ad$$

$$vfy^2 - v_{iy}^2 / 2(-9.8) = d$$

By putting values $d = 0 - 2.68^2 / 2(-9.8)$

$$-7.18 / -19.16 = dy = 0.37$$

now finding the horizontal displacement: we have

$$dx = v_{it}$$

By putting the values

$$dx = (2.9)(0.546)$$

$$dx = 1.63m$$

Hence, the values were verified by putting the same angle and velocity (See sequential procedure of Figure 5).

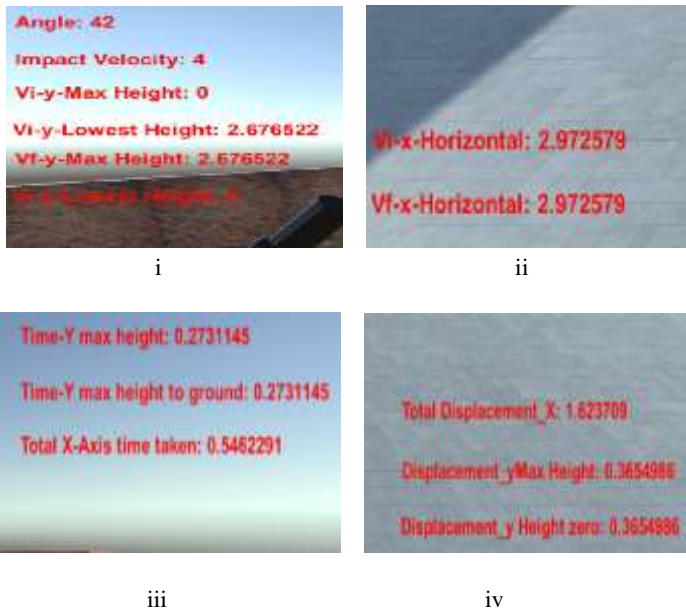


Figure 5 Calculated output

III. RESULTS AND DISCUSSION

At the end of the lecture we decided to take a feedback from the student. This feedback is a collective opinion from 19 students present in the class at that moment. The results from the feedback show the enthusiasm and level of interest the students had at that time (Figure 6).

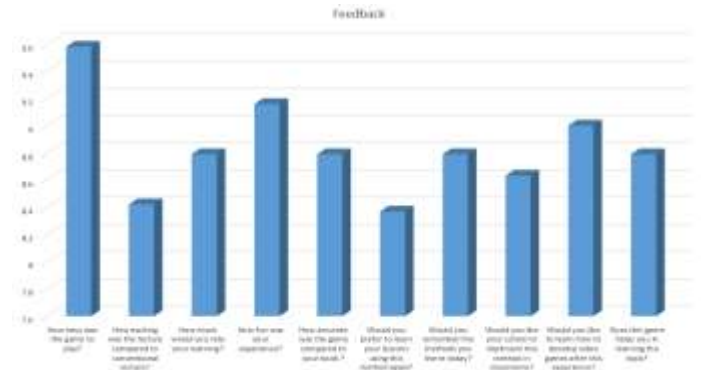


Figure 6 Calculated output

IV. CONCLUSIONS

The finding of the study revealed that simple easy customized games can be sources of both engagement and learning simultaneously. Therefore, novice teachers particularly having limited technical knowledge may also get benefit of computer assistance devices. The results from the feedback also show that there is a need for teachers training for polishing the required skills for 21st century students. Therefore, it is recommended for future study that there is teacher's training on appropriate knowledge and expertise is required. In-addition, awareness on identifying appropriate content for particular type of learning is also needed.

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