DEVELOPING AN INTERACTIVE-EDUCATIONAL MULTI-PLATFORM GAME FOR LEARNING FOREIGN LANGUAGE THROUGH SONY PLAYSTATION 3™ GAME CONSOLES

Sercan Alabay, [1] , Gizem Günçavdı [2*]
[1,2] Faculty of Education, University Uludag Bursa, 16159 Gorukle Kampusu , Nilufer, Turkey
*Correspondent Email:gizemguncavdi@gmail.com

ABSTRACT: *The purpose of the paper is to examine the benefits of multi-platform video games for learning a foreign language. The participants of the study consisted 130 preparatory class students, 82 of which were female and 48 of which were male. This research was conducted in two phases. In the first phase, the multi-platform game was prepared to form an interactive learning environment. After that, participants started to play console games which were not in their mother tongue. At the end of this process, participants were asked their opinion about the benefits of playing console games to their language learning process. The results showed that participants found consoles beneficial for learning a foreign language. They also stated that learning vocabulary of a foreign language was the most probable benefit of console games, and it was followed by written and oral comprehension.*

KEYWORDS: Foreign language, Playstation, videos games, language

INTRODUCTION

Information technologies have progressed since the appearance of the first computers in the middle of 20th century at a pace which has not been observed in any other sector. Although it has not been 70 years after the manufacturing of the first computer which weighed over a ton and required an army of operators to run, today nanotechnology enables us to fit billions of transistors into areas to be measured in millimetres. Hence, the terms having been used to describe the computer speed and capacity such as "super", "mega", "ultra", and "giga" has been replaced with the terms such as "tera", "peta", and "exa" as the former ones were not just enough to describe the largeness of the related numbers (Table 1). Computers can now be considered as the most important assistants of the humanity in the fields of education, health, engineering, marketing, economics, and communication as they can provide precise and accurate calculations besides saving time.

With the help of information technologies' progress, using these for education has become a widely accepted way of teaching something. One of the areas that information technologies are used is teaching a foreign language. Mayer [1] suggested a theory which is called as Multimedia Learning. This theory suggests that students learn a foreign language more effectively and easily with the help of using technology. Using information technologies for teaching a foreign language included using personal computers formerly. However, game consoles have become as popular as computers recently.

The game consoles which appeared within the same time period of the first computers chronologically can be described as complex microcomputers optimized originally for games and fun (music, video). While the first game consoles produced in the previous century can provide their target group with games designed with a restricted visual and graphics infrastructure, today's game consoles resemble to super computers in that they have an increasingly complex architecture which offers developed graphics-based and online games, music and video streaming, and internet connection.

The description procedures for super computers were first introduced in Japan in 1990 and updated in 2005 in compliance with the necessities of time. According to this, the computers with 1,5 teraflops or more are described as super computers and their sale, rental, and leasing transactions are subject to predetermined special conditions. The term 'Flops' stands for 'floating-point operations per second'. Thus, a super computer with 1,5 teraflops can perform 47.533.155 operations per second.

Table 1. Computing performance prefixes

Prefix	Abbreviation	10^n	Computing Performance
giga-	G	10^9	gigaFLOPS (GFLOPS)
tera-	T	10^{12}	teraFLOPS (TFLOPS)
peta-	P	10^{15}	petaFLOPS (PFLOPS)
exa-	E	10^{18}	exaFLOPS (EFLOPS)
zetta-	Z	10^{21}	zettaFLOPS (ZFLOPS)
yotta-	Y	10^{24}	yottaFLOPS (YFLOPS)

LITERATURE REVIEW

When Sony PlayStation 3 was first released towards the end of 2006, RSX GPU with 1.8 teraflops on these game consoles is defined as the first game console graphics processing unit outperforming supercomputers with 1.5 teraflops. In this regard, a platform of games, fun, and multimedia which was built without the intention of having a computer had the specifications of a supercomputer for the first time. Then, the scientists realized its amazing processing potential. Dr. Gaurav Khanna [2] from the University of Massachusetts Dartmouth studying the physics and calculations of black holes created a supercomputer by connecting Sony PlayStation 3 game consoles. He initially connected 16 game consoles which were donated by Sony and provided by the university through Linux operating system to create a supercomputer, and he has now been working with 1716 game consoles in a large container with a cooling system

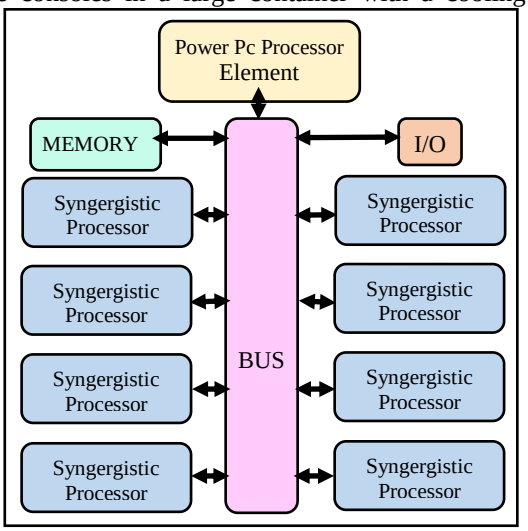

Figure 1. Cell processor

which was originally designed to transport milk. This system having the operating power of approximately 3000 laptop computers was produced at a cost of 75.000 American Dollars which cannot be compared with the conventional super computers manufactured at a cost of millions of dollars. Dr. Khanna stated that the system with PlayStation Cell processors was nearly 10 times faster than the computers with conventional processors in his research on parallel and delegated computer systems. Dr. Khanna and Chris Poulin published a manual and explained the steps of building a super computer in detail through connecting Sony PlayStation game consoles.

PlayStation 3 game consoles were clustered for the purpose of building a supercomputer, but they were specifically used for the analysis of black holes. This paper not only presents creating an educational game with networked PlayStation 3 consoles as research output but also aims to cluster cheaper (approximately $100 in the time of writing this paper) and nearly inutile PlayStation 3 game consoles into economic recycle as computer alternative system.

When Ken Kutaragi, president and CEO of Sony Computer Entertainment Inc. (SCEI) noticed that a new and more powerful processor platform for gaming consoles was inescapable, the idea to build network based computing and

Figure 2. Sony PlayStation running Linux operating system

broadband processing units founded by an army of engineers from hi tech pioneer companies like Sony, IBM and Toshiba. After about four years of hard work, the Cell Broadband Engine or generally known as "The Cell Processor" was born (Figure 1). The architecture is based on a power pc processor element (PPE), a 64-bit, two-way simultaneous multithreading (SMT) processor running at 3- 4 Ghz with 512 Kb of Level 2 cache and 8 Synergistic Processor Elements (SPEs), among them only 6 available for games in PlayStation 3, having 256 Kb of local memory for each. A high-speed interconnection bus provides data transfer between the processors system memory and I/O interfaces. PPE performs as an orchestra chief and the orchestra consists of SPEs, which cannot run any operating system but very good at vector processing and number crunching (Figure 2 and Figure 3). The powerful Single Instruction/Multiple Data architecture of the 6 SPEs in PlayStation Cell system allow processing of multiple data with a single instruction. In contrast to the conventional sequential approach using one instruction to process each individual data [3].

2.1. Cell processor in brief

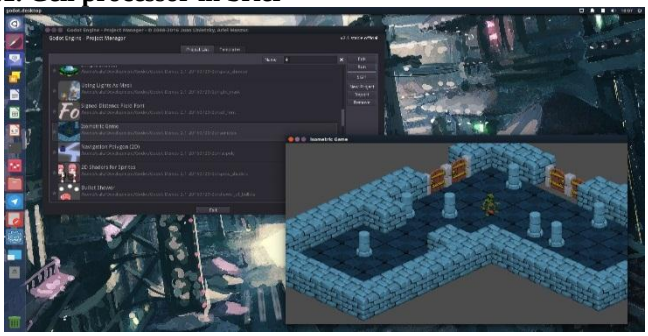

Figure 3. Godot installed on Linux system, running by 4 Sony PlayStation 3 consoles linked

In a simple subtraction example, it is very evident the difference between conventional scaler programming and SIMD programming. In the first one, in order to obtain the result three subtraction operation, have to be performed which means that the CPU gathers data one by one and performs the operation. However, in SIMD programming data is fetched and processed with one instruction. This represents a huge gain of time in areas like multimedia or game design where operations are pretty much same but the data processed is very large.

As a result, in multimedia processing like gaming, The Cell Processor is very capable and cheap when compared to conventional desktop processors (Figure 4). Thus, it is possible to say that using game consoles such as Play Station 3 for teaching a foreign language is a more practical and effective way.

With this study, researchers aimed to create a productive and entertaining environment for learning a foreign language which still faces difficulties in Turkey. It can easily be said that the interests of high school students in foreign languages are going to increase by employing the cluster system in high

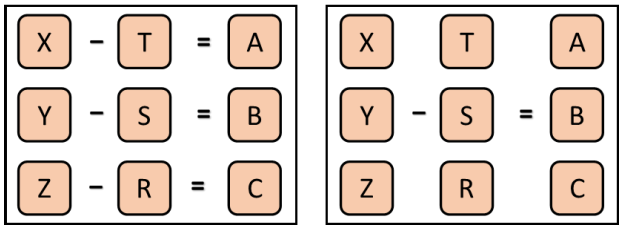

Figure 4. Same process made with three individual steps by the conventional desktop processor on the right, and with only one step by the Cell processor on the left

schools. This system is going to initiate the use of game consoles, which are already available at homes and used only for the purpose of entertainment, as interactive educational-instructional materials.

In the first stage of this study, 8 Sony PlayStation game consoles (4 Playstation3, 4 Playstation4) were connected in parallel for the purpose of building a super computer with approximately 15 teraflops. After that, this supercomputer was used to design an interactive educational-instructional game for the students studying a foreign language. The games to be designed through powerful game development software such as Scratch, Stencyl, Play Canvas, Construct 3, Godot Engine, Blender Game Engine and CraftStudio were used to constitute interactive educational materials providing multi-platform support such as web, desktop, and mobile (Android, IOS). In the second phase of the study, participants started to play console games which were not in their mother tongue. At the end of this process, participants were asked their opinion about the benefits of playing console games to their language learning process.

RESEARCH METHOD

A survey has been conducted to learn student perception about the role of video games and gaming consoles in learning a foreign language. The research design of the survey was descriptive. The participants consist of 130 preparatory class students, (82 female students and 48 male students) between 19 and 28 ages (Table 2). They were asked 10 multiple choice questions which aim to determine the time and frequency they spent to play a video game, what kind of videogames they played, which game consoles they had. Students also were asked to express their ideas on teaching and learning functions of the games, which learning skills could be developed by playing console games. The students were also asked to give their opinions on possible outcomes and / or benefits of linking Sony PlayStation 3 game consoles and installing Linux operating system along with open source game creation software on them. The results were analysed through IBM SPSS Version 25.

RESULTS AND DISCUSSIONS

The results showed that more than 70 % of the total participant play video games at least once per week or more. Nearly 25 % of them have PlayStation consoles at home. More than half of the students said that they play video games more than once in a week (Table 3), and more than two third of the total students answered the survey play video games up to 2 hours a day (Table 4).

Table 2. Demographics of participants

Demographics		Frequency	Percentage
Gender	Female	82	63,1
	Male	48	36,9
	Total	130	100
Age	19-21	76	58,5
	22-24	44	33,8
	25-28	10	7,7
	Total	130	100

Table 3. Descriptive statistics related to frequency of participants' playing video games

Choice	Frequency	Percentage
Everyday	33	25,4
More than once in a week	59	45,4
Once in a week	17	13,1
Once in a month	12	9,2
Never	9	6,9
Total	130	100

Table 4. Descriptive statistics related to the time participants spent playing video games in a day

Choice	Frequency	Percentage
0-2 Hours	98	75,4
2-4 Hours	16	12,3
More than 4 hours	5	3,8
Never	11	8,5
Total	130	100

According to the results, it is vocabulary that learners find most probable to be developed by playing video games with

more than 85 percent. It is followed by written and oral comprehension (Table 5).

Table 5. Descriptive statistics of participants' views about which learning skills can be developed by playing video games

Choice	Percentage
Oral Comprehension	45,4
Written Comprehension	53,1
Written Expression	6,2
Vocabulary	86,9

The results show that using video games for educational purposes may still be an effective method as it is one of the major activities that young and adolescent foreign language learners allocate their time. The studies of Anderson et al. [4], Becker & Jacobsen, [5], Cheng & Su [6], Cherney & London [7], Dumitrache, Logofatu, & Almasan [8], Dwyer [9], Frossard et al. [10], Holmes [11] also seems to be supporting this hypothesis.

CONCLUSION

Game based foreign language teaching and learning are not the newest concepts in 21st century reigning methodologies, there are already a dozen of open source (which means completely free and will remain free) and commercial and / or educational game creation software and services on the market, which run generally on computer operating systems like Microsoft Windows and Linux. Game creation software and services demand generally high-end computer hardware, especially in terms of graphics and processor power. But in the proposed system, the cost of the hardware is much less than a conventional computer hardware capable of delivering the same graphics and processing power. At the time writing this article, one Sony PlayStation 3 console cost was about 100 USD in Turkey, thus an eight-console packed super computer with all peripheric and racking stuff could be built for as low as 900 USD. This cost is 5-6 times higher if we build a personal computer with same graphics and processor capabilities. As a conclusion, it can be said that the proposed system may create a low cost easy to install alternative for educational game creation in foreign language learning process and learning industry enabling a very useful method for recycling and reusing old consoles at home.

REFERENCES

1. Mayer, R. E. Multimedia learning. *Psychology of Learning And Motivation*, **41**: 85-139. (2002).
2. BBC. *The PlayStation powered super-computer*. https://www.bbc.com/news/technology-11168150 (2010, September 04).
3. kernel.org. *Basics of SIMDprogramming*. https://www.kernel.org/pub/linux/kernel/people/geoff/cell/ps3-linux-docs/CellProgrammingTutorial/BasicsOfSIMDProgramming.html. (2017, May 05).
4. Anderson, B. O., Anderson, M. N., Taylor, T. A. New territories in adult education: Game-based learning for adult learners. *50th Adult Education Research Conference (AERC)* (pp. 1-5). Chicago: National- Louis University. (2009).
5. Becker, K., Jacobsen, D. M. Games for learning: Are schools ready for what's to come. *DIGRA 2005 Conference: Changing Views-Worlds in Play*. Vancouver: DIGRA. (2005).
6. Cheng, C., Su, C. A game-based learning system for improving student's learning effectiveness in system analysis course. *Procedia-Social and Behavioral Sciences*, **31**: 669–675. (2012).
7. Cherney, I. D., & London, K. Gender-linked differences in the toys, television shows, computer games, and outdoor activities of 5- to 13-year-old children. *Sex Roles*, **54**(9-10): 717-726. (2006).
8. Dumitrache, A., Logofatu, B., Almasan, B. GBL to support professional distance education. In *Proceeding of GACET'11, The 2011 International Conference on Games and Creativity in Education and Training*. (2011).
9. Dwyer, J. Computer-based learning in a primary school: Differences between the early and later years of primary schooling. *Asia-Pacific Journal of Teacher Education*, **35**(1): 89–103. (2007).
10. Frossard, F., Barajas, M., Trifonova, A. A learner-centred game-design approach: Impacts on teachers' creativity. *Digital Education Review*, **21:** 13-22. (2012).
11. Holmes, W. Using game-based learning tosupport struggling readers at home. *Learning, Media and Technology*, **36**(1): 5-19. (2011).