IMPACT OF COMPUTER BASED EDUCATIONAL GAMES ON COGNITIVE PERFORMANCE OF SCHOOL CHILDREN IN LAHORE, PAKISTAN

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ABSTRACT:

This study examines the impact of computer based educational games on cognitive performance of school children in Lahore, Pakistan. It focuses on the accessibility, positive and negative characteristics and usage as well as level of adaptability of computer-based educational games among school going children. Theoretical grounds of the study was supported by two theories i.e. uses and gratification and theory of cognitive development. The study applied two research methods one was experimental and other was causal comparative method. Universe of the study was Lahore and students of 4 and 5 grades from selected public and private schools of Lahore were the Population. Stratified sampling technique was used to identify schools and respondents of the study. The suggested hypotheses were statistically tested through Chi-square and ANOVA. The findings confirm that private school students have more facilities of computers at school than public schools but surprisingly none of them were using computer as a source of teaching and learning. Moreover majority respondents were agreed that the process of learning perk up with educational games and improves the understanding of different concepts. The study also suggested some of the recommendations for the field and future researchers.

Introduction

Video games have always been popular source of entertainment for our teenagers and now it's a favorite time pass for the people of all age groups (Gee, 2007). Rapid increase in the consumption of gadgets like computers, tablets, video games have made these games quite accessible to the user of Facebook and android phones. However, this media has a direct impact on the behavioral and developmental factors of the users (Huesmann& Taylor, 2006).

Nowadays, variety of software's are created which are not only considered as a best source for education for both in classrooms and corporate sector but also improve thinking abilities, skills to

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cater different situations, besides develop positive attitude towards life. It is the best source to impart know-ledge to the students of any age group (Maass, Klöpper, Michel, & Lohas, 2011). A wide range of web–based educational games might be utilized as a part of an educational domain. It is important to distinguish between educational and edutainment games prior to proceeding with a review focused on educational video game design. According to Denis and Jouvelot (2005), "The main characteristic that differentiates edutainment and video games is interactivity, because, the former being grounded on didactical and linear progressions, no place is left to wandering and alternatives" (p. 464).

Educational games support the individuals to find out about specific subjects, extend ideas, fortify improvement, comprehend a verifiable occasion or culture, or help them in taking in ability as they play. From last two decades, E-learning is becoming more popular due to computer based games which were mainly inspired from digital computer games after determining its potential towards learning process (Egenfeldt, 2005).

All those students who are more into video game based learning develop consequential insight and deeper understanding in different academic areas. These learning platforms develop social and leadership skills in students. All those classrooms where game based learning promoted, students enable to enhance their knowledge by allowing them to take leadership of their progress towards the learning objectives (Bainbridge, W. 2007)).

The revolution from last decade has made digital games not only the source of entertainment for the children and youth but also comprehend that how important these are from educational point of view. These games have also appealed researchers to study and signify its importance from academic approach. Information technology has revamped our academics, being an important tool for building abilities and enhancing learning capabilities; games have been developed particularly for educational purposes. These games are now been the growing interest to enhance learning and cognitive abilities by educational institution both in and outside the classroom (Prensky, 2005).

At the same time, psychology and cognitive sciences research

have explored the impact of computer-based educational games on the players, taking after two bearings: A first assemblage of research goes for measuring the impact of playing computer-based educational games on subjective capacities (discernment, visual consideration) and on advancement and identity (especially on forceful practices). A second group of research showed up as of late inside the hypothetical structure of the sight and sound learning group, in which content-based advanced games are considered as a specific intuitive interactive media instructional material. In both cases, the computer-based educational amusement is utilized as a specific undertaking or material yet its specificities are not thought about. The impacts of playing computer-based educational games on psychological and perceptual capacities, passionate reactions and learning developed in the writing however they stay exceptionally dissimilar and conflicting. Also, in spite of formal contrasts, the brain science research never looked at the impacts of various sorts of games on the created evaluations.

Keeping in view the above-cited concerns this study analyses the Impact of computer based educational games on cognitive performance of school children in Lahore, Pakistan. It is a general observation that the new generation is living in a virtual world, where they interact more with electronic gadgets like Televisions, cell phones, computer, laptops, tablets, video games etc. These gadgets on one hand have a positive influence as they get to learn a lot from these. Their access to information, their ability to learn, and their knowledge seeking capacity have been improved from previous generations. On the other side, these are causing a negative influence on our youth and making their interactions minimal with the society. So owing to the importance of digital games the study explores the impact of computer-based educational games by testing them on school-children for measuring their cognitive abilities. The specific objectives of the present study are to:

- Study the accessibility and usage of computer-based educational games among school going children of Lahore.
- Monitor the level of adaptability of academic concepts through computer-based educational games both in public and private school students.

- Identify the positive and negative characteristics of computer-based educational games influencing the academic abilities / skills of selected group children.
- Compare the accessibility of computer-based educational games of both public and private schools.

The hypotheses designed for the study were as follows:

H1: More the children play computer-based educational games more the enhancement in their cognitive performance.

H2: More the children play computer-based educational games better their academic skills.

H3: Children belong to high socio-economic status (private school) has better cognitive performance due to more exposure to the computer-based educational games then children of low socio-economic status (public school).

Several studies have been conducted to explore the impact of computer based educational games in all over world. Creighton and Szymkowiak (2014) in their study states that computer games are of competitive and cooperative in nature and both these game players develop different attributes. These games determine impacts of playing helpful and aggressive PC games on students' classroom communication recurence, as a file of their collaboration and engagement in class. However, advanced studies revealed that those participants who played cooperative games have higher interaction ratio with class then those who played competitive games.

Cankaya and Kuzu (2010) in their study revealed that how should children with autism need to be educated and what basic education we should provide them to make them independent enough to perform basic functions of life. Special games should be designed for these kids to make them learn in a fun way. Researchers should explore how kids with a mental imbalance associate with PC games, how PC recreations can be utilized for instructive purposes, and what attributes instructive PC games ought to have in training of youngsters with extreme introvertedness.

Turkay and Adinolf (2012) further researched with the objective

to add to the developing literature on game based learning. In their exploratory research, they tried to find out other peoples opinion about game based learning and what are the major consequences on the participants. Survey was conducted which determined that participants learn from game mechanics, narratives used while developing the game, team work and other participant also influence their learning abilities and lastly there can be few thing in the game which players want to get more knowledge about it using other sources.

Turkay (2012) tried to determine how collectible card games along with digital games affect the learning process of the players. These games may convey to a learning ecology by analyzing how CCGs invigorate innovativeness, comprehension, and logical reasoning, and how these components could help players integrating information, and create aptitudes that may be hard to instruct in a classroom setting.

Gholamitooranposhti, et.al. (2012) in a study was conducted that focuses on how computer games influences creativity and psychological modification of the participants. A test was conducted over the sample group to access familiarity, innovations, elaboration and adaptability qualities among them. However, later the results determined those who play computer games have lesser creativity in comparison to those who don't plays computer games. Similarly, positive relation was determined between the use of computer games and psychological modification.

Ashraf, Motlagh& Salami, (2014) in their revealed that Computer games software are designed in a way that it cast a long lasting impact of human brain. To measure the impact, researcher tried to find out whether these games can influence players enough to learn any foreign language. To test the same, two groups of Iranian students were made. The experimental group was asked to play computer based games and to control group they tried to teach English vocabulary traditionally. So, researchers were successful in determining that computer based game learning is the effective technique to teach students anything even foreign language easily.

Simkova (2014) in the study focuses on the impact of computer games on the education process. The methodology used tried to analyze methods of effective use of computer games. Results determined that computer games are positively correlated with the education process especially when games software's are developed for the learning purpose. Few games were then evaluated in the particular research and it was proved beneficial learning style for kids.

Al-Mansour, and Al-Shorman (2012) to support the research, in Saudi teachers and researchers collectively developed software for the students of Kind Saud University to measure the impact of Computer Assisted Language Learning. They developed the software to teach students English Language. To measure the impact, control and experimental group were made. They are randomly selected students from the university which were taught English through CALL and traditional method also. However, the study revealed that experimental group achievement shows the positive impact of this method teaching. Students get to learn foreign language in minim-um numbers of days as they feel themselves motivated by keeping them interacted towards the learning process.

Yüksel and Yüksel (2015) conducted study to understand the link between computers based teaching activities and academic achievement. To measure the impact experimental group and control group were made. Experimental group were exposed to computer based educational software whereas the control was taught through conventional way. The main purpose of conducting the test was to determine the success of second class students of Vocational Foreign Language lesson was used as pretest, post-test and maintenance test. As a result, it is appeared that the use of PC helped instructional techniques utilized foreign language lesson is more successful than conventional instructional strategies as far as understudies' scholarly accomplishment and maintenance.

Creighton and Szymkowiak (2014) in the research takes a gander at the impacts of playing helpful and aggressive computer games on student classroom associa-

tion recurrence, as a record of their collaboration and engagement in class. It was anticipated that students who played an agreeable amusement would get higher educator appraisals of classroom collaboration recurrence, though students who played an aggressive diversion would get lower instructor evaluations of classroom cooperation recurrence. Thirty-two school kids with conduct and learning challenges played either a helpful or aggressive rendition for a week. The pre-and-post-amusement classroom collaboration scores were distinctive for the helpful and aggressive diversion conditions in the anticipated bearings. The discoveries propose that helpful diversions may advantage the social collaboration of students inside the classroom.

Cheng and Su (2012) after the execution of diversion based learning framework, the accomplishment scores and survey of the test gathering are gathered for all intents and purposes, and the distinction in learning accomplishment between the exploratory and control gatherings is inspected. The outcomes demonstrate that the learning inspirations of students have critical effect on the learning

accomplishment, and the learning accomplishments of students with amusement based learning are superior to the individuals who utilize the conventional vis-à-vis instructing. Also, the outcomes could give the related teachers as references.

In the light of the above mentioned studies it is summed up, that there are few things which could be quite evident; in contrast with traditional ways of teaching and learning new and innovative methods of teaching are more favorable and implementable for educators. It is also found that students who learn new concepts by using interactive teaching methods have much clarity of concepts than the students of traditional methods. Moreover, all of the above mentioned researches deal with higher school level or for professional studies. It was also concluded from literature review that less focus has been paid regarding effectiveness of educational games at primary school level as children learnt most of the basic concepts at this level. At first it was thought that cognition was developed later in life but now it's proven that these previously held assumptions were inaccurate. So, present study aimed to

explore the low cost practicable ways to inculcate new media in the field of education for enhancing and boosting the cognitive abilities of school-children.

The current research deals with Game Based Learning, a relatively new term in education and media; it was found that due to technological advancements, game based learning is now successfully implemented in many western developed countries at various levels. Acklund and Hendrix (2013) stated that over the last decade there are many educational games specifically designed and inculcated in school curriculum, as well as a number of entertainment games that have been successfully used for educational purposes at multiple levels i.e. pre-school, elementary school, secondary school, high school and higher education. Game based learning has two way benefits, at one point it is facilitating teachers by lessening their burden of preparing manual task and one the other hand students can learn and understand new concepts by just playing games. Zin and Yue (2013) concluded after interviewing number of teachers that by inducing educational games in curriculum students has ov-

ercome two major issues formally faced i.e. boredom and lack of interest in studies. Simultaneously, it was also found that despite the fact that Game Based Learning has many benefits there are some ground realities which cannot be underestimated; for implementing Game Base Learning as a proper course work, there will be a great need of raising the level of computer education of teachers as they are the one who provide this facility to the students in schools. Prensky (2001) argued in his study that "digital natives" (who born and raised in computer age) are more like to learn and practically implement new technology as compare to the older generation who are learning and adopting new technology naming them "digital immigrants". Hence selection or designing of educational games is also a big challenge which can only be achieved through proper planning by educators and teachers. Albirini (2006) concluded in his study the teachers' urge for the creation of local computers and software that would better serve the country's identity, culture and educational needs.

Theoretical Framework

The study discovers the Impact

of computer based educational games on cognitive performance of school children in Lahore, Pakistan. Therefore two theories have been applied in this study. One Uses and Gratification (U&G), this is anapproach to understand why and how people actively seek out specific media to satisfy specific needs. It is a gathering of individual's concentrated approach to manage cognizance mass correspondence. Thus it is considered an audience-centered approach to understanding mass communication. Diverging from other media effect theories that question "what do media do to people whereas," U & G focuses on "what do people do with media"? With respect to new media Ruggiero (2000) stated "new media like the Internet possess at least three attributes of data not commonly associated with traditional media: interactivity, demassification, and asynchroneity." Interactivity and asynchroneity are directly applicable to the current study as Heeter (1989) defined *Interactivity* as a multidimensional concept: amount of effort a user must exert to access information (computer-based educational games in this case) and how actively responsive a medium is to us-

ers will decide the outcomes (improvement in the cognitive skills of school-children). Moreover, *Asynchroneity* refers to the concept that messages may be staggered in time, in case of present study the for instance grammar related games will provide maximum output when they correlate with the teachers' lesson plans. Second was Piaget's Theory of Cognitive Development. To Piaget, cognitive development was a progressive reorganization of mental processes resulting from biological maturation and environmental experience. He believed that children construct an understanding of the world around them, experience discrepancies between what they already know and what they discover in their environment, then adjust their ideas accordingly (McLeod, 2012). In current study it is examined that teaching new concepts in playful manner ultimately in the developmental process and level of understanding of school-children. The researchers instill the theory in different behavior in the study like at first it is utilized to build up a solid method of reasoning to bolster the study. Fundamentally, the third stage characterize by Piaget is the age gathering of youngsters is the

focused on age gathering of the present study. The research applies the research grounds characterized in theory and later turns into the wellspring of theory testing.

Research Methodology

In this research, experimental and causal comparative methods were used to obtain the data. Computer-Based Educational Games available on web were independent variable of the study. It means the impact of playing these games on the respondent and cognitive performance of school children is dependent variable where the comprehension about academic concepts and ideas of school children are to be studied. Universe of the study was all the schools of Lahore city. Population of the study was students belong to Grade-4 and Grade-5 of all the public and private schools of Lahore city. The reason of selecting respondents from Grade-4 and Grade-5 was that the focus this research was primary level of education in schools of Lahore. The highest level of primary education is 4 and 5 and most of the basic concepts have introduced and taught at this level therefore, this study targeted these children for data collection. Stratified method of sampling is selected because the current research study deals with students of same age, same grade, same level of education level of education and compare those who have or have not the facilities of the computer and taught same courses. There are nine towns of Lahore and among those nine towns Samanabad Town was selected for many reasons, first of all, according to Wikipedia, Samanbad Town is oldest posh town located in the center of the Lahore city, it has all kind of locality from business man to lay man and from educational elite to skilled workers, so schools located in this towns probably covers the maximum type of community found in Lahore city. All the four selected schools are located in Samanbad town. Sample size was comprised of total 200 primary school students. 100 students from public sector, respectively 50 from Government Boys high school Samanabad and 50 from Government Girls high school Samanabad. Similarly, 100 students from private schools i.e. 50 students from Beacon House School System AllamaIqbal Town and 50 from Lahore Grammar School Samanabad Branch were taken as a sample of the study. At

first, Quasi Experimental Method of research is used in which pre-test-posttest design is included. There was a single selected group at a time under observation, with a careful measurement being done before applying the experimental treatment and then measuring after. This design has minimal internal validity, controlling only for selection of subject and experimental mortality. It has no external validity.

Following are the experimental conditions in which the experiments were conducted. At first step the respondents filled their socio demographic forms then they were given response sheet 1 (all the response sheets are developed by keeping close look on the syllabus of respondents) of English after some time they played a game related to those concepts and then they filled another response sheet with having a bit higher difficulty level with same concepts to check if there is some betterment in the learning of respondents occur. Same method was applied for the response sheet of Maths.

Moreover to verify and bring authenticity in the study the experimental results further be tested through causal comparative res-

earch method, causal-comparative research attempt to determine the cause or consequences of differences that already exist between or among groups of individuals. Questionnaire was used as tool of collecting data for this study, according to the desired conditions Universe, Population and Sampling Method remains same as experimental method.

The data was collected in three months during Feb. 2016 to April 2016.In order to test the relationship between suggested variables in hypothesis statistical analysis test, Chi-Square and ANOVA were used. ANOVA is applicable when more than two groups or variables are compared, based on one factor (independent variable). The Chi-Square test is often used in researches work where the data consists of frequencies or counts. The most common use of the test is probably with categorical data. The data of this research was of categorical nature hence the Chi-Square was applied to analyze it. The results were tested at 0.05% level of significance which means that researcher is 95% confident in making the correct decision (Chaudhry, S. & Kamal, S. 2006, p. 129), one major and first sub-hypothesis was tested by Chi-square testing software.

Findings

Testing Hypothesis H₁

For testing H_1 chi-square test was applied. Statistical test of chi-square presents affiliation among variables and mostly find out the dependent and independent variables.

H₁: More the children play computer-based educational games more the enhancement in their cognitive performance.

Table-1:
Results of Chi Square test regarding children cognitive performance

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	114.463ᵃ	32	.000
Likelihood Ratio	148.183	32	.000
Linear-by-Linear Association	92.685	1	.000
N of Valid Cases	200		

Table 1 showed that chi-square value is 114.463 and p-value is .000 which is lesser than the level of significance (0.05). So the above findings revealed that null hypothesis is rejected and research / alternate hypothesis (H1) is accepted. It means use of educational games can improves the cognitive performance of students at school level.

Hypothesis H₂

For testing H_2, chi-square test was used. Statistical test of chi-square presents affiliation among variables and mostly find out the dependent and independent variables.

H₂: More the children play computer-based educational games better their academic skills.

Table-2
Results of Chi square test regarding children academic skills

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	60.264ᵃ	32	.002
Likelihood Ratio	74.733	32	.000
Linear-by-Linear Association	40.893	1	.000
N of Valid Cases	200		

Table 2 showed that chi-square value is 60.264 and p-value is .002 which is lesser than the level of significance (0.05). So the above findings revealed that null hypothesis is rejected and research/alternate hypothesis (H2) is accepted. It means playing computer games can improve the academic skills of children.

Hypothesis H₃

For testing H₃, ANOVA test, a statistical method in which the variation in a set of observations is divided into distinct component was applied.

H₃: Children belong to high socio-economic status has better cognitive performance due to more exposure to computer-based educational games then children of low socio-economic status.

Table-3
Results of *ANOVA* test for Cognitive Score on the basis of
Socio-economic status of children

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	130.529	2	65.264	1.043	.354
Within Groups	12321.626	197	62.546		
Total	12452.155	199			

Table 3 indicates the significance of relationship between socio-economic status of school children and their cognitive performance, the cognitive score variable (F=1.043, p=.345). In other words there is no significant relationship between socio-economic status and their cognitive performance of school students at grade 4 and 5. So the above results revealed that null hypothesis is accepted and research/alternate hypothesis is rejected.

Discussion

Statistical interpretation of data shows that students belong to private sector has more exposure, accessibility, and availability of Computer-Based Educational Games than the public school students. Main reason for this is their socio-economic status which makes them able to have access to modern gadgets than the students of public school but the findings show nearly same adaptability towards these games. Gee (2003) speaking from a socio-cultural perspective, has given one of the strongest theoretical accounts for understanding the learning mechanisms in web-based educational games. A similar study by Simkova (2014) focuses on the impact of computer games on the education process. The methodology used tried to analyze methods of effective use of computer games. Result determined that the computer games are positively correlated with education process especially, when games software's are developed for the learning purpose. Few games were then evaluated in the particular research and it was proved beneficial learning style for kids of primary school.

The results of current experimental study demonstrate that all the students whether they belong to public schools or private schools has clear and marked difference in their post-test activity. Majority students secure better marks in their post-test activity from their pre-test activity, which is clear indication of improvement. Rosas et al., 2018 concluded an improvement in motivation to learn, and a positive technological transfer of the experimental tool.

It was also observed from the results that basic conceptual understanding of student has also improved. So, the findings suggested that this method of game based learning is also very helpful for teachers while introducing any new concept. The results of this study is reliable as many foreign research studies have conducted that have confirmed that experimental study is the best source of getting accurate data from primary school level children. For instance, an experimental research finds out that experimental group was significantly higher than the control group. However, this result shows that demonstrating the beneficial outcome of utilizing computerized recreations as a part of showing

English vocabulary to kids (Ag-hlara, L., &Tamjid, N. H; 2011).

The findings also revealed that students belong to public schools faced some difficulty in getting through some Maths concept like fractions, but after playing that game small ratio of the students actually improved their understanding towards the concept of fractions. As concluded in another research study that not only do teachers and students enjoy using Skills Arena, students have exceeded the expectations by doing three times more math problems in 19 days than they would have using traditional worksheets **(**Lee et al., 2018).It can be used a teaching aid for getting better learning outcomes. Another si-milarly study was conducted in 2012 focuses on how computer games influences creativity and psychological modification of the participants determined positive relations between the use of computer games and psychological modification (Gholamitooranposhti, M., Sabzaliani, H., & Aghaei, M. 2012).

This study was restricted to English and Maths. The effectiveness of Game Base Learning (GBL) demonstrated in the current study

because it employed the interactive nature of these Computer-Based Educational Games. Findings of the current study are in line with the literature on Game Based Learning. Students learning in all areas and in all subjects can be improved by the help of Game Based Learning. Simulation and animation are distinguishing features of Educational games which enables children to understand those concepts easily which hard to comprehend in traditional method of learning.

Conclusion

Broadly stated, the article concludes that most of the private schools have computers to use for their students; on the contrary, the students of public sector do not have computers accessibility at schools however few of them have access to computers at home therefore their acceptability towards web-based computer games is more or less equal to the students of private schools who has computers at school and home as well. Moreover majority respondents of private schools use computer in school on regular basis but not for educational purposes. Similarly, knowledge regarding educational

games of private schools' responents is far better than public schools students. The research also sums up that despite the availability of computers, only few of the private schools include the game base learning through computers in their teaching methodology. However, it appears, students are still inclined to do activities through computer-based educational games available on web for clarity of the concepts.

This study further concludes that GBL (Game Based Learning) validated as an enhanced mode of teaching than prevailing style of learning in subject especially focused by this study while introducing new concepts. The results reflect that game-based learning can be beneficial for teaching other subjects also. The study also accomplished that respondents felt more independence while learning from Educational Games, they get benefited from individualization, self-pace and interactive nature of Computer-Based Educational Games as the experiment was conducted with Minimal Control over the respondents. It was also observed that there is a need of developing Computer-Based Educational Ga-

mes related for different subjects. These games are also very helpful for slow learners with its feature of interactivity self-pacing.

The outcomes are encouraging which makes it reasonable to assume that educational games have been a positive contribution to student learning in the course. In real life, many students would not do paper exercises rather copy them. The motivational advantages of Computer-based educational games mean that on average, students will spend more time in doing exercises when these are computer game than when they are the traditional paper-based variety. At the same time, the experiment indicates that the learning effect of game based learning (GBL) is better for introducing new concepts of Maths and English. On the basis of the conclusion this study recommends the following suggestions for the improvement of the situation.

1. Computer-Based Educational Games must be an essential part of curriculum.
2. Both private and public schools should adopt the interactive teaching methods such as game –based learning in their pedagogy for better results.
3. Computer literacy and its usage has become essential part of

curriculum, all over the world. Federal and provincial governments of Pakistan should take immediate actions to expand the facilities of computers in every school because expansion in computer education, paved the way of Game Based Learning in primary education especially.

4. Teachers' education institutions should introduce innovative plans to give chance to freshly graduated soft-ware designers, game developers, engineers and experts with well-found pedagogical skills.

5. Revolutionary steps should be taken to inculcate computer knowledge in the prevailing curriculum.

6. Upcoming researcher should commence the research to define the efficiency of several forms of Computer-Based Educational Games for various subjects and grades.

7. Future researcher should work on developing their own Computer-Based Educational Games, due which the gap between learner and goals can be lessened.

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