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Teaching Time Concepts to Children with Intellectual Disability through Computer Game Based Learning

^aAyesha Wajihullah, ^bSamina Ashraf, ^cShaistaMajid

^aPh. D Scholar, Department of Special Education, Allama Iqbal Open University, Islamabad, Pakistan
Email: cwcuaou@gmail.com

^bAssistant Professor, Department of Special Education University of the Punjab, Lahore, Pakistan
Email: samina.dse@pu.edu.pk

^cAssistant Professor, Department of Special Education, Allama Iqbal Open University, Islamabad, Pakistan

ARTICLE DETAILS	ABSTRACT
History: Accepted 08Sep2020 Available Online 30Sep2020	<p><i>Computer games based learning is considered as most effective teaching techniques now days including for the children with intellectual disability (CWID). This type of instructional strategy has the potential to address the challenges of learning abstract concepts and their manipulation. The purpose of the present study was to determine the efficacy of computer game based learning for teaching time concepts to CWID. Population of the study comprised of CWID studying in the special schools of Lahore city. Participants included 30 children whose functioning levels ranged from IQ 55 to IQ 60 with mental age of 3 to 5 years. The chronological age range of these children was between 08 to 16 years. An inclusion criterion was devised for the selection of sample of 30 CWID. The study followed the quasi experimental research design. 30 children were randomly divided into two groups. Curriculum based test was used as an instrument of the study. An online computer game of time concept after validation was used for intervention. Total 10 sessions were given to teach the time concept in two weeks. Results showed that computer games based instruction have contributed to learn time concept in these children. The results of the study recommended the use of the computer game based learning as instructional technique to teach the time concept to CWID. Limitations of the study and future research implications are discussed.</i></p>
Keywords: Computer Game Based Learning, Time Concept, Intellectual Disability	
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Corresponding author's email address: cwcuaou@gmail.com

1. Introduction

Intellectual disability (ID) is a lasting state describe by considerable restrictions in the academic performance and in the adaptive capability of persons concerning perceptual, social and adaptive skills, self- management, living at home, self-reliance, health and safety, practical learning, recreation and

work (Kiarie, 2006). For their education, collective behavioral and cognitive approaches are generally useful (White, Keonig&Schill, 2007).

However, the preference for modern interdisciplinary approaches to address children with intellectual disabilities (CWID) is strong (Friend, Cook, Hurley &Shamberger, 2010).

In this perspective, activities are needed, through which the knowledge and skills can be imparted after being constructed and integrated through daily teaching practice. It is emphasized that the CWID should actively participate in these activities. Alternative methods and strategies are useful for addressing the specific needs of CWID. Information and Communication Technologies (ICT) can be effectively used for the education of CWID (Omeda Andrew A, 2014). As a current educational advancement, teaching through computer is a mind boggling procedure where many experts play a vital role (Baumol, 2005).

As a momentous movement towards the acknowledgement of the Universal Right to Education in Pakistan, the Right to Free and Compulsory Education (RTE) Act, 2012 is in proclamation since Nov, 2012. The education and training privileges of children with special educational needs (SEN) were tended to as instructional program and practices planned for children with an impairment, either corporal or academic, which require unique instructional methodologies, equipment and every single such gadget and material which guarantee the equivalent chances of instruction to a learner with SEN. Now a day's everywhere throughout the world children with intellectual disability (CWID) are growing up with the contact of digital gadgets in their lives. These digital gadgets can help CWID in their training, vocational rehabilitation, and independent movement in society.

2. Background of the Study

Researches on the use of media for the intervention of learning has been proved affective to develop the interest, attention, social problem solving skills and the psychomotor skills of students with different disorders and disabilities (Moore, 2014; Salomon, 2012). The capacity to draw consumer interest make technology based learning a most capable learning tool, in general and special education setups (Kearney, Schuck, Burden, &Aubusson, 2012).

A child with intellectual disability (ID) is an individual who has “considerably sub average mental functioning, existing simultaneously with deficiencies in adaptive behavior and manifested during the developmental period, which negatively influence an individual's performance in education” (Lynberg, 2018; Baroff, &Olley, 2014). CWID have sub-average general intellectual development due to which teaching has become a challenge for their teachers (Chia, &Wong, 2014). Some of the researchers in the field of special education emphasize that information and communication technology (ICT) can help CWID to increase self-confidence and stimulus through creative activities and web browsing (Stendal, 2012; Ledford, &Gast, 2009). Use of computer based game for teaching purposes is a latest trend for the education of children with disabilities (Flanagan, Bouck, & Richardson, 2013). According to the Durlak, Weissberg, Dymnicki, Taylor, &Schellinger, (2011) the competency of computer game based learning is not limited to the normal students but have potential to facilitate the learning of students with SEN. These researchers have further elaborated that computer based games likely to have potential to create a center of focus and expand the concentration level and interest of CWID in a task by giving them confidence on the attainment of target skill (Bartoli, Garzotto, Gelsomini, Oliveto, &Valoriani, 2014). Computer game based learning offers to enhance and advance the abilities of its user on a specific skill of their own requirement (Hsiao, Chang, Lin, & Hu, 2014).

Special educational services for CWID are available in Pakistan since 1980s. However, the usage of technologies to facilitate children with special needs in their education is very rare. To trim down the learning problems common among CWID needs to introduce the new instructional approaches to maximize their residual potential. Therefore, it is necessary for the special education teachers that they should be compatible with new instructional approach in the learning process of CWID.

In all around the world there are many examples of time which affect our lives. The hypothesis of time is completely self-evident. An hour comprises of a distinct figure of minutes, comparatively multi day comprises of specific hours and a year establishes up of positive number of days (MacKay & Oldford, 2000). In science time is portrayed as its estimation by a clock (Sobel, 2007). Being able to tell the time is necessary for the adjustment of CWID in home living or in work environment. Acquisition of time concept is a great challenge for CWID due to their weak ability to understand the abstract concepts (Bouck, Bassette, Taber-Doughty, Flanagan & Szwed, 2009). CWID don't read the clock perfectly because of their poor manipulative skills. The learning of abstract concepts requires careful teaching strategies to let the children be able to understand the concepts with manipulative skills (Fritz, Ehler & Balzer, 2013). CWID require the practices of reading clock for the optimal level of independence in their lives (Ahmad, Hussain, Ahmad, Sarfraz, 2012). It is an era to make progressive movement, in the education of these children, through the usages of inventive practices for teaching essential concepts in promulgation of the Right of Education Act in Pakistan (RTE Act, 2012).

3. Objectives of the Study

The objectives of the study were to:

1. Find out an appropriate computer based time concept game for CWID.
2. Teach the time concept to CWID with computer game based learning.
3. Explore the effect of computer game based learning in the development of time concept in CWID.
4. Highlight the difference of computer game based learning and traditional instructional method in acquiring time concepts skill among CWID.

4. Research Hypothesis

As the present study was experimental in nature so following research hypothesis was investigated;

H₁: There will be significant difference in acquiring of time concept skills of CWID after receiving the intervention of computer game based learning.

H₀: There will be no significant difference in acquiring the time concept of CWID after receiving the intervention of computer game based learning.

5. Research Procedure

A quasi experimental pretest/posttest nonequivalent group design was used to conduct this study. This research design is recommended in the situation when random sampling is not possible due to sample characteristics (Rachels, 2016; Campbell & Stanley as cited in Gay, 2009). In this research design researcher put every effort to use groups as equivalent as possible (Gay, 2009).

6. Population of the Study

Population of the study was all the 70 students, who were studying in a center of CWID and their respective teachers. The chronological age range of these children was between 8 to 16 years. A sample of 30 children was selected from the population by following the inclusion criteria and divided into two groups (A & B) 15 each randomly and by further balancing on the basis of pretest score. Group A was

assigned 15 children and considered as control group and group B was also assigned 15 children and considered as experimental group.

7. Inclusion Criteria

Following inclusion criteria was formulated for student's participation in the study:

1. Children whose parents were agreed to include them in the study.
2. CWID who have some prerequisite of using computer.
3. CWID whose behaviors were settled with and without medication.
4. CWID who can have recognized number symbols 1 to 12.

8. Instruments of the Study

In this study two different types of instrument were used:

1. A curriculum based time concept test to assess the children current level in time concept.
2. A questionnaire for the selection of appropriate computer game for intervention.

9. Time Concept Test

A curriculum based test comprised of 08 items on the skill of time concept was developed and used as pretest and posttest for the CWID. Basic purpose to develop this test was to grasp the understanding of CWID during the study. Initially 10 items related to time concept was construct. Items related to time concept was: Identification of clock hands big & small (2 items), concept of an hour matching with time (2 items) concept of half hour (2 items), concept of quarter past (2 items) and concept of quarter to hour (2 items). Time concept skill test was presented to the experts from special education to determine the content and construct validity. Experts were provided to checklist with response category of Yes/No. On the basis of teacher's response CVI was calculated and 2 items were excluded. Now the test comprised on 08 items was constituted. The Cronbach alpha reliability of this test was .85 tested through pilot testing.

10. Questionnaire for the Selection of Game

Another tool, questionnaire based on 10 questions was developed for teachers to select one most appropriate computer game for intervention. Questionnaire was based on two response category Yes/No. Items of questionnaire was based on the construct of (i) relevance of the game to time concept, (ii) age appropriate activities (iii) Easy to use and (iv) Free on line game and interest of the children. This questionnaire was validated by committee approach. Five teachers of CWID were the participant of this committee. This committee gave their responses for item inclusion on the given criteria. On the basis of their responses and CVI three items were excluded which was based on interest. Final questionnaire consisted on 07 items was finalized for the selection of one game.

11. Selection of Game

Researcher selected three computer games through net surfing for teaching time concept to CWID. These selected games were presented to the seven special education teachers of CWID. They rated each game separately by giving their responses on a questionnaire. Data of 21 questionnaires was analyzed to find out one highly rated game for intervention. For the selection of appropriate game for intervention experts followed the criteria of (i) relevance of the game content to the time concept, (ii) mental age appropriate activities (iii) Easy to use and (iv) Free on line game. BBC game Clock works was found as most appropriate game for intervention program as table 1 & 2 shows.

Table: 1. Frequencies & Percentages of Games for Teaching Time Concept N=7

	Relevance of Content		Mental age appropriate activities		Easy to use		Free online game	
	F	%	F	%	F	%	F	%
Clock works	6	86	6	86	6	86	6	86
Telling time	2	29	3	43	4	57.2	6	86
Time o Clock	1	14.3	3	43	3	43	6	86

Table: 2. Descriptive Statistics of Time Concept Games N=7

	Relevance of the Content		Mental age appropriate activities		Easy to use		Free online game	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Clock works	3.86	.90	4.14	.69	4.00	.58	4.14	.69
Telling time	3.28	.95	3.14	.90	3.42	1.39	4.00	1.00
Time o Clock	3.14	.38	3.28	1.38	3.14	1.21	4.14	1.06

Figure: 1. Descriptive Statistics of Games for Teaching Time Concept

Figure:2. Interface of Time Concept Game**12. Intervention Plan**

In execution part of the study initial arrangements were made. Centre management was consulted to get permission to conduct the experiment. In this phase one day teachers training regarding the use of game were conducted by coaching 03 children. Consent of parents was obtained through letter for placing their children in experiment. These parents were also requested to ensure the present of their children in center during intervention. Setting of experiment was done through the arrangement in computer lab by allocating the PC and developed the schedule for each child session according to the time table. A schedule program for the division of time concept activities was developed. In this phase pretesting of both groups was conducted and pretest was analyzed to visit difference between control and experimental groups. No significant difference in pretest score of CG and EG was found on the basis of total score. EG was taught time concept with computer game based activities in computer lab, whereas participant of CG was taught time concept through the activities of conventional/traditional teaching methods in their classrooms. Time concept activities of computer game based learning were taught in one to one session by three special education teachers. Total 10 sessions for each participant of experimental group were administered for imparting time concept. In this way each participant of intervention group received 300 minutes' computer based instructional practices. Activities of time concept were divided in three levels. In the first level understanding of hands of clocks and their functions was developed by introducing the interface of the game clock works. In the second level (medium level of the game) concept of one full hour was taught through the click on right time among three presentation of the time. In the third level (hard level of the game) concept of half an hour was imparted through click on right time. At the same time control group received the same instructional plan in the classroom through conventional method. In game supported educational program learners' activities with game were supported by the worksheets, which were used with the aim of formative assessment and feedback from EG. Worksheets were used for gathering data and providing evidence for the effect of the game based learning on the acquisition of time concept skills in CWID. Table 3 below shows the details of intervention plan.

Table: 3. Intervention plan of sessions:

Phases	Concepts	Time	Total
Phase 1	Concept of hands of clocks	60 minutes	(2 session)
Phase 2	Concept of an hour	120 minutes	(4 session)
Phase 3	Concept of half an hour	120 minutes	(4 session)

13. Data Analysis

Posttest was administered and score analyzed by using SPSS22. Independent sample t-test was applied to determine the difference in the performance of CG and EG time concept skills before intervention. On the other hand, paired sample t- test was applied to compare the performance of CG and EG after the intervention of computer game based learning.

14. Results

The analysis of the data showed that no significant difference was present in the results of mean score of EG = 1.40, SD=1.80 and mean score of CG = 1.40, SD= 1.76 in pretest score. Results showed that children of EG and CG performed equally on test of time concept before the intervention. The analyzed data has been tabulated and presented in table No. 4.

Table: 4. Independent Sample t-test between CG and EG groups on Time Concept

	CG*			EG**			Independent t-test		
	<i>M</i>	<i>SD</i>	<i>S.E</i>	<i>M</i>	<i>SD</i>	<i>S.E</i>	<i>T</i>	<i>Df</i>	<i>P</i>
Pre-test	1.40	1.76	.46	1.40	1.80	.46	.000	28	1.00
Post-test	2.20	1.15	.29	4.93	1.53	.39	-5.53	28	.000

*N=15 **N=15

Table 5. Paired t-test on pre-test & post-test scores on time concept (N= 30)

	Pre-test			Post-test			Paired t-test		
	<i>M</i>	<i>SD</i>	<i>S.E</i>	<i>M</i>	<i>SD</i>	<i>S.E</i>	<i>T</i>	<i>Df</i>	<i>P</i>
CG	1.40	1.76	.46	2.47	1.85	.48	.000	14	1.00
EG	1.40	1.80	.47	3.67	1.95	.50	-2.90	14	.012

The above tables show no significant difference in the performance of CG on time concept as the alpha value $=p=1.00(p>.05)$ on posttest. Whereas a significant difference is present in the performance of CG and EG after the intervention. EG performed better on time concept as the alpha value $p=.012(p<.05)$ and t value is -2.90.

15. Discussion

This research was conducted to observe the outcome of computer game based teaching on the learning of time concept by CWID with comparison of CG. Results of pretest showed that there was no significant difference between CG and EG before intervention and both groups were found equal in time concept skills. Post test results showed significant improvement in time concept score of EG. This study also showed that computer game based teaching increases student's interest and motivation. The research study conducted by Zin, Yue, & Jaafar, (2009) showed the effectiveness of computer games

based learning in education. Research conducted by Tüzün, Yılmaz-Soylu, Karakuş, İnal, & Kızılkaya, (2009) verified that computer game based learning motivates the learning process and also provide immediate feedback on the action of learner. These games also support the development of different skills such as attention, concentration and eye hand coordination which may require in smooth learning process and influence changes in behavior and attitudes of learner (Hanus, & Fox, 2015).

There are multiple educational benefits in the instructional technology of computer game based learning (Wu, Wu, Chen, Kao, Lin, & Huang, 2012; Sampson, 2012). The computer games are supportive in improving the understanding and have the capacity to teach the abstract learning concepts (Bartoli, Corradi, Garzotto, & Valoriani, 2013). Results of this study are also aligned with the findings of Singh and Agarwal (2013) who evaluated the main effect of group (CG vs. EG) on remediation of time concept abilities deficit among children with MR and reported that main effect of group was highly significant through the time concept game. These results revealed the effectiveness of the selected game on the learning of time concept skills in CWID.

16. Conclusion

This study was designed to teach time concept through computer game based learning and to observe its effect on the acquisition of time concept skills in CWID. Results indicated that participant from EG shows improved results in the learning of time concept through games clock works. The study further highlighted an increased interest of participant of EG in learning time concept skills. This study is significant in its nature as it's emphasized on the use of latest technology to teach time concepts to CWID.

17. Limitation and Directions for future Research

There is an obvious gap in the literature even though most of the countries have carried out many researches and projects with regard how technology could be helpful in the social problem solving skills, attention skills and self-confidence of CWID. Only one study conducted by Singh & Agrawal (2013) was carried out on the time management skills of these children. In Pakistani context this practice is still not evident. Keeping in view the background this study was conducted to check the potential of computer game based learning for teaching to CWID. The effect of computer game based learning in the teaching of CWID has been little explored. Therefore, more researches would be required to authenticate this learning approach to optimize the learning skills of CWID.

18. Recommendations

On the basis of findings of the study following recommendations have been made.

1. CWID should be taught time concept with computer game based activities.
2. There is a need to train the teachers of CWID to use the computer based games by arranging the training sessions and workshops.
3. This study also responds to calls for responsibility from researcher and policymakers for thorough support indicating whether computer game based learning can truly support learning of these children. Furthermore, current findings are the valuable addition in the research based literature on the achievement of CWID directly linked to the use of computer game based learning as an instructional strategy for teaching time concepts.

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