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Long abstract of dissertation

The impact of computer assisted instruction on the phonological awareness and working memory of the first grade Students whom identified as At-Risk for Reading disabilities in EAST JERUSALEM

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Background:

Since the last decade, the researchers and practicing educators have sought to develop, disseminate, and implement methods for teaching reading that will help all children to acquire adequate reading skills (Toregson, Alexander, Wagner, Rashotte, Voller, & Conway, 2001). The demands regarding literacy have increased for students with disabilities. The American "No Child Left Behind Act" (NCLB) of 2001 clearly emphasizes the importance of improving the educational outcomes of all students (Erickson, 2005).

The acquisition of reading is a complex neurobiological process. Identifying the most effective instruction and remedial intervention methods for at-risk students by developing reading problems and for those who are already struggling is equally complex (Alexander, 2004).

The motivation to achieve this goal arises not only from the increase in understanding the broad impact that early reading failure has on general cognitive development, but also from recognition of the increasing demands for literacy in our technological society (Torgesen, 2000). Despite the major improvement in reading standards, the gap between populations at high risk for poor reading skills and good readers does not appear to be closing (Morgan, Frisco, Farkas, & Hibel, 2010).

The No Child Left Behind Act (National Dissemination Centre for Children with Disabilities. (2009) encourages focusing on early reading achievement to ensure that all children are proficient readers by the end of third grade. Research has demonstrated that LD students acquire reading skills at a different rate from their peers, which places them on a reading trajectory that is resistant to change (Juel & Leavell, 1988). Early identification is vital for the struggling reader to catch up in a short period and to implement meaningful interventions to change the course of a student's reading trajectory (Lyon & Chhabra, 1996).

Substantial research has examined the connection between deficits in phonological processing, which mainly related to phonology awareness, working memory limitations, and reading achievement (Gersten, Fuchs, & Williams, 2001; Greenway, 2002).

A large body of longitudinal have documented the relationship between early phonological awareness skills and later reading ability (Byrne & Fielding-Barnsley,

1995; Torgesen, Wagner, & Rashotte, 1994; Wagner, Torgesen, Rashotte, Hecht, Barker, Burgess, Donahue, & Garon, 1997).

LD students with a deficit in phonological processing usually experience a "bottleneck" to reading growth primarily because of early difficulties in acquiring accurate and fluent phonemic decoding skills (Torgesen, Wagner, Rashotte, Herron, & Lindamood, 2010). Those skills divide into the syllable, onset-rime, and phoneme levels (Gillon, 2004).

Additionally, studies have also revealed that students who experience reading difficulties consistently display impairments in the area of phonological awareness (Ataiba & Fuchs, 2002; Fletcher, Shaywitz, Shankweiler, Katz, Liberman, Stuebing, & Shaywitz, 1994). The importance of phonological awareness skills in reading development emphasises the importance for early intervention.

This disorder affects approximately 7% of monolingual five to six year old students (Vandewalle, Boets, Ghesquiere, & Zink, 2012). Phonological processing described a wide range of skills (Siegel, 2003). It involves the representation, manipulation, short-term storage, and retrieval of speech sounds (Snowling, 2000; Wagner & Torgesen, 1987). The speech sounds refer to the term of phonological awareness, which is responsible for recognizing the sounds in spoken words at the word, syllable, and phoneme level. Strong phonological awareness skills increase a student's understanding of the alphabetic principle, which is a vital aspect of reading development (Wagner & Torgesen, 1987).

"According to DSM-5 the term dyslexia or decoding difficulty which affects the development of decoding skills in reading, refers to children who have difficulty in mastering the relationships between the spelling patterns of words and their pronunciation. These children typically read aloud inaccurately and slowly, and experience additional problems with spelling. Dyslexia appears to arise principally from a weakness in phonological (speech sound) skills, and there is good evidence that it can be ameliorated by systematic phonic teaching combined with phonological awareness training" (Snowling & Hulme, 2012).

Furthermore, in DSM-5 emphasis is on the term 'decoding' which refers to the component reading skills that reflect the ability to map phonology (the speech sounds of words) onto orthography (Snowling & Hulme, 2012). Besides that, DSM-5

suggests that learning disorder, which replaces "learning disabilities", indicates experiencing difficulties learning academic skills, which significantly affect academic achievement or daily functioning if accommodations are not applied (Snowling & Hulme, 2012).

(Vaughn & Fuchs, 2003) describe such accommodation. They mention the validity of a special education classification according to three criteria:

a) The quality of the general education program is such that adequate learning might be expected;

b) The sufficient value of special education program to improve student outcomes;

c) The accuracy of the assessment process for identification.

Suitable accommodation validity relies on early intervention. Thus, the National Reading Panel (Ehri, Nunes, Stahl, & Willows, 2001) noted the importance of early intervention in five essential areas of reading instruction for all children. These were phonemic awareness, phonics, fluency, vocabulary, and text comprehension. Within these five areas, phonemic awareness considered a foundational (Wood, Mustian, & Lo, 2013). Although research has reported the significance and importance of explicit direct instruction for phonological awareness, some students will develop phonological awareness skills despite the absence of direct instruction. However, LD students require specific directed training programs (both teacher-led and computer-delivered) which developed to provide this explicit instruction.

Due to the technological development in the educational era, a large body of research has investigated the great potential of integrating a supplementary technological tool to practice phonological awareness training for reading inside the classroom (Torgesen, 2010, Lindamood,Lindamood, 1992) .

Due to this progress, an increasing number of computer software programs have been designed to deliver aspects of reading instruction that were once only available from teachers. Advances in technology such as high-quality sound, digitized speech, colorful graphics, and interactive design have added to the instructional value of computer software programs. Additionally, computer software programs have benefits such as allowing students to work independently at their own pace and instructional level, providing opportunities for individual feedback and motivation, and repetition of needed skills.

Although there has been an increase in the research exploring the utility of computer software in the classroom and its effect on reading instruction, there is still considerable need for research in this area. Specifically, with regard to phonological awareness, the Report of The National Reading Panel (Ehri et al., 2001) states, "More research is needed to determine whether and how PA might be taught more effectively using computers" (National Institute of Child Health and Human Development, 2000, p.44).

Research Focus & Problem Statement:

The findings above do not yet has resonate in the awareness and practice in the in the Palestinian-Arab children schools in general, and in special education system in particular in Israel, due to a several factors that face remarkable challenges to the Palestinian local education system. These factors may include, but are not limited to, overcrowded classrooms, unprepared teachers, understaffed schools, inappropriate learning material, and lack of adequate related services under an institutionalized Israeli-dominant inequities system (Coursen-Neff, 2005; Patel& Dakwar, 2005).

The evidence for such conditions witnessed in the latest international academic outcomes. The Palestinian Arab children, as part of the minority of Israel, participated in the 'Program for International Student Assessment' (PISA) in the year 2006 and in the 'Progress in International Reading Literacy Study' (PIRLS) in the same year. In both tests, these children's scores were significantly lower than Israeli Jewish peer's (Ministry of Education, 2007).

Also (PISA, 2009) reported that 55 % of Arab pupils in Israel performed below the average in reading and comprehension, and 18% of the total 55% are at high risk. In addition, pupils in other Arab countries also did not reach the scale median of the program in the Pisa test of 2006. In Jordan a study conducted by (Manasra, 2005; Sharif, 2005; Al Ayed, 2006) showed a generally poor, assisted competency amongst Arabic language teachers in the early grades in reading skills training. The disturbing numbers of those who did not acquire the reading abilities pointed to the importance of early identifications and intervention (Wood, Mustian, & Lo, 2013). Those targeted

in this study are Palestinian-Arab primary school pupils with LD, who taught under traditional conditions, lack assessed knowledge and suitable educational intervention.

Current research on the efficacy of computer-assisted instruction on the phonological awareness of the Palestinian Arabic speaking students at the early school levels is remarkably scarce. In fact, an electronic search of 'ERIC', 'Psych INFO', and 'Education Research Complete' databases, using various descriptive terms including 'strategy instruction', 'reading comprehension', 'learning disabilities', and 'Arabic or Arabic language' yielded no results.

The Current study:

The purpose of this study is to examine the effectiveness of an early intervention-using computer assisted instruction as a specific and systematic supplemental tool for enhancing the phonological awareness and working memory skills for the first grade pupils. Pupils diagnosed as poor readers and they exhibit-reading delay according to their school records and psychological tests. The sixty participants attend special education classes in regular primary schools in east Jerusalem.

Thirty computerized lessons package designed and delivered consisted of all phonological awareness skills that have accommodated and designed according to intervention instruction principles to meet the features of Palestinian Arabic speakers.

Special education teachers introduced, modeled, and delivered thirty lessons under supervision of the researcher, and his assistant. All pupils from first grade assigned to four experimental groups and two control groups divided into two different locations and by gender.

The experimental group received computerized lessons that introduced and modelled by the teacher inside the classroom for 45 minutes daily for 30 days, resulting in a total of 23 hours of exposure to the intervention for the extended group and daily 45 minutes for 15 days for the reduced group. Without any computerized treatment for the control group.

Research questions

1. Does applying computer-assisted instruction improve phonological awareness skills of first grade pupils with LD;

   A) When compared to traditional instructional methods?

   B) When compared to the period of intervention for phonological subskills between the experimental sub groups (extended and condition)?

2. Does applying computer-assisted instruction improve working memory skills of first grade students with LD;
   A) When compared to traditional instructional methods?
   B) When compared to the period of intervention on the size effect on phonological subskills between experimental sub groups (extended and condition)?

3. How do teachers value the using of computer-assisted instruction practices that differ from traditional instruction methods?

Mythology and design

A mixed-methods approach designed for this study, mixed methods that both quantitative and qualitative phases. A mixed methods approach offers explanations on how pupils and teachers who are participated in the study interact under certain conditions (Klassen & Lynch, 2007).

This quasi-experimental research design included a group of 60 first grade pupils who participated in a ten-week intervention, and included qualitative research made measures and data collection procedures, as well as data analysis procedures.

The intervention focus on the application of the "Five essentials phonological awareness skills" explained in chapter three. The data collection included the following:

1. Performance in phonological awareness was pretested to establish a pretest measure and post-tested to measure improvement in the phonological awareness performance at the end of the intervention. The researcher designed and prepared test based on the most expected tests, since the test asses the

benchmark (Fuchs), the test reviewed by a ten-speech language specialist and five special education specialists.

2. Performance in phonological awareness using the researcher-prepared daily checklist that administered at the end of each lesson while observing the participants to ensure equal participants of all students.
3. Working memory test, which based on Kiewit standardized test that is suitable for the Jordanian population (and similar to the Palestinian population).
4. A rapid naming speed (RAN) test applied, in the first of the intervention as pretest, to ensure pupils linguistic abilities to participate in the study.
5. A receptive–expressive Likert survey, completed by the teacher and speech specialist for each. The survey prepared by a five professional speech – language specialists and reviewed by another five from the same occupation. The survey applied once before the intervention to exclude those who suffer from severe language impairment.

Settings:

The study was conducted in two regular elementary schools in East Jerusalem:

The first school: The Al- Tour elementary boy's school located behind the Old City in Jerusalem. For this research, three first grade classes were chosen to participate, each class having ten students, between grades 7 - 9. The goal of this mainstream classroom is to implement special education based on international standards by the authority of the Israel education ministry. The services focus on the methodology of the intervention approach in aiming to provide support in literacy, mathematics and general skills so the pupils can return to regular classroom school.

The second school*;* Beit Hanina elementary girls school also located in East Jerusalem, and about five km. distant from the Old City of Jerusalem. In the school are three special education classroom that offer special education services for students whom diagnosed with LD according to the same educational policy that described.

For the aim of this research three first grade classes were chosen to participate in the research, each with ten students, aged between grades 7 - 9.

The usual procedures used for special education eligibility are the following stages:

1. Initial identification of learning difficulties and delay in literacy and basic learning skills in in the regular school with supervision of special education teacher or /and therapists team; and psychologists and school headmaster.
2. A discussion of the student's academic challenges based curriculum standards and requirements level with the presence of parents after they informed;
3. Individualized work with the student. Based on the results of this individualized intervention, if the student persists with his or her difficulties in the targeted academic areas, the special education team then proceeds to the next phase;
4. Officially informing the parents for initiating a full psycho-educational assessment, which includes psychological assessment and educational assessment.

   According to international intelligence test, such as normalized Arabic version of WISC-R for Arabic speaking students;
5. Decision on suitable educational frame for the student. The assessment team, mostly consisting of a school psychologist, meets with the placement team, which includes, in addition to the school psychologist, special education personnel, a school administrator representative, and a child guardian informed in the process. Finally;
6. The students were placed in a best match setting according to the special education service available.

Research population

The design of the research facilitated implementing the intervention in their classroom, hence this was considered a perfect condition to teach all the students in their real environment with their teacher.

Students:

Sixty first-grade children participated in the study, the students of the study who were learning in mainstream classrooms in two schools, which were established recently for LD students to reduce the gap between their abilities and their performance and to enable them to return to the regular classroom.

The 60 first-grader students identified with LD participate in their six classrooms with ten students for each classroom in the following order:

First school: Al Tour (boy's school)

a. Ten students have extended intervention for thirty computerized lessons delivered by teacher.
b. Ten students had reduced intervention for fifty computerized lessons delivered by teacher.
c. Ten students had special education curriculum of the school with intervention designated by the study (control group).

Second school: Beit Hanina (girl's school)

a. Ten students had extended intervention for thirty computerized lessons delivered by teacher.
b. Ten students had reduced intervention for fifty computerized lessons delivered by teacher.
c. Ten students had special education curriculum of the school with intervention designated by the study (control group).

All participating students were diagnosed with learning disabilities according to the regional psychological services within their educational record, and were all assessed by a school psychologist through a comprehensive psycho-educational assessment WISC-R IQ following assessment and placement phases described in the setting section (see table 3.1 for detailed IQ data).

The participants, both boys and girls from the two schools, were divided into three main groups:

A. Twenty students received extended intervention: 30 computerized lessons.

B. Twenty students received reduced intervention: 15 computerized lessons.

C. Twenty students received traditional lessons according to their special education curriculum inside the classroom.

	gender		place		type		
	1.00	2.00	1.00	2.00	1.00	2.00	3.00
Value Label	male	female	Beit Hanina	Al Tour	control group	Experimental (reduced intervention)	Experimental (extended intervention)
N	25	31	31	25	19	19	18

The students were from average socio-economic status families, and shared the same Arabic language dialects living in the same demographic area (Jerusalem).

Child participants were required to:

(1) Attend first grade with homogenous age;

(2) Have written parental permission to participate in the study;

(3) Have no sensory, neurological or severe emotional disturbances or behaviour disorders and with no physical abilities that required specialized equipment to achieve accurate testing.

Teachers:

Six special education certified teachers, who are the main teachers for the participating classrooms served as the two participant teachers in the study.

All teachers were females, with B.A. degrees in special education and held teaching certificates from Israeli based colleges with two-seven years of experience in this occupation. They expressed their willingness to fully cooperate and participate in the study. Teachers were provided with information about the study, including an initial description of the study, a consent form provided at an administrative meeting held by mainstreaming classroom director for Jerusalem area, employed six teachers, and six teaching assistants who agreed to participate through the Israeli education ministry.

A certified speech-language pathologist (SLP) also held an initial meeting with teachers and parents asking their permission for their child to participate in the study. At this meeting, parents had an opportunity to ask questions, and were encouraged to ask about the details of the research.

Instructional materials:

The main purpose of this thesis is to determine the efficacy of instructional computerized program inside the classroom in comparison with the conventional methods in teaching and enhancing phonological awareness skills for students with learning disabilities. For this purpose, a computerized program was built that relate to the efficacy of computer-assisted instruction and its effects on phonological awareness for both students with/without learning disabilities.

The computerized program was considered a fundamental theme in this study, along with access to phonological awareness metrics to determine the skills and then work on the preparation of training activities along with children with learning disabilities. The program consisted of thirty lessons, which included visual and auditory stimuli and reinforcement.

The program was presented to a group of specialists in psychology, mental health, special education, educational technology, and teachers in the learning disabilities program. Their notes were implemented and appropriate adjustments were taken into consideration.

Furthermore, the program was been applied to five students with learning disabilities from a sample of non-participant in order to determine the appropriateness of the program in terms of style and content. Moreover, it aimed to make sure there were no mistakes or obstacles during the application as well as ensure appropriate lessons in terms of time optimal for the lesson to suit the students.

Contents of the computer instructional program

The program consists of 30 educational lessons, designed using PowerPoint computer software; each lessons has 15 exercises, each focusing on one word task with specific settings according to the lesson targeted phonological skill. Thus, the number of slides reached 450 slides, designed for training of multiple phonological awareness skills on its wide content, which designed in chronological order according described below. The order of the lessons was based on the phonological awareness continuum, from the larger sounds of language to the smallest considering the three cognitive skills; recognizing, deletion, adding, replacing skills as it described before in the phonological development section. As describes above the program was designed to facilitate the essential skills of phonological awareness, from the basics to advanced levels through multiple cognitive activities, with chronological order.

Table1 : computrized program sessions sequence

No.	Section	targeted skill
	Auditory discrimination	
1	Auditory discrimination	Recognizing different environmental voices
2	Auditory discrimination	Recognizing real words from non-words which similar in articulation
	Word awareness	
3	Word awareness	Recognizing the number of words inside the sentences
	Rhyming	
4	rhyming	Recognizing rhyming words
5	rhyming	Comparing between two rhyming words
6	rhyming	Ordered rhyming words in context
	Syllable awareness	
7	onset	Isolating onset
8	rime	Isolating rime
9	Onsets and rime	Segmenting's two syllable words
10	Onsets and rime	Segmenting's three syllable words
11	Syllable	Recognizing words start with same Onsets and rime

12	Syllable	Recognizing words start with same Onsets and rime
13	Syllable	Blending two syllable to form words
14	Syllable	Blending three syllable to form words
15	Syllable	Deletion onset
16	Syllable	Deletion rime
17	Syllable	Add onset to words and form new words
18	Syllable	replacement onsets and form new words
	Phonemic awareness	
19	Phonemic awareness	segmenting the first phoneme
20	Phonemic awareness	Produce words start with same phoneme
21	Phonemic awareness	segmenting the last phoneme
22	Phonemic awareness	Produce words ends with same phoneme
23	Phonemic awareness	Segmenting one syllable words to its phoneme
24	Phonemic awareness	Segmenting's two syllable words to its phoneme
25	Phonemic awareness	Blending phoneme in order to from one syllable words
26	Phonemic awareness	Blending phoneme in order to from two syllable words
27	Phonemic awareness	Deletion the first phoneme.
28	Phonemic awareness	Deletion the last phoneme.
29	Phonemic awareness	Phoneme Substitution first phoneme in order to form new real words
30	Phonemic awareness	Phoneme Substitution last phoneme in order to form new real words

Procedures

Initial Observations and Pre-test

Prior to conducting the study both schools six classes were observed by the researcher for one week without any treatment, in matter to screen classes core curriculum in language and pre-reading classes activities, and teachers knowledge about phonological awareness area. In the next week, all participated teachers asked to join one-week intensive course that last for ten hours designed to explore to the teachers the rationale of the designed procedure of research implementation.

The course included the following procedures;

A); literature background of the phonological awareness and its relation to reading and writing success and its typical development;

B) Research design and period;

C) The pretest-posttest component and regulations of assessment;

D) The potential benefit of computer assisted instruction of developing phonological awareness and working memory;

E) Explore the computerized program, its component, and teaching strategies and techniques, such as modelling, expanding and rephrasing. How to respond to correct and incorrect responses, and role-play activities.

After the intensive course, all students of both schools were pretested with a research made measurement of phonological awareness. The test has been developed and administered as it mention in the previous chapter to meet the research goals and students age.

The reasons for design and choose a research made measurement because there not exist a standardized phonological awareness test for Palestinian students that meet their linguistic, cultural.

The pre-test assessed for all students who participated in either condition at the beginning of the study. At the end of intervention, three-week later, both experimental groups received Post-test that conducted after on month of the intervention ends, this delay planned for measuring phonological skill maintenance.

Instructional Procedures for the CAI

Extended condition; the study for the Extended Condition, which was conducted over a ten-week period, included a full implementation of the CAI activities that each student received the following intervention:

The intervention consisted of; A) pre-test 45 minute; (B) two sessions about auditory discrimination ;(C) one session for word alliteration; D) three session about rhyme skill ; (E) twelve sessions about syllabus awareness; and (F) eleven sessions about phoneme awareness. Finally 45-minute posttest. Two groups selecting as extended condition from the two participated schools, one group designed for boys and the others for the girls.

Reduced Condition; A comparison condition (referred to as 'Reduced Condition') was used compare the effectiveness of CAI to traditional methods. The students of the Reduced Condition received the same phonological activities that given for the

Extended Condition at all weeks. The Reduced Condition received a shortened implementation of the CAI activities, in weeks one through five only. In weeks six-ten, the teacher in the Reduced Condition taught the same activities that were used during the period for the Extended Condition using printed traditional teaching methods, which were the practices they typically employed. (Conversations with the teachers and prior observations indicated that the traditional teaching methods included non-strategic, direct instruction and drilling of basic skills. Procedures for documenting the tradition practices used in the Reduced Condition are described in the Data Analysis section).

The study for the reduced Condition, which was conducted over a ten-week period, included a half implementation of the CAI activities, and the other half were traditional, each student received the following intervention:

The intervention consisted of; A) pre-test 45 minute; (B) two CIA sessions about auditory discrimination ;(C) one CIA session for word alliteration; D) three CIA session about rhyme skill ; (E) twelve CIA sessions about syllabus awareness; and (F) eleven traditional sessions about phoneme awareness. Finally 45-minute post-test.

Two groups selecting as extended condition from the two participated schools, one group designed for boys and the others for the girls.

No treatment condition (control group); A comparison condition was used compare the effectiveness of CAI to traditional methods. The students of the control group did not received any CAI activities that given for the Extended Condition and reduced groups. Yet the teachers informed of the control group informed to implement the school curriculum in pre-reading session focus on phonological awareness activities. Furthermore, they joined part of the intensive course that held to the teachers and acknowledged about the importance of phonological awareness and its relation to later reading success, and they informed about the results of their students pre-tests results of phonological awareness and working memory that considered low and need improvement. Two groups selecting as control group from the two participated schools, one group designed for boys and the others for the girls.

The control group taught on session a day using school core curriculum, for the ten weeks with printed traditional activities that used during the intervention period without any treatment or intervention from the researchers.

Teacher's Training for using CAI in PA intervention

After the intensive fifty hours course that delivered for the four participated teacher of both condition (reduced and extended) the researchers participated in the first session for each group to give the exact model to the teacher that participating session as a "co-teacher" according to Friend and Bursuck's (2006) "one lead, one assist" model of co-teaching. After that, the teachers take the lead and start the intervention with the students. In the first two week, the research observed part of the session to ensure correct and suitable implementation of the computerized program, through observations several discussions held with the teachers about difficulties or notes they noticed through session inside the classroom. Daily discussion held with the teachers through smartphone app (what's up) chat forum, the matter of this group were to receive and give daily feedback on the progress of CAI and guidance on how to follow up with students.

Researcher made measure

The primary purpose for the assessment of phonological awareness was to identify children who may require extra instructional help (Torgeson, 2004).

For the lack of standardized test for phonological awareness for Arab population in general, and the Palestinian population in particular, the researcher made an assessment test based on the evidence of research and practice in this area. The test adopted the wide definition of the phonological awareness that designed to test phonological awareness in its hierarchy ordered. Researchers have used a wide variety of tasks to measure PA ability in children of different ages (Catts et al., 1997). PA measured at the syllable, rhyme and phoneme levels. However, performance at the phoneme level considered the strongest indicator of later literacy ability (Gillon, 2004). Therefore, screening and monitoring children's ability at this level is an important practice for special education teachers. The tests contain tasks which vary in the complexity of the cognitive operations being performed (e.g., identifying,

blending, segmenting and deleting), which demands on working memory (e.g., holding one operation in memory while performing another) (Yopp, 1988).

Non-word retention test

The non-word retention test designed to evaluates phonological WM (Gathercole, 1999) that observes, "Early sensitivity to phonology and their resulting phonological representations memory Chiat (2006:p553). The research made measures included a section to assess the participant's (WM) ability to remember the correct order of non-real words, which consist a number of different sounds in its structure in the correct order. The researcher made measure consist of eighteen different non-real words that differ in its length and phoneme order sequences inside the selected non- words.

The students asked to repeat the heard word immediately without errors within three seconds in the same phoneme order as he\she heard from the researcher.

If the students repeat the word in correct order he\ she achieve on point , if spell it in wrong order he\she achieve zero point , moreover if he\she spell it in wrong order then correct it with 3 seconds he\she achieve half point.

FINDINGS

In this chapter, the major findings for the following three research questions are

4.1: Analysis of the first research question

1. Does applying computer-assisted instruction have a significant difference in improving phonological awareness skills of Palestinian Arab first grade students with LD,A) When comparing to traditional instructional methods; B) When comparing size effect between experimental sub groups (extended and condition)

ANOVA was used to answer the first research question for gaining a wider perspective about the results obtained from both the instructional method and computer-assisted instruction. The data was analysed and compared with the following two major categories: the type of intervention (traditional instruction and

computerized instruction) and the condition (between extended intervention and reduced intervention).

Analysis by type of intervention

For the first part of the question (Does applying computer-assisted instruction have a significant difference in improving phonological awareness skills of Palestinian Arab first grade students with LD when compared with traditional instructional methods. This part of the question served as the independent variable, and the difference in the number of points earned between the pertest and the post-test (gain score) served as the dependent variable. Separate tests (pre-post) were given for phonological awareness subskills. A repeated-measure ANOVA test was used to measure the differences between the pre and post-test for all participants. The results obtained for phonological awareness tests using the research suggest that two experimental groups conditions (extended and reduced) taught through computerized lessons have shown progress in both measured areas from pre to post testing more than control group.

The results indicate a greater gain for the extended condition with (M= 119, SD =11.14) with the reduced condition (M= 84.42, SD= 19.35), whereas, the control group achieved a lower score (M= 52.84 ,SD= 18.78) This shows a considerable gain effect of the computer-assisted instruction over the traditional instructional methods.

Analysis by condition (extended and reduced)

For the second part of the first question, does applying computer-assisted instruction improve phonological awareness skills of first grade students with LD when comparing period of intervention on phonological subskills size effects between experimental subs groups (extended and condition).

ANOVA was used to calculate the mean size effect between the phonological sub skills between the two-intervention group (extended and reduced). Through comparison between the different phonological skills that targeted in pretest-posttest researcher made test, the skills ordered by recognizing number of words inside the sentences), by rhyme, by non-real tasks which examine the pupils' ability to recognize different sounds in the first and last words among number of words, by syllable awareness and by phoneme awareness.

A paired-sample T-test indicated significant difference between pretest and posttest scores that were significantly higher for extended intervention than reduced intervention, Syllable section (M=60.8, SD=.0) for the extended condition over reduced condition (M= 39.7, SD= 7.95). Also Phoneme section (M=25.5, SD=8.9) for extended intervention over reduced intervention (M= 13.68, SD=6.51).

While there is small gained score in the No. words section (M= 8.66, SD= 2.56) for the extended intervention over the reduced (M= 8.37, SD= 2.51). Moreover, Rhyme section (M=8.7, SD= 1.95) for extended condition over the reduced condition (M= 8.47, SD= 1.8).and Non-real tasks (M= 16, SD= 4.54) for the extended condition over reduced condition (M= 14.1, SD= 5.37).

Analysis of the second research question

Does applying computer-assisted instruction have a significant difference in improving working memory skills of Palestinian Arab first grade students with LD

a) When compared to traditional instructional methods; b) When compared to the period of intervention on the size effect of phonological sub skills between the experimental sub-groups (extended and condition).

For the first part of the question, does applying computer-assisted instruction have a significant difference in improving working memory skills of Palestinian Arab first grade students with LD when compared to traditional instructional method.

The independent variable, and the difference in the number of points earned between pre-test and post-test (gain score) served as the dependent variable. Separate tests

(pre-post) test were delivered for working memory; the test has 14 tasks and two points scored each task.

A repeated-measure ANOVA test was used to measure the differences between the pre-post-test for the three groups, both in the second experimental group (extended and reduced) which is considered as one group in comparison with the control group. The following table showed a significant change for all the groups who received phonological awareness intervention at pre-post-test by condition.

The results obtained for phonological awareness tests using the research made measures which suggest that experimental groups in both conditions (extended and reduced), instructed by computerized lessons, have shown progress in both measured areas from pre to post testing in comparisons to the control group. The results indicate a greater gain in phonological awareness skills with (M= 97.3, SD= 27.7) for the extended condition over the reduced condition which achieved (M= 96.6, SD= 25.6). The control group achieved a lower gain score (M= 60.1, SD= 24.3) this shows a high gain effect for the instructional method with computer assisted intervention.

Analysis the third question of the research

A thematic analysis performed to answer the fourth research question:

3. How do teachers value using computer-assisted instruction practices toward phonological awareness that differ from traditional instruction methods?

The four teachers were individually interviewed, and their in-depth opinions on the application of the computerized program on the phonological awareness skills and its effect on student's skills were recorded.

The interviews were constructed as semi-structured interviews, in which each interview included five key questions with follow up sub-questions as needed throughout the interviews. All interviews were conducted in Arabic, which is the first language of both the teachers and the researcher.

Data stemming from the interviews was thematically analysed following procedures used by Braun and Clarke (2006). Major ideas that emerged from the data were categorized into the following three themes:

a. Computerized phonological awareness structure;

b. Academic skills;

c. Pedagogical shift.

All emerging themes related to the questions presented at the interview. Key points that are described in the following section supported each of these major themes.

The themes indicate that the teachers considered the intervention successful, highlighting the importance of

a. Providing an explicit structure that organized the students' and teachers' working environment within the CAI
b. Differentiating instructions that strengthen students' academic skills, including engagement, motivation, study skills,
c. Providing explicit feedback track for students' progress,
d. Strengthening students' achievements
e. The teachers felt that the CAI changed the way they perceived phonological awareness instruction. The CAI, as evidenced by the themes, reflected a change from the previously applied instructional approaches and provided valuable resources and tools for students and teachers to use.

DISCUSSION

The first research question investigated the effect of the CAI intervention on students' performance on phonological awareness using researcher-prepared phonological awareness measures in comparison to the control group who received the traditional curriculum method.

There were no significant differences between treatment and control groups on pretest research-made measures of phonological skills and working memory. However, the results of posttest scores indicate significantly greater gains for the treatment group for both conditions (extended and reduced) than the control group.

The results of the study indicate that both conditions that received CAI intervention improved their phonological skill performance, from pre to post in comparison to the control group. Statistically significant growth from pre- to post-testing was found for the experimental group above the control group. F (1, 50) = 103, p = .000, np^2 .675

effect size (ES) at post-test which is considered a large effect size according to Cohen's [1988] criteria which considered a big difference.

These positive results, for both conditions, resonate in the literature review which was conducted in the past two to three decades on the effects of computer assisted instruction on phonological awareness for LD students (Cullen, Keesey, Alber-Morgan, & Wheaton, 2013; Fuchs & Fuchs, 2006; Macaruso & Rodman, 2011; Macaruso & Walker, 2008; Mioduser, Tur-Kaspa, & Leitner, 2000; Torgesen, Wagner, Rashotte, Herron, & Lindamood, 2010). Furthermore, findings show pre-schoolers, first grade students and low-performing kindergartners can benefit from intensive, systematic practice provided by CAI programs, and this resonates with studies by (Fuchs & Fuchs, 2006; Macaruso & Rodman, 2011; Torgesen, 2010; Wood, Mustian, & Lo, 2013). Both treatment and control groups made large gains over the intervention period, with significantly greater gains found in the treatment group, particularly in the area of syllabus skill.

Dynarski et al., (2007) notes that many studies on CAI conducted outside the classroom, without clear structure for instructional and pedagogical consideration. Students who practice CAI intervention depend on the teacher's role inside the classroom and have been validated as beneficial for students with LD at the primary first grades (Hall, Hughes, & Filbert, 2000; Macaruso & Rodman, 2011; Torgesen et al., 2010).

However, this study was the first. At least based on existing international recorded databases, to investigate the effects of computer-assisted instruction on phonological awareness and working memory in first grade students with LD at the Palestinian regional level, it adds a valuable source for future researchers in the field of education and for researchers at the Arab states level.

The effect of computer assisted instruction on students' phonological awareness

Students of the two conditions (extended and reduced) significantly improved the phonological awareness from pre to post-test in comparison to the control group. However, the results indicated that there was significant growth from pre- to post

testing. F (1, 35) = 168, p = .000, np^2 .828 effect size (ES) at post-test for extended intervention in comparison to reduced intervention. Particularly in the syllabus with significant growth registered from pre- to post testing. F (1, 35) = 168, p = .000, np^2 .828 effect size (ES) at post-test for extended intervention in comparison to reduced intervention, and phonemic skills with significant growth registered from pre- to post testing. (F (1, 35) = 38, p < .000, np^2 .519 effect size (ES) at post-test for extended intervention. These results emphasis the effective role of CAI on accelerated PA skills, its resonate with (Macaruso & Rodman, 2011,Torgesen et al., 2010,Gale, 2006, Mioduser et al., 2000).

The results indicate that a short-duration, high-intensity computer assisted PA instruction improved phonological skills immediately in the end of the intervention that lasts for eight weeks. A reduction in the percentage of children experiencing PA difficulties was similar to that reported by Shapiro and Solity (2008) and was achieved in a shorter period (e.g., 10 weeks compared to 2 years) cited from(Carson et al., 2013).

This result encourages such instructional implications for emergent students with LD students. Short CAI intensive intervention may be a promising supplementary tool for teachers to integrate into existing curriculums. Time-efficient periods of PA instruction prevent the Mathew effect, and ensure that all students acquire the necessary phonological skills of the beginning of reading instruction. In addition, these results demonstrate the efficacy of a maintained and modified CAI program implemented by teachers in a large group of children with differing skill levels.

The effect of computer assisted instruction on students working memory

The results of the present study indicate slight significant improvement of working memory from pre- to post-testing F (1, 50) = 4, p = .000, np^2 .115 effect size (ES) in favor of the experimental group at the end of the intervention as shown by the posttest research-made measurement in comparison to the control group.

The results considered logical because the strong relationship between phonological awareness improvement and working memory is considered vital and essential to storing and processing auditory representation information in working memory. This relationship represents the ability to convert and encrypt spoken sounds into written language, thus it plays a key role in the spelling and reading process. The findings amongst Arabic-speaking children are consistent with those in English-speaking studies (Oakhill & Kyle, 2000; Betourne & Sandy, 2003; Gorman, 2012; So & Siegel, 1997; Wagner & Torgesen, 1987; Baddeley, 2003; McGettigan et al., 2011).

Findings suggest that when targeting and accelerating PA tasks, the WM's central executive may be involved in encoding and storing syllabi and phonemes (Hecht, Burgess, Torgesen, Wagner, & Rashotte, 2001).

Teacher's values of computer assisted instruction

The overall position of the teachers on the CAI intervention was positive and supportive of continuation with the model. However, the teachers highlighted a number of key points that they perceived as important components in the CAI intervention. Among them, the teachers emphasized the role of structure, which included the organization, and order of activities, the meaning multisensory aspects of applying different instruction to match all students' abilities that positively affects student's engagements inside the classroom.

The continuous program feedback helped the students' self-modification and guided the teachers to track their students' progress. Both teachers pointed out that most students' study skills including engagement, social skills, and academic skills during the intervention witnessed improvement and enabled them to gain better skills in the CAI.

Both teachers have a pedagogic shift in their opinions and belief about the efficacy of CAI implementation inside the classroom. They make declarations about the positive efficacy of implementation of computerized activities that designed and guided by the teacher as a supplemental tool.

This positive effect is for both teachers who use the computerized activities as a guided medium that helps them to bring better learning sequences that lead their pedagogical practices, especially their knowledge about phonological awareness and its important, and for the students whom show an improvement in their PA skills

Conclusion

The results of the current study indicate that Palestinian-Arab first grade students with LD benefit from computer assisted instruction on improvement in phonological awareness and working memory. As evidence, their phonological awareness and working memory performance improved according to pre-post-test using a research made measure.

Using computer-assisted instruction CAI appeared to have positively influenced students' phonological skills in the intervention in both conditions (extended and reduced) instructed by CAI. On the other hand, working memory positively influenced just the extended group with no significant difference between reduced condition and the control group.

The teachers of both conditions (extended and reduced) validated the importance of the CAI for the students. They emphasized the importance of the pedagogical design of the program that emphasizes the role of explicit and organized structure of the computerized program, facilitating academic skills, and encouraging students for engagement and self-pacing through differentiated instructional strategy that is implemented in the program. The results from implementation of the CAI influence on students' performance and attendance include an apparent impact on teachers' pedagogical practice and beliefs concerning the positive potential of applying CAI combined with different multisensory strategies, study skills and modality learning that targeted the cognitive process theory that fit students' needs.

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