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FACULTY OF Education

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**The Impact of a Computer- Based Program in EFL on
Hearing- Impaired Pupils' Writing and Reading Skills
and their Motivation towards Learning
English as a Foreign Language**

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The Impact of a Computer- Based Program in EFL on Hearing- Impaired Pupils' Writing and Reading Skills and their Motivation towards Learning English as a Foreign Language

Abstract

This study aimed at investigating the impact of an EFL computer- based program on hearing- impaired pupils' reading and writing skills and their motivation towards learning English as a foreign language. The present study adopted the quasi - experimental design using a control group and an experimental group. The participants of the study were twenty pupils at first year prep stage at "Al Amal" governmental school for hearing impaired pupils in Mansoura. The researcher used a pre post reading test and a pre post writing test to determine the extent to which EFL hearing impaired prep pupils master the specified reading and writing sub-skills. The researcher used a motivation checklist to identify the level of motivation of EFL hearing impaired pupils towards learning English as a foreign language. Results indicate that the suggested computer-based program is effective in developing only some specific reading and writing skills. However, not all the specified reading and writing skills were developed. In addition, the suggested program is not effective in developing hearing impaired pupils' motivation towards learning English as a foreign language.

Key terms: Hearing impairment, motivation, computer-based program, reading, writing.

المستخلص

تهدف الدراسة الحالية إلى التعرف على تأثير برنامج قائم على الكمبيوتر على مهارات القراءة والكتابة في اللغة الإنجليزية كلغة أجنبية لدى الطلاب ضعاف السمع وكذلك دوافعهم نحو تعلم اللغة الإنجليزية. اعتمدت الدراسة على تصميم شبه تجريبي باستخدام مجموعة ضابطة ومجموعة تجريبية. تمثلت عينة هذه الدراسة في عشرين (٢٠) طالباً من طلاب الصف الأول من المرحلة الإعدادية في مدرسة "الأمل" لضعاف السمع في المنصورة. استخدم الباحث اختباراً للقراءة وآخر للكتابة لاستخدامهما كاختبار قبلي وبعدي من أجل تحديد مدى إتقان التلاميذ ضعاف السمع للمهارات الفرعية للقراءة والكتابة في اللغة الإنجليزية كلغة أجنبية. واستخدم الباحث أيضاً مقياساً للدافعية لتحديد مدى إهتمام الطلاب ضعاف السمع بتعلم اللغة الإنجليزية كلغة أجنبية. تشير نتائج الدراسة إلى أن البرنامج المقترح والقائم على الكمبيوتر فعال في تنمية بعض المهارات الفرعية للقراءة والكتابة لدى الطلاب ضعاف السمع. لم تتم تنمية كافة المهارات التي تم تحديدها. وبالإضافة إلى ذلك، لم يكن البرنامج المقترح القائم على الكمبيوتر فعالاً في تطوير كافة أبعاد الدافعية لدى الطلاب ضعاف السمع تجاه تعلم اللغة الإنجليزية كلغة أجنبية.

الكلمات المفتاحية: ضعف السمع، الدافعية، برنامج قائم على الحاسوب، القراءة، الكتابة.

Introduction:

Hisyamuddin Hashim (2013) noted that there are a lot of hearing impaired pupils who have the right to be educated. Such pupils usually possess the same level of the mental capability as the normal hearing pupils in the terms of studying. They study the same courses as those for the normal hearing pupils of the same age but they may encounter a problem if the teachers use the same techniques that are used for the normal hearing pupils.

Shaista Majid (2011) revealed that there are common characteristics among the hearing impaired pupils. These characteristics include the use of gestures to communicate and trying to imitate other people. The academic problems related to these characteristics include poor academic performance and they encounter interpersonal difficulties.

Juniper Russo (2013) added that without a prompt and an effective treatment, hearing impairment can lead a student to suffer from significant speech delays, social problems and educational challenges. They may encounter some problems concerning reading and writing. Pupils who are deaf and hard of hearing encounter significant difficulty developing literacy skills during elementary grades.

Hannah M. Dostal (2014) stated that one of the challenges that face the hard of hearing pupils is that they often learn to read in English while developing their mother tongue for communication. Many deaf and hard of hearing pupils are language deprived because of inaccessible or impoverished language environments. Without drawing on their prior experiences, and engaging them in critical thinking and reasoning, learning will be remarkably affected.

As for writing, Pelin Karasu (2017) stated that hearing-impaired pupils were found to be poor writers. This may be due that hearing-impairment does not allow them to acquire language experiences as their normal hearing peers. Furthermore, teaching practices for writing are insufficient. Such pupils may encounter difficulty in acquiring skills because of the classrooms that are overcrowded, the physical conditions that are inadequate, or being unable to use hearing aids effectively.

Everline Nyokabi Maina et al. (2014) stated that for the past three decades, motivation has been a central area for empirical research and theoretical work within the context of learning a language other than one's mother tongue. Motivation represents one the most complex variables used to explain individual differences in language learning. Pupils who are hearing impaired must generally rely on additional support to learn systems

for communication development. Without prompt and effective treatments, hearing loss can cause a child to suffer from significant speech delays, social problems and educational challenges. To ensure that the pupils who are hearing impaired receive the quality education they deserve, educators must understand the learning needs of these pupils and their characteristics and prepare instructional programs that meet these needs and cope with these characteristics.

Sugeng Susilo Adi et al. (2017) stated that hearing impaired pupils tend to be visual learners. This is difficult in an environment where much essential information is delivered exclusively. Moreover, Basak Baglama (2018) noted that computers are used with the aim of improving the academic skills of the hearing impaired pupils in special education settings. Many studies concluded that computer training programs positively affect the academic skills, language, mathematics, literacy, and competence of the pupils with disabilities by improving their attention span and learning performance.

Previous studies

Previous studies on hearing impairment:

Sharon J. Becker (2017) conducted a case study of eight pupils. The English language learning of four pupils who were hard of hearing and four pupils who were normal hearing English learners was explored through a multiple-case study using cross-case analysis. Results revealed implications in the areas of practice, teacher preparation, and identification of pupils.

Sugeng Susilo Adi et al. (2017) outlined teachers' challenges to teach English for hearing impaired pupils and described the strategies to cope with those challenges. The sample consisted of an English teacher and eight tenth grade hearing impaired pupils who are taught by the teacher. Results revealed several challenges such as getting pupils' attention, understanding words from pupils' lip movements, giving definitions and examples, differentiating similar words in different contexts and delivering materials related to pupils' prior knowledge. This study suggested the use of computer dictionary software, which can show pictures of words.

Ragia Hamdy Hassan (2019) studied the impact of using enriched subtitling on the acquisition of vocabulary by hard of hearing pupils. The performance of the pupils in an experimental class, using an enriched subtitling -based lesson, was compared to two classes using traditional educational methods, focusing on text reading and sign language. Results showed that the experimental class achieved the best results, supporting the research hypothesis that, when integrated in carefully planned lessons,

enriched subtitling can be a valuable tool to enhance vocabulary acquisition by deaf pupils.

Akbota Sultanbekova (2019) analyzed the practices of EFL teachers of hearing impaired learners in the context of Kazakhstan. Two teachers participated in the study. One of the participants worked with primary school pupils (Grades zero to three), the other one with secondary school pupils (Grades five to ten). Results revealed the challenges emerged in EFL teachers' practices; these were related to professional development, English curriculum development, teaching techniques, classroom arrangement, and technical equipment. There were also positive aspects of English as a foreign language teachers' responses. These aspects include vitality and the motivation of hearing impaired pupils towards English learning and towards their colleagues.

Edit H. Kontra and Kata Csizér (2020) investigated deaf and severely hard-of-hearing pupils' foreign language learning characteristics. Semi structured interviews were conducted with thirty one hearing impaired pupils aged between 14 and 19. Results indicated that deaf and severely hard-of-hearing pupils' foreign language learning experiences are fraught with challenges. Motivating and effective learning environments have to be created where the use of the national sign language contributes to the efficiency of teaching. Furthermore, teaching should include presenting effective learning strategies as well as introducing autonomous ways of learning.

Previous studies on reading

Ye Wang and Peter V. Paul (2011) appraised the effectiveness of the Cornerstones approach which is a technology-infused literacy project. Participants included five teachers with 22 pupils from New England in a diversity of program types, which included one oral, two simultaneous speaking and signing (i.e., Total Communication), and two American Sign Language–English bilingual/bicultural classrooms. Results revealed that deaf and hard of hearing pupils demonstrated differences in beginning reading skills as measured by Word Identification. No differences were found for Word Knowledge, and mixed results were found for Story Comprehension. There were some effects from the Cornerstones approach to the use of the Typical approach in subsequent experiments, which might have affected the results. The carryover effects also supported the feasibility of using the Cornerstones approach for beginning literacy instruction.

Kanyanat Plaewfueang and Surachai Suksakulchai (2012) devised an applicable framework to HI-pupils learning to read more naturally and to

determine how the content of these guidelines could be accurately extrapolated to the situation in which hearing-impaired pupils are being taught how to read. Results revealed that hearing impaired pupils pay attention while reading and they can practice using sign language themselves. This framework can be used in motivating hearing impaired pupils to be more interested in learning to read.

Kanyanat Plaewfueang, Michael Pullis and Surachai Suksakulchai (2013) conducted a study to incorporate first sign language and second spoken language skills in bilingual programs adapted from hearing impaired pupils. Results revealed that hearing impaired pupils can learn Thai written language and Thai sign language at the same time. They can learn to read using the sign language and picture story technique. The context of the story can be perceived through the text meaning and help pupils learn another language through picture and sign language. These results confirm the expectation that hearing impaired pupils can learn Thai-written language and Thai sign language at the same time.

Everline Nyokabi Maina et al. (2014) analyzed the learning strategies used by hearing impaired pupils in English reading comprehension and the implications on academic achievement. Saturated sampling technique was used to select 79 pupils and 11 teachers of English. Results revealed that the learning strategies used by hearing impaired pupils in reading comprehension included re-reading, reading slowly and carefully, signing while reading, finger spelling, looking at pictures and titles, pointing at words with fingers, determining main idea, memorization, using prior knowledge and using the dictionary.

Kendra M. Benedict, Maria C. Rivera, and Shirin D. Antia (2015) examined the use of a metacognitive strategy on the strategic reading behavior, the nonstrategic reading behavior, and the reading comprehension of hearing impaired pupils. Results showed an increase in the strategic reading behavior of hearing impaired pupils.

Previous studies on writing:

Hannah M. Dostal and Kimberly A. Wolbers (2014) appraised the impact of strategic and interactive writing instruction on developing the signed expressive language and the written English. The sample consisted of a fourth grade classroom, two fifth grade classrooms, and two sixth grade classrooms. These classes include the entire middle grades (grades 4–6) population of a southeastern residential school for the hearing impaired at the state of San Francisco. Results indicated a focus on building the signed expressive language and the written English proficiency at the same. There

were significant gains by the hearing impaired pupils in writing. On the other hand, a focus on the signed expressive language did not detract from pupils' writing growth in English.

Ghulam Haider (2016) examined the writing processes of pupils with hearing impairment. The sample consisted of twenty seven pupils at the Training College for Teachers of the Deaf. Results revealed that pupils improved the organization and the content of their texts although their texts had very clear errors of language and vocabulary.

Chabari Patrick (2017) studied the strategies used in teaching written English language to learners with hearing impairment in Meru County, Kenya. A sample of five English language teachers, eight hearing impaired learners and one head teacher were involved in this study. The study recommends that teachers of hearing impairment pupils should be frequently inducted on strategies for teaching writing. They should be fully exposed to ways of identifying learners with writing difficulties. The school administration should ensure that hearing impairment pupils are given adequate writing practices. Pupils should be exposed to Kenyan Sign Language structures early enough. English language teachers should constantly evaluate the effectiveness of their remedial programs.

Pelin Karasu (2017) explored the writing skills of hearing-impaired pupils who benefit from the supporting services at the public schools in Turkey. Seventeen pupils, who were enrolled in the primary and middle school classes of public schools and benefited from the supporting services, participated in this study. Results revealed that the mean writing score of the pupils was 68.35 out of 100. Hearing-impaired pupils enrolled in public schools benefit from the supporting services designed according to their individual needs.

Previous studies on technology:

Joanna E. Cannon, et al. (2011) examined whether using a computer software grammar instruction program frequently would influence comprehension of grammar by hearing impaired pupils who use American sign language. There were 98 participants (49 deaf or hard of hearing and 49 hearing) in Grades 2–6. Results revealed that the pupils' grammar (syntax) improved and pupils' understanding of meanings (semantics) remained the same.

Kenneth L. Moore (2012) conducted a study in order to determine if the use of the reading component of Ticket to Read, which is a computer-based educational program that is developed to improve hearing pupils' fluency, could improve deaf pupils' fluency. The sample consisted of

twenty seven pupils from an urban school for the deaf. Results have implications in the field of deaf education and are congruent with the findings of similar studies involving Repeated Readings program and its influence on comprehension.

Patience Dadzie-Bonney and Samuel K. Hayford (2017) investigated pupils' informational technology knowledge, skills, and utilization at Oguua School for the Deaf in the Central Region of Ghana. A randomly selected sample of forty pupils completed the researcher-developed questionnaire. Results revealed that the pupils could not confidently and creatively use information technology for learning.

Shwan Hadi and Oğuzhan Özdemir (2017) conducted a study to develop a learning software for the deaf. According to a survey three pupils out of one thousand are born deaf but are generally diagnosed within 2-5 years. Results revealed that the proposed e-Learning mechanism is a good proof of the concept using e-Learning mechanism for the deaf.

Obondo Gaudence, Nabwire Violet Kafwa and Too Jackson Kiprop (2018) investigated the attitudes towards use of hypermedia based content on the constructivist learning context. Seventy nine pupils and ten teachers participated in the study. Results indicate that hypermedia affected the constructivist learning context positively. Pupils were positive and satisfied with hypermedia because it was found to be interactive, motivating, enjoyable, promotes understanding, encourages autonomy and fosters learning than traditional learning.

Previous studies on motivation:

Veronika Morávková (2011) examined whether hearing impaired pupils think that learning English as a foreign language is essential and if they are interested in learning foreign language, especially English. Participants were nineteen secondary school pupils, five pupils were the first grade pupils, seven were the second grade pupils and seven were the third grade pupils. Results revealed that hearing impaired pupils at secondary school are aware of the importance of the foreign language, namely English.

Ann Mette Rekkedal (2012) identified the factors pertaining to pupils' use of hearing technologies and their attitudes towards such technologies. The sample consisted of 153 hearing impaired pupils. Results revealed that males view hearing technology more positively than do females. Having severe hearing loss also promoted positive attitudes towards hearing aids and cochlear implants, but not towards microphones. Pupils with positive self-descriptions tended to be more satisfied with hearing aids or cochlear implants than pupils with negative self-descriptions.

Edit H. Kontra, Kata Csizér and Katalin Piniel (2014) explored how pupils in eight specialized institutions across Hungary perceive the challenge of learning a foreign language. The sample consisted of thirty one hearing impaired learners aged between 14 and 19. Results revealed that in spite of low levels of initial motivation, many of the interviewed hearing impaired learners aspire to work abroad, where they hope to use the foreign language learnt.

Kata Csizér, Edit H. Kontra and Katalin Piniel (2015) investigated self-related concepts of hearing impaired pupils at eight different sign language schools. Results revealed that hearing impaired learners lack pronounced, well-developed second language to guide their learning. Furthermore, pupils' language learning experiences are greatly affected by the choice of the language used as the medium of education, the intensity and the content of the English classes as well as how far the pupils internalize extrinsic motives.

Gnonlonfoun Jean-Mark (2017) described the hearing-impaired Beninese post-beginners' English learning motivation questionnaire. Data was collected using an adapted version of the Language Learning Motivation Questionnaire. Results show that the attitude towards English language is generally positive, but the pupils' experience, competence and ability are quite low. Females' self-esteem is lower than that of males, but females have a greater desire to succeed in English. Integrative orientation seems to become such a major motivational force. Learners need to be guided towards networking, making contacts, and internalizing the integrative orientation early. Diversifying teaching methods reduce the boredom effect of motivation.

Definition of terms:

Hearing impairment:

Shaista Majid (2011) defines hearing impairment as the loss of hearing in one or both ears that results in hearing loss at different degrees like; mild, moderate, severe and profound deafness.

Kenneth Moore (2012) defines hearing impairment as lacking the ability to process linguistic information through hearing, with or without amplification.

For the purpose of the study, hearing impairment is defined operationally as a permanent unaided hearing threshold level (average for frequencies 0.5, 1, 2, 4 kHz) of 31 dB or greater.

The Ministry of Education administers a test to identify if the pupil is a hearing impaired or a normal a normal hearing pupil. The researcher adopted the classification by the Ministry of Education.

Reading:

Mayer (2003) defines reading as the techniques for improving pupils' success in extracting useful knowledge from text.

Islam (2007) defines reading as a process in which the reader construct meaning while, or after, interacting with text through the combination of prior knowledge and previous experience, information in text and immediate, remembered or anticipated social interactions and communication.

For the purpose of the study, reading is defined operationally as the ability of the learner to decode the printed material and give it meaning.

Writing:

Lauren Perry (2001) defines writing as a cognitive process that involves comprehension of ideas, expressive language, and mechanical skills for the skilled writers. Writing is seen as a process of discovery as the writers try to discover their way during struggling to think, composing and putting their ideas together. In that way, writing is not a static process but a social, dynamic, and cognitive one.

Jyi-yeon Yi (2009) defines writing as the ability to produce contextually correct forms of language that follow prescribed patterns at the sentence or discourse level.

For the purpose of the study, writing is defined operationally as the process of making visual message through the visual medium of paper to be transmitted to a reader to achieve a certain goal.

Motivation:

Lonna J. Dickerson (2004) defines motivation as an inner drive, impulse, emotions or desire that move one towards a particular action. Motivation is a combination of desire and effort to achieve the goal of learning a language and the favorable attitudes toward learning the language and the extent to which the individual works or strives to learn a language because of the desire to do so and the satisfaction experienced in this activity.

Duan Yuan-bing (2011) defines motivation as a process in which a certain amount of instigation forces indicates action, and persists as long as no other forces come into action to weaken it.

For the purpose of the study, motivation is defined operationally as the learner's inner desire to participate in learning a foreign language.

Technology:

Humara Bano (2007) defines technology as the functional knowledge of the current technical means that is applied in the human adaptive systems, the skills of using and creating such means and the ability to find the way to control their impact on civilization.

Basak Baglama (2018) defines technology as products with higher quality scientific knowledge and techniques with its present connotation.

For the purpose of the study, technology is defined operationally as the technical means that is used for facilitating the teaching learning process of hearing impaired pupils.

The pilot study:

The researcher has conducted a pilot study to investigate hearing impaired preparatory pupils' reading and writing skills and their motivation towards learning English as a foreign language. To achieve this objective, a reading test, a writing test and a motivation scale were administered on 40 prep stage hearing impaired pupils from one of the governmental schools in the city of Mansoura. Table 1 summarizes the results of these tests.

Table (1)

The means and the standard deviations of the scores of the samples on both the reading and writing tests and a motivation scale

The tests	The mean	The standard deviation	Total mark
<i>Reading</i>	5.5	2.9	10
<i>Writing</i>	3.8	2	10
<i>Motivation</i>	3.6	1.1	10

Results of table 1 indicate that the hearing impaired pupils' reading and writing skills tend to be low. Furthermore, they lack high motivation towards learning English as a foreign language. The researcher adopted the specified level by the Ministry of Education as a clue of passing the tests. This level is five out of ten. Although the mean score of 5.5 out of 10 is not a high mark, it indicates that pupils have hardly passed the reading test. So, it could be said that they face difficulties in reading even simple passages. As for the writing test, the mean score of 3.8 out of 10 indicates the low level of pupils' writing skills. They are not able to compose simple sentences. Finally, the hearing impaired pupils are reluctant to learn English as a foreign language and when they are exposed to learning English they do this with a relatively low degree of willingness.

Statement of the problem:

Egyptian hearing-impaired prep pupils, who learn English as a foreign language, have low reading and writing skills. This may be either due to the

teaching method or the content that they study. Surprisingly, they study the same content as that of ordinary pupils except for the auditory exercises. This content neither satisfies their needs and nor is aligned with their characteristics. Consequently, they face many difficulties in reading or writing simple passages. This leads to poor motivation to learn English as a foreign language and thus their participation in classroom activities suffers.

Questions of the study:

The problem of the study can be addressed in the following main question: How far is a computer-based program effective in developing hearing impaired pupils' reading and writing skills as well as their motivation towards learning English as a foreign language?

For the research purpose, this main question can be subdivided into the following sub questions:

- 1-How far is a computer-based program effective in developing hearing impaired pupils' reading skills?
- 2-How far a computer-based program effective in developing hearing impaired pupils' writing skills?
- 3-How far a computer-based program effective in developing hearing impaired pupils' motivation towards learning English as a foreign language?

Hypotheses of the study:

The following hypotheses are postulated to be verified throughout the research:

- 1- There is a statistically significant difference at 0.05 level between the mean scores of the control group and the experimental group on the post administration of the reading test in favor of the experimental group.
- 2- There is a statistically significant difference at 0.05 level between the mean scores of the control group and the experimental group on the post administration of the writing test in favor of the experimental group.
- 3- There is a statistically significant difference at 0.05 level between the mean scores of the control group and the experimental group on the post administration of the motivation scale in favor of the experimental group.
- 4- There is a statistically significant difference at 0.05 level between the mean scores of the pre and the post administration of the reading test on the experimental group in favor of the post administration.

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- 5- There is a statistically significant difference at 0.05 level between the mean scores of the pre and the post administration of the writing test on the experimental group in favor of the post administration.
 - 6- There is a statistically significant difference at 0.05 level between the mean scores of the pre and the post administration of the motivation scale on the experimental group in favor of the post administration.

Purposes of the study:

- 1- This study helps identify hearing impaired pupils' reading and writing skills and their motivation towards learning English as a foreign language.
- 2- This study helps design some computer based activities suitable for EFL hearing impaired prep pupils.

Delimitations of the study:

This study is limited to:

- 1- A sample of first year prep pupils at a governmental school for hearing impaired pupils in Mansoura.
- 2- The assigned content for the hearing impaired pupils for the second term of the first prep stage.

Design of the study:

The present study adopted the two group quasi - experimental design. The sample consisted of twenty pupils at the first grade of the preparatory stage. Two equivalent groups were formed, an experimental group (ten pupils) and a control group (ten pupils) from Al Amal School for the Deaf in Mansoura. Pre - post reading and writing tests and a motivation scale towards learning English as a foreign language were administered to both the experimental group and the control group before and after the treatment. The present study included both qualitative and quantitative approaches to calculate the results and discuss the findings.

Sample of the study:

The sample of this study is a purposive sample of twenty hearing-impaired first year prep pupils at Al Amal School for the deaf in Mansoura. Two equivalent groups were formed, an experimental group (10 pupils) and a control group (10 pupils). Participants were randomly assigned to be either of the experimental group or the control group.

Tools of the study:

The following tools were used:

- 1- A writing test to be used as a pre – post test.
- 2- A reading test to be used as a pre - post test.
- 3- A motivation scale.

Procedures of the study:

In order to answer the three questions of the study, the following steps were followed:

- 1- Reviewing related literature.
- 2-Preparing the reading and writing pre-post tests and the motivation checklist.
- 3-Validating the instruments of the study.
- 4- Modifying the writing and reading tests and the motivation scale according to the jurors' modifications.
- 5-Administering both the writing and reading tests and the motivation scale on the experimental group and the control group as pre-tests.
- 6- Teaching the assigned syllabus to the experimental group using the suggested program.
- 7- Re-administering the same writing and reading tests and the motivation scale on the experimental group and the control group as post-tests.
- 8- Analyzing the data statistically using the appropriate statistical methods.
- 9- Discussing the results and providing conclusion and recommendations.

The reading test:

The researcher prepared a reading test (appendix A). The test was based on the final form of the reading sub skills list. It was used as a pre-post test in order to identify how far first year hearing impaired preparatory pupils master the identified reading sub skills. The reading test consisted of one passage. The Flesch–Kincaid readability test was administered on this passage to determine its readability. The readability of this passage was 86.4. This means that it is readable. It was followed by a group of multiple choice questions. These questions measure the identified reading sub skills.

The reading test validity:

In order to determine the validity of the reading comprehension test, it was submitted to a jury of EFL specialists in curricula and methodology. They were requested to determine to what extent the test is appropriate to measure the identified reading sub skills. The jury agreed that the test is valid and they suggested some modifications which were taken into consideration while designing the final form of the test.

The reading test reliability:

The researcher estimated the reliability of the test using the split-half methodology. Using Pearson Correlation, the correlation among the odd and even numbered items was .605. Then Spear-Brown prophecy formula was

used to estimate the reliability of the whole test. The estimated reliability was 75%.

The writing test:

The researcher prepared a writing test (appendix B). The test was based on the final form of the writing sub skills list. It was used as a pre-post in order to identify how far first year preparatory stage pupils master the identified listening comprehension sub-skills. The writing test consisted of five sections. Each section consisted of some questions. These questions measure the identified writing sub-skills.

The writing test validity:

In order to determine the validity of the writing test, it was submitted to a jury of EFL specialists in curricula and methodology. They were requested to identify to what extent the test is appropriate to measure the determined writing sub skills. The jury agreed that the test is valid and they suggested some modifications which were taken into consideration while designing the final form of the test.

The writing test reliability:

The researcher estimated the reliability of the test using the split-half methodology. Using Pearson Correlation, the correlation among the odd and even numbered items was .68. Then Spear-Brown prophecy formula was used to estimate the reliability of the whole test. The estimated reliability was 80%.

The motivation scale:

The researcher prepared a motivation scale (appendix C). It was used as a pre-post scale in order to identify how far first year hearing impaired preparatory pupils are motivated to learn English as a foreign language. The motivation scale included a group of the main dimensions of motivation such as curiosity, social peering, involvement and recreation. The list also included thirty six (36) items that handle these four main dimensions.

The motivation scale validity:

In order to determine the validity of the motivation scale, it was submitted to a jury of EFL specialists in curricula and methodology. They were requested to determine to what extent the scale is appropriate to estimate the first year hearing impaired pupils' motivation. The jury agreed that the scale is valid and it was used as the final form of the scale.

The motivation scale reliability:

The researcher estimated the reliability of the motivation scale using the split-half methodology. Using Pearson Correlation, the correlation among the odd and even numbered items was .605. Then Spear-Brown

prophecy formula was used to estimate the reliability of the whole scale. The estimated reliability was 75%.

Results:

1- Results related to the effectiveness of the suggested program in developing the reading skills of hearing impaired pupils

Table (2)

U value and its statistical significance of Mann-Whitney test of the differences between the mean scores of the experimental group and the control group on the post administration of the reading test

Reading skills	Groups	N	Mean	Std. Deviation	Mean Rank	Sum of Ranks	Mann-Whitney U	Z	Sig.
Knowing word meaning	<i>experimental</i>	10	1.70	1.3374935	12.15	121.50	19.000	-	1.289
	<i>control</i>	10	1.00	0.8164966	8.85	88.50			
Knowing that words may have more than one meaning	<i>experimental</i>	10	0.80	0.421637	14.00	140.00	45.000	-	3.067
	<i>control</i>	10	0.10	0.3162278	7.00	70.00			
Guessing the meaning of the new vocabulary from the context	<i>experimental</i>	10	1.30	0.9486833	13.25	132.50	45.000	-	2.336
	<i>control</i>	10	0.30	0.6749486	7.75	77.50			
Identifying referents of pronouns	<i>experimental</i>	10	1.20	0.9189366	12.55	125.50	45.000	-	1.700
	<i>control</i>	10	0.50	0.8498366	8.45	84.50			
Finding the main idea of a certain passage	<i>experimental</i>	10	0.30	0.4830459	12.00	120.00	19.500	-	1.831
	<i>control</i>	10	0.00	0	9.00	90.00			
Drawing conclusions from the author's words	<i>experimental</i>	10	1.10	0.875595	13.05	130.50	16.500	-	2.139
	<i>control</i>	10	0.30	0.6749486	7.95	79.50			
Total	<i>experimental</i>	10	6.40	4.1150132	13.70	137.00	12.000	-	2.511
	<i>control</i>	10	1.60	2.4129281	7.30	73.00			

Results in table (2) indicate that the control group achieved some kind of development in the sub skills of knowing that words may have more than one meaning and guessing the meaning of the new vocabulary from the context. On the other hand, they did not achieve any development in the sub skills of knowing word meaning, identifying referents of pronouns, finding the main idea of a certain passage and drawing conclusions from the author's words. This may be because of the difficulty of the undeveloped sub skills for such group of pupils. Moreover, these sub skills require much more training to be developed and they cannot be developed during one

semester. In addition, the assigned content and the traditional way of teaching neglect developing such skills.

Table (3)
Wilcoxon value of the mean scores of the experimental group on the pre and post administrations of the reading test and its statistical significance

Reading skills	Ranks Sign	N	Mean Rank	Sum of Ranks	Wilcoxon R.S W	Z	Sig.
Knowing word meaning	<i>Negative Ranks</i>	6a	5.08	30.50	5.50	-1.831-b	Not sig.
	<i>Positive Ranks</i>	2b	2.75	5.50			
	<i>Ties</i>	2c					
Knowing that words may have more than one meaning	<i>Negative Ranks</i>	7d	4.00	28.00	0.00	-2.646-b	0.01
	<i>Positive Ranks</i>	0e	0.00	0.00			
	<i>Ties</i>	3f					
Guessing the meaning of the new vocabulary from the context	<i>Negative Ranks</i>	5g	3.00	15.00	0.00	-2.070-b	0.05
	<i>Positive Ranks</i>	0h	0.00	0.00			
	<i>Ties</i>	5i					
Identifying referents of pronouns	<i>Negative Ranks</i>	3j	3.67	11.00	11.00	-.520-c	Not sig.
	<i>Positive Ranks</i>	4k	4.25	17.00			
	<i>Ties</i>	3l					
Finding the main idea of a certain passage	<i>Negative Ranks</i>	2m	2.00	4.00	11.00	-.577-b	Not sig.
	<i>Positive Ranks</i>	1n	2.00	2.00			
	<i>Ties</i>	7o					
Drawing conclusions from the author's words	<i>Negative Ranks</i>	3p	3.33	10.00	5.00	-.707-b	Not sig.
	<i>Positive Ranks</i>	2q	2.50	5.00			
	<i>Ties</i>	5r					
Total	<i>Negative Ranks</i>	6s	6.17	37.00	8.00	-1.732-b	Not sig.
	<i>Positive Ranks</i>	3t	2.67	8.00			
	<i>Ties</i>	1u					

Results in table (3) indicate that the suggested computer-based program is effective in developing hearing-impaired pupils' subskills of knowing that words may have more than one meaning and guessing the meaning of the new vocabulary from the context. This proposed program is not effective in developing hearing-impaired pupils' subskills of knowing word meaning, identifying referents of pronouns, finding the main idea of a

certain passage and drawing conclusions from the author's words and for the total score.

Knowing that words may have more than one meaning, guessing the meaning of the new vocabulary from the context, knowing word meaning, identifying referents of pronouns, finding the main idea of a certain passage and drawing conclusions from the author's words are easy sub skills and the pupils may be well trained during the primary stage. Moreover, hearing impaired pupils have the visual ability to observe the word in various positions in the text and so it can have various meanings. In addition, the program has many pictures that clarify the various meanings of the words. On the other hand, the program did not present many pronouns and their referents so the pupils were not able to identify the referents of pronouns.

2- Results related to the effectiveness of the suggested program in developing the writing skills of the hearing impaired pupils

Table (4)

U value and its statistical significance of Mann-Whitney test of the difference between the mean scores of the experimental group and the on the post administration of the writing test control group

Writing skills	Groups	N	Mean	Std. Deviation	Mean Rank	Sum of Ranks	Mann-Whitney U	Z	Sig.
Symbolic understanding	<i>experimental</i>	10	1.3	0.8232726	13.60	136.00	19.000	-	2.554
	<i>control</i>	10	0.3	0.6749486	7.40	74.00			
Memorizing letters	<i>experimental</i>	10	0.1	0.3162278	11.00	110.00	45.000	-	1.000
	<i>control</i>	10	0	0	10.00	100.00			
Recognizing and understanding spelling conventions and patterns	<i>experimental</i>	10	0.3	0.4830459	11.00	110.00	45.000	-	.503
	<i>control</i>	10	0.2	0.421637	10.00	100.00			
Memorizing words	<i>experimental</i>	10	2.6	1.9550504	11.00	110.00	45.000	-	.388
	<i>control</i>	10	2.2	1.3984118	10.00	100.00			
Understanding and applying semantic conventions	<i>experimental</i>	10	1.6	0.9660918	13.55	135.50	19.500	-	2.422
	<i>control</i>	10	0.5	0.8498366	7.45	74.50			
Memorizing punctuation types and capitalization rules	<i>experimental</i>	10	1.5	0.8498366	13.85	138.50	16.500	-	2.676
	<i>control</i>	10	0.4	0.6992059	7.15	71.50			
total	<i>experimental</i>	10	7.4	1.6465452	14.30	143.00	12.000	-	2.899
	<i>control</i>	10	3.6	2.5473298	6.70	67.00			

Results in table (4) indicate that the simplicity of the sub skills of memorizing letters, recognizing and understanding spelling conventions and patterns and memorizing words. These sub skills were developed by using both the traditional way of teaching and the proposed program. On the other hand, the sub skills of symbolic understanding, understanding and applying semantic conventions, memorizing punctuation types and capitalization rules are rather difficult sub skills. So, they were not developed by using the traditional way of teaching while they were developed using the proposed program. Moreover, the program focused on these sub skills while it neglected the sub skills of memorizing letters, recognizing and understanding spelling conventions and patterns and memorizing words.

Table (5)

Wilcoxon value of the mean scores of the experimental group on both the pre and the post administration of the writing test and its statistical significance

Writing skills	Ranks Sign	N	Mean Rank	Sum of Ranks W_{obs}	Wilcoxon R.S W	Z	Sig.
Symbolic understanding	<i>Negative Ranks</i>	0a	0.00	0.00	0.00	-2.640-b	0.01
	<i>Positive Ranks</i>	8b	4.50	36.00			
	<i>Ties</i>	2c					
Memorizing letters	<i>Negative Ranks</i>	0d	0.00	0.00	0.00	-1.000-b	Not sig.
	<i>Positive Ranks</i>	1e	1.00	1.00			
	<i>Ties</i>	9f					
Recognizing and understanding spelling conventions and patterns	<i>Negative Ranks</i>	0g	0.00	0.00	0.00	-1.414-b	Not sig.
	<i>Positive Ranks</i>	2h	1.50	3.00			
	<i>Ties</i>	8i					
Memorizing words	<i>Negative Ranks</i>	2j	3.25	6.50	6.50	-1.279-b	Not sig.
	<i>Positive Ranks</i>	5k	4.30	21.50			
	<i>Ties</i>	3l					
Understanding and applying semantic conventions	<i>Negative Ranks</i>	2m	5.50	11.00	11.00	-1.381-b	Not sig.
	<i>Positive Ranks</i>	7n	4.86	34.00			
	<i>Ties</i>	1o					
Memorizing punctuation types and capitalization rules	<i>Negative Ranks</i>	0p	0.00	0.00	0.00	-2.565-b	0.05
	<i>Positive Ranks</i>	8q	4.50	36.00			
	<i>Ties</i>	2r					
total	<i>Negative Ranks</i>	0s	0.00	0.00	0.00	-2.812-b	0.01
	<i>Positive Ranks</i>	10t	5.50	55.00			
	<i>Ties</i>	0u					

Results in table (5) indicate that there are no statistically significant differences at 0.05 level between the mean scores of the pre administration

and the post administration of the writing test on the experimental group for the sub skills of symbolic understanding, recognizing and understanding spelling conventions and patterns, memorizing words and understanding and applying semantic conventions. On the contrary, there are statistically significant differences at 0.05 level between the mean scores of the pre administration and the post administration of the writing test on the experimental group for the sub skills of memorizing letters, memorizing punctuation types and capitalization rules and for the total score in favor of the post administration.

This means that the suggested computer-based program is effective in developing hearing-impaired pupils' sub skills of memorizing letters, memorizing punctuation types and capitalization rules and the writing skill as a whole. This proposed program is not effective in developing hearing-impaired pupils' sub skills of symbolic understanding, recognizing and understanding spelling conventions and patterns, memorizing words and understanding and applying semantic conventions.

The sub skills of memorizing letters, memorizing words and understanding spelling conventions and patterns are very easy and the sample are well trained on these sub skills during the primary stage while the sub skills of symbolic understanding, recognizing and understanding spelling conventions and patterns and memorizing punctuation types and capitalization rules are very difficult and need more training. Hearing impaired pupils are not interested in the type of words that are included in the program and the assigned text book. These words are not related to their real life. Moreover, the proposed program allowed the sample to be exposed to the letters and punctuation types and capitalization rules more than symbols, words, semantic conventions and spelling conventions and patterns.

3- Results related to the effectiveness of the suggested program in developing the hearing impaired pupils' motivation towards learning English as a foreign language

Table (6)
U value and its statistical significance of Mann-Whitney test of the differences between the mean scores of the experimental group and the on the post administration of the motivation scale control group

Motivation dimensions	Groups	N	Mean Rank	Sum of Ranks	Mann-Whitney U	Z	Sig.
Curiosity	<i>experimental</i>	10	9.20	92.00	37.000	-1.032	<i>Not sig.</i>
	<i>control</i>	10	11.80	118.00			
Social peering	<i>experimental</i>	10	9.65	96.50	41.500	-.675	<i>Not sig.</i>
	<i>control</i>	10	11.35	113.50			
Involvement	<i>experimental</i>	10	10.80	108.00	47.000	-.248	<i>Not sig.</i>
	<i>control</i>	10	10.20	102.00			
Recreation	<i>experimental</i>	10	9.40	94.00	39.000	-.860	<i>Not sig.</i>
	<i>control</i>	10	11.60	116.00			
total	<i>experimental</i>	10	9.70	97.00	42.000	-.634	<i>Not sig.</i>
	<i>control</i>	10	11.30	113.00			

Results in table (6) indicate that the proposed program did not help developing the various dimensions of motivation among the pupils of the experimental group because such dimensions require much time to be developed. Moreover, the proposed program did not provide the pupils of the experimental group to develop their creativity. So, both the traditional way of teaching and the proposed program led to the same level of motivation among the pupils of both the control and the experimental groups.

Table (7)
Wilcoxon value of the mean scores of the experimental group on the pre and post administration of the motivation scale and its statistical significance

Motivation dimensions	Ranks Sign	N	Mean Rank	Sum of Ranks	Wilcoxon R.S W	Z	Sig.
Curiosity	<i>Negative Ranks</i>	4a	4.88	19.50	4.88	-.356b	<i>Not sig.</i>
	<i>Positive Ranks</i>	5b	5.10	25.50			
	<i>Ties</i>	1c					
Social peering	<i>Negative Ranks</i>	5d	4.60	23.00	4.60	-.460b	<i>Not sig.</i>
	<i>Positive Ranks</i>	5e	6.40	32.00			
	<i>Ties</i>	0f					
Involvement	<i>Negative Ranks</i>	5g	3.80	19.00	3.80	-.416b	<i>Not sig.</i>
	<i>Positive Ranks</i>	4h	6.50	26.00			
	<i>Ties</i>	1i					
Recreation	<i>Negative Ranks</i>	5j	4.60	23.00	4.60	-.459b	<i>Not sig.</i>
	<i>Positive Ranks</i>	5k	6.40	32.00			
	<i>Ties</i>	0l					
Total	<i>Negative Ranks</i>	5m	3.80	19.00	3.80	-.415b	<i>Not sig.</i>
	<i>Positive Ranks</i>	4n	6.50	26.00			
	<i>Ties</i>	1o	4.88				

Results in table (7) indicate that Z values of the normal distribution and the corresponding Wilcoxon values of the difference between the mean scores of the experimental group on both the pre administration and the post administration of the motivation scale were not significant for the dimensions of curiosity, social peering, involvement and recreation. Moreover, these values were not significant for the total score.

The researcher concluded that there are no statistically significant differences at 0.05 level between the mean scores of the pre administration and the post administration of the motivation scale on the experimental group for the dimensions of curiosity, social peering, involvement and recreation and for the total score. This means that the suggested computer-based program is not effective in developing hearing- impaired pupils' motivation towards learning English as a foreign language with all its dimensions.

This may be due the fact that these dimensions are higher dimensions of motivation that cannot be easily developed. Moreover, the proposed program lacks a great deal of reward except for the part of exercises. Furthermore, the pupils of the sample are not interested in learning English as a whole. This may be because that most of the boys work at different crafts after the school day to earn their lives. Girls are interested in love, make up, fashion and mobile phones. They always play truant and attend schools for just few days and for exams.

Interpretation of the results

The obtained results can be interpreted in the light of the nature of the sub skills, the characteristics of the sample and the features of the suggested program.

1- Interpretation of the results related to reading:

As for the nature of the sub skills, knowing that words may have more than one meaning, guessing the meaning of the new vocabulary from the context, knowing of word meaning, identifying referents of pronouns, finding of the main idea of a certain passage and drawing conclusions from the author's words are easy sub skills and the pupils may be well trained during the primary stage. There is a need for the specialists to figure out some lower skills suitable for this category of pupils.

As for the characteristics of the sample, they are very active and interested in reading tasks. Therefore, they can easily know that words may have more than one meaning and can guess the meaning of the new vocabulary from the context. In addition, they have the visual ability to

observe the word in various positions in the text and so it can have various meanings.

As for the features of the suggested program, the program has many pictures that clarify the various meanings of the words. Moreover, the program presents the word in various contexts so it was easy for the pupils to know that words may have more than one meaning and to guess the meaning of the new vocabulary from the context.

2- Interpretation of the results related to writing:

As for the nature of the sub skills of memorizing letters, memorizing words and understanding spelling conventions and patterns, these sub skills are very easy and the sample are well trained on these sub skills during the primary stage while the sub skills of symbolic understanding, recognizing and understanding spelling conventions and patterns and memorizing punctuation types and capitalization rules are very difficult and need more training. Even though, the identified skills were agreed upon by a group of experts in the field of specific education, the fact remains that these sub skills seem to be hard to master by such category of learners.

As for the characteristics of the hearing impaired pupils themselves, they are not interested in the type of words that are included in the program and the assigned text book. These words are not related to their real life while these pupils need the vocabulary that can be used during their daily life. There is a need not to treat those pupils like normal ones.

3-Interpretation of the results related to motivation towards English as a foreign language:

As for the nature of the motivation dimensions, these dimensions are higher dimensions of motivation that cannot be easily developed and that need more training and more programs to be developed. Therefore, the specialists have to address lower dimensions of motivation and to move slowly to higher dimensions.

As for the features of the suggested program, it lacks a great deal of reward except for the part of exercises. It doesn't evolve the pupils' curiosity, social peering, involvement and recreation. So, there is a need for more active and interesting programs to be developed and applied for such pupils.

As for the characteristics of the sample, they are not interested in learning English as a whole. This may be because that most of the boys work at different crafts after the school day to earn their lives. Girls are interested in love, make up, fashion and mobile phones. They always play truant and attend schools for just few days and for exams.

Recommendations:

Based on the findings of this study, it is recommended that:

Curriculum designers should:

- 1- develop curricula that are appropriate to the characteristics and interest of the hearing impaired pupils because they feel that there is a gap between what they study and what they are interested in.
- 2- select the appropriate approaches and activities for developing hearing impaired pupils' reading and writing skills and their motivation towards learning English as a foreign language.

Foreign language teachers should:

- 1-pay attention to the characteristics and interests of hearing impaired pupils.
- 2-make use of some computer- based programs that were proved to develop the various skills of the hearing impaired pupils and their motivation towards learning English as a foreign language.

testers should:

- 1- focus on the appropriate sub-skills and affective domains for the hearing impaired pupils.
- 2- design the appropriate techniques for evaluating reading and writing skills.

Suggestions for further research:

It is suggested to carry out more researches concerning:

- 1-identifying the characteristics of the hearing impaired pupils.
- 2-identifying the reading and the writing sub-skills and the affective domains that are appropriate for different stages.
- 3-developing reading and writing tests for different stages.

References

- Adi, S., Unsiah, F., Fadhilah, D. (2017). Teaching Special Students: English Lessons for Deaf Students in Indonesian Special Junior High Schools. *International Journal of Education and Research*. Vol. 5, No. 12, pp. 121-136.
- Becker, S. (2017). An investigation of English learning of a sample of students who are deaf or hard of hearing and English learners and a sample of students who are English learners. Unpublished thesis.
- Benedict, K. et al. (2015). Instruction in metacognitive strategies to increase deaf and hard-of-hearing students' reading comprehension. *Journal of Deaf Studies and Deaf Education*. Vol. 20, No. 1, pp. 1-15.
- Cannon, J., et al. (2015). The Comprehension of written grammar test reliability and known-groups validity study with hearing impaired and

-
- deaf and hard of hearing students. *Journal of Deaf Studies and Deaf Education*, 2015, pp. 1–10.
- Csizér, K., Kontra, E., (2020). Foreign Language Learning Characteristics of Deaf and Severely Hard-of-Hearing Students. *The Modern Language Journal*. Vol. 104, pp. 233-249.
- Csizér, K., Kontra, E., Piniel, K. (2015). An investigation of the self-related concepts and foreign language motivation of young Deaf and hard-of-hearing learners in Hungary. *Studies in Second Language Learning and Teaching*. Vol. 5, No. 2, pp. 229-249.
- Dadzie-Bonney, P., Hayford, S. (2017). Factors inhibiting students' ICT knowledge acquisition and utilization at Oguaa School for the Deaf in Ghana. *Rwandan Journal of Education*. Vol. 4, No. 1. pp. 34-46.
- Dostal, H., Wolbers, K. (2014). Developing language and writing skills of deaf and hard of hearing students: A simultaneous approach. *Literacy Research and Instruction*. Vol. 53, pp. 245–268.
- Gaudence, O., Kafwa, N., Kiprof, T. (2018). Attitudes towards use of hypermedia in hearing impaired students' pedagogy. *Journal of Education and Practice*. Vol.9, No.2, pp. 75-82.
- Hadi, S., Özdemir, O. (2017). Development of learning software for deaf: A sample of language learning material. *International Journal of Engineering Research & Technology*. Vol. 6, No. 6, pp. 35-40.
- Haider, G. (2016). An investigation of the writing processes of students with hearing loss: implications for teaching of writing. *International Online Journal of Primary Education*. Vol. 5, No. 1, pp. 1-10.
- Hashim, H., Tasir, Z., Mohamad, S. (2013). E learning environment for hearing impaired students. *The Turkish Online Journal of Educational Technology*. Vol. 12, No.2 , pp. 67- 70.
- Hassan, R. (2019). Teaching vocabulary to deaf students through enriched subtitling: A case study in Qatar. *International Journal of Language and Intercultural Communication*. Vol. 8, pp. 10-27.
- Jean-Mark, G. (2017). Exploring the motivation of Beninese deaf postbeginner students in learning English as a foreign language in Beninese secondary schools. *The Modern Journal of Applied Linguistics*. Vol. 9, No. 1, pp. 11-27.
- Karasu, P. (2017). Writing skills of hearing-impaired students who benefit from support services at public schools in Turkey. *World Journal of Education*. Vol. 7, No. 4, pp. 104-116.
-

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- Majid, S. Saif, M. (2011). Classroom social behavior of hearing impaired children. Retrieved 23rd April, 2017 from <http://pje.aiou.edu.pk/classroom-social-behavior-of-hearing-impaired-children/>.
- Moore, K. (2012). Effectiveness of a computer-based program for improving the reading performance of deaf students. Unpublished thesis. Georgia State University.
- Morávková, V. (2011). Deaf students and their motivation to learn English. Unpublished thesis. Masaryk University Brno.
- Patrick, C. (2017). Strategies used in teaching written English language to learners with hearing impairment: A case of Njia Special School in Meru County, Kenya. *International Journal of Education and Research*. Vol. 5, No. 12, pp. 1-14.
- Plaewfueang, K., Suksakulchai, S. (2012). A Framework for promoting reading skills for hearing-impaired persons using the sign language picture story. Proceedings of the World Congress on Engineering and Computer Science.
- Plaewfueang, K., et al. (2013). A Design of an interactive multimedia learning environment for supporting reading skills of deaf individuals. The Asian Conference on Language Learning.
- Rekkedal, A. (2012). Assistive hearing technologies among students with hearing impairment: Factors that promote satisfaction. *Journal of Deaf Studies and Deaf Education*. Vol. 17, No. 4, pp. 499-517.
- Russo, J. (2013). Characteristics of hearing impaired and deafness children. Retrieved 1st march, 2016 from [خطأ! مرجع الارتباط التشعبي غير صالح.](#)hearing-impairment-and-deafness-in-children.
- Sultanbekova, A. (2019). Teaching English as a foreign language to deaf and hard-of-hearing students at one school in Kazakhstan. Unpublished thesis.
- Wang, Y. (2011). Integrating technology and reading instruction with children who are deaf or hard of hearing: The effectiveness of the cornerstones project. *American annals of the deaf*. Vol. 156, No. 1, pp. 56-68.