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Teaching English to Pakistani Mainstream School Dyslexic Students through Computer-Assisted Reading Materials

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ABSTRACT

The present research aims at investigating the potential of indigenously developed computer-assisted reading materials for teaching the English language to dyslexic students of elementary level in Pakistani mainstream schools. In doing this, grade VI students from a public school were screened using the Learning Disabilities Checklist. Twenty purposively selected participants with a checklist score of 50% or more formed the study sample. Computer-assisted reading materials were designed in the light of Mayer's (2005) Cognitive Theory of Multimedia Learning. A two-week treatment was administered to the students in the computer lab of a public high school. Data collected from the pretest and post-test scores of the participants were analyzed using descriptive statistics and paired sample t-test. The study's findings reveal the efficacy of specifically designed computer-assisted reading materials for teaching the English language to Pakistani mainstream school dyslexic students of elementary level.

Keywords: Computer-assisted reading materials, dyslexic students, disabilities checklist, Cognitive theory of multimedia learning

Introduction

Pakistan is a country with diversity in language and culture. Urdu is the national language (Seifi, 2015), however a proficiency in the English language is the key to success, prosperity, and higher social prestige (Ahmad, 2016). According to The National Education Policy (MFEPT, 2017), exposure to English as a compulsory subject should start from grade one, and English as a medium of instruction for science and mathematics should be used from class V onwards.

Mastery over the reading skill frequently marks the success in the academic achievement tests (Ansari, Panwhar & Umrani, 2016). Teaching reading in the public sector mainstream schools is deplorable (Teevno & Raisani, 2017), as the common strategy is reading the text aloud, followed by Urdu translation (Muhammad, 2013). Unlike regular students, dyslexic students find it challenging to manage with such a strategy. Studies report that the dyslexic students usually remain passive in the classroom sessions (Smith, 2013; Bonacina, Cancer, Lanzi, Lorusso, & Antonietti, 2015; Farris et al. 2016) often resulting in lower academic grades

(Knight, 2018). Learning disability/difficulty (LD) refers typically to significant malfunctioning of psychological processes necessary for learning (Siegel, 2012; Asharf & Najam, 2017; Brenchley & Costello, 2018). Children with learning disabilities find difficulties in processing information leading to low output (Firth, Frydenberg & Bond, 2012). The most common characteristics of reading disability, or dyslexia, include poor decoding, word recognition, and reading comprehension skills (Handler & Fierson, 2011). Typically found more in men than women (Skues & Cunningham, 2011), misguided attention to dyslexia can result in lower academic performance (Krafnick, Flowers, Luetje, Napoliello, & Eden, 2014).

The term reading disability or dyslexia has been defined differently by various researchers (Flaugnacco et al., 2015; Colling, Noble & Goswami, 2017; Billington, 2017), and the most agreed-upon definition is that dyslexia is a specific learning disorder that is neurological in origin, often associated with poor spelling and decoding abilities (Norris, Hammond, Williams & Walker, 2019). Dyslexia is associated with the phonological deficit, which affects the child's reading comprehension and background knowledge (Gori & Facoetti, 2014; Duranovic, Senka & Gavric, 2018; Bachmann & Mengheri, 2018).

Existence of dyslexia in Pakistan has been pointed out by several studies (Ashraf & Majeed, 2011; Malik, Mufti, & Akhtar, 2013; Asharf & Najam, 2017; Khalid & Anjum, 2019) however, the exact number of dyslexic students are not available, also in part due to the absence of screening facilities (Rehman & Arif, 2006; Ashraf & Majeed, 2011; Farukh & Vulchanova, 2014; Asharf & Najam, 2014, 2017). Therefore, Jumani et al. (2011) suggest establishing clinics for the early detection/diagnosis of dyslexia in Pakistan.

Although a few studies on computer-assisted materials development for teaching English to mainstream students are available (Irshad, 2008; Waheed, 2012; Anjum, 2012; Hussain, 2016); but the field of computer-assisted materials development for teaching English reading to dyslexic students remains unexplored.

Research Question

What is the effect of computer-assisted reading materials on the English language performance of dyslexic students at the elementary level?

Literature Review

Dyslexia is divided into acquired dyslexia and developmental dyslexia. Acquired dyslexia is common among people who acquire dyslexia after some trauma, while developmental dyslexia is the general type of dyslexia--- neurological in origin with problems inaccurate or fluent word recognition, decoding, and spelling abilities (Livingston, Siegel & Ribary, 2018). Developmental dyslexia is not the result of any kind of intellectual disabilities, sensory impairments, or inadequate educational instruction (Lyon, Shaywitz, & Shaywitz, 2003; American Psychiatric Association, 2013). Deficits in phonological awareness and rapid naming speed are the usual features of children with developmental dyslexia (Tobia & Marzocchi, 2014).

Any kind of disability, especially reading disability, can harm the child's academic achievement, often resulting in emotional and behavioral problems (Francis, Caruana, Hudson, & McArthur, 2019). Developing reading skills in young children involves teaching phonemic awareness, phonics, vocabulary, and oral reading fluency, enhancing the child's comprehension skills (Stark, Snow, Eadie, & Goldfeld, 2016). Commonly, two types of approaches are used while designing intervention strategies for dyslexia: cognitive-oriented interventions (focus on the training of phonological awareness) and symptomatic approaches (focus on reading and spelling) (Trautmann, 2014). The studies' findings reveal that the combination of both approaches can produce significant results (Al Otaiba, Rouse, & Baker, 2018; Caute et al., 2018).

In Pakistan, a few studies are conducted regarding intervention-based approaches/techniques to manage dyslexia. In their study, Ashraf and Majeed (2011) revealed that the public sector schools have no screening facilities for dyslexia, and the English language teachers are ignorant of the specific needs of the dyslexic students by tagging them as academically weak. This paucity of awareness is due to the lack of governmental and institutional level interests (Khaliq, Ramzan & Aslam, 2017). These findings were further supported by a study conducted by Malik, Mufti, and Akhtar (2013), where it was revealed that an alarming number of Pakistani school children have dyslexia, which needs the authorities' serious attention to combat this disorder. In another study by Naeem, Mahmood, and Saleem (2014), it was found that several factors (lack of qualified personnel, screening facilities, and faulty teaching methodologies) are responsible for the non-availability of screening facilities for Pakistani dyslexic students.

As far as the screening of dyslexia in Pakistan is concerned, Farukh and Vulchanova (2014) concluded that rapid automatized naming (RAN) and non-word repetition (NWR) tasks are valid for screening reading deficits in Urdu language for Pakistani public sector primary school students. In another study by Jaka (2015), it was revealed that Pakistani public mainstream English language teachers are ignorant of the necessary knowledge and screening of dyslexia. Ashraf and Najam (2017) further highlight the view by stating that early screening for learning disabilities is necessary for mainstream English language teachers and school authorities should work in close collaboration with clinical psychologists to plan effective interventions at earlier stages.

Researchers suggest that the poor reading experiences of dyslexic students are generally associated with the visual, auditory, and phonological deficits (Perea, Panadero, Tatay, & Gómez, 2012; Leong & Goswami, 2015) requiring teachers to have a sympathetic approach towards dyslexic students in the class (Naz & Habib, 2015). Apart from reading related issues, Lam et al. (2011) found that the dyslexic students also have issues of writing. Tariq and Latif (2015, 2016) concluded that the development of indigenous need-based Computer-assisted materials could produce significant differences in the performance of students with reading disabilities.

Computer-Assisted Reading Materials is a sub-branch of Computer Assisted Language Learning (CALL), which was very popular among researchers, especially in English as a second language teaching (Hashmi, 2016). CALL offers a multifaceted platform where researchers can use different pedagogical skills to accomplish the task (Tabassum & Parveen, 2013; Sun, 2017; Smith, 2018). To meet with the changing needs of the 21st century ESL Pakistani learners, the government of Pakistan established the CALL subcommittee in 2005, and the function of the subcommittee was to empower in-service English language teachers with the latest technological skills (HEC, 2007). In some cases, the English language teachers used commercial Computer-assisted materials, which were unsuited to the Pakistani students' needs (Irshad & Ghani, 2017) and did not take into account the needs of the students with learning disabilities. Some researches point towards the development of computer-assisted reading materials for teaching the English language to mainstream students (Irshad, 2008; Waheed, 2012; Anjum, 2012; Bhatti, 2013, Hussain, 2016); but the field of computer-assisted materials development for teaching English language reading to dyslexic students remains unexplored.

English language teachers developed a few computer-assisted materials/ software, while computer experts developed the bulk of commercially available materials with no language (Tomlinson, 2012). As a result, English language teachers found these materials incompatible and not learner-centered truly (Liu, 2013). Computer-assisted materials offer multiple modes of learning opportunities so that the learner may explore different alternatives for the completion of the task (Greene, 2013; Smith, 2018).

In Pakistan, a few pieces of research are available on computer-assisted materials development for English language learners. Irshad (2008) developed computer-assisted materials to enhance the reading skills of advanced ESL learners, and findings proved that the materials had a significant impact on the performance of the experimental group students. However, Anjum (2012) developed computer-assisted materials for intermediate level students to enhance their comprehension of the English language and found a statistically significant difference in the performance of treatment group students. Waheed (2012) found that the materials had the power to bring change in the participants. Hussain (2016) developed computer-assisted materials to enhance the students' speaking skills at the intermediate level and concluded that the indigenous computer-assisted materials had a significant impact on the performance of the participants. In all these studies, there is a palpable absence of computer-assisted materials developed specifically for teaching English language reading to Pakistani dyslexic students, prompting the current study, to explore the possibilities of using indigenously developed computer-assisted materials for dyslexic students.

Today's market is flooded with commercially available computer-assisted materials and technological applications; however, limited knowledge of assessment and intervention of learning disabilities is challenging for many researchers in generalizing results, as the findings of the research often mismatch when tested in clinical and educational settings (Brenchley & Costello, 2018). Therefore, intervention can be effective only if it administered in earlier

stages, as delays can be disastrous on the part of the students and challenging to manage by ELT stakeholders (Reynolds, Wheldall, & Madelaine, 2011). Although the success rate of intervention is higher at an earlier stage than the later stage of dyslexia (Kochva, 2016), a few children sometimes require continued reading support even at later stages.

Most of the available research on intervention strategies for dyslexic children is concerned with the impact of focused / layered reading interventions on the reading performance of dyslexic children (Molfese, Fletcher & Denton, 2013). Through these interventions, it has been revealed that the success rate of intervention strategies varies differently among such children, as some improve significantly better than others, and some continue to struggle throughout life. In the development of reading intervention program for teaching phonics, sight words and guided book reading, Buckingham, Beaman, and Wheldall (2012) found that although the content is the basic unit of any reading program, but the way of presentation of the content can have a significant impact on the reading recovery of the children (Rahimi, 2015). Although reading recovery programs have always been popular, the reviews suggest that there have been methodological limitations for implementing these programs (Slavin, Cynthia, Susan, & Nancy, 2011). Similarly, Björn and Leppänenb (2013) developed a computer-based intervention project named EngLexia to accelerate decoding-related skills in poor readers learning English as a foreign language, and the findings revealed a significant change in the performance of treatment group students. On the other hand, Franceschini et al. (2013) conducted a study and found the use of action video games in the enhancement of reading skills of dyslexic children very significant. Furthermore, Kochva (2016) designed an intervention program to enhance the reading and spelling of dyslexic students, and evaluation of the intervention remained successful in meeting the objectives.

In Pakistan, Jumani et al. (2011) evaluated the effectiveness of four months of remedial techniques for elementary level ESL dyslexic students, and the findings revealed a significant difference in the performance of the treatment group students. In another study, Khan (2013) adapted and validated the SMILES intervention plan for Pakistani children having behavioral problems, and the findings suggested that timely care significantly change the behavior of these students. Likewise, Tariq and Naz (2017) conducted a study to assess the impact of the Pakistan Early Learning System (PELS) for teaching the Urdu alphabets in children, and it was concluded that the significant change in the performance of the students proved computer-assisted learning advantageous. Furthermore, Tariq and Latif (2015, 2016) designed a mobile application for improving the writing skills of dyslexic children. The findings revealed that the application had justified its role in improving the writing skills of young dyslexic students. However, a significant area that showed a gap was the study that could develop and investigate the effectiveness of computer-assisted reading materials explicitly based on the needs of Pakistani students for learning the English language at the elementary level in mainstream schools.

Method

A quasi-experimental quantitative research design was employed. Generally, these designs are preferred in social sciences, especially when a program is considered as an intervention (White & Sabarwal, 2016), as was the case for the current study.

Theoretical Framework

The computer-assisted reading materials were developed in the light of Mayer's (2005) Cognitive Theory of Multimedia Learning, which is based on three theoretical assumptions. The first one is related to dual coding (Paivio, 1991), which divides working memory into the visual and auditory channel. The second assumption states that working memory, visual and auditory channel are constrained to hold and actively process about 3–4 items at a time. The third assumption suggests learning as an active process of filtering, selecting, organizing, and integrating information. As dyslexia impedes verbal processing (Duff & Clarke, 2011), therefore, it can be expected that dyslexic individuals may find verbal information challenging and visual information accommodating. According to Mayer (2014), there is a scarcity of research showing how multimedia materials could influence dyslexic students.

Setting

The present study was conducted in a public sector high school computer laboratory equipped with Intel Core i5 computers, supported by high-speed internet connectivity.

Sample

All students enrolled in grade VI of a public sector high school were screened for dyslexia through the Learning Disabilities Checklist (Asharf & Najam, 2014). The study sample consisted of purposively selected twenty participants with a screening score of 50% or more.

Development of Indigenous Computer-Assisted Reading Materials

The materials, developed from Punjab Textbook board's class VI English book, were based on two parameters: the chapters considered difficult among the students by the teachers and the chapters, which included difficult vocabulary, leading to the students' poor performance. The treatment continued for two weeks, where the students were taught through the indigenously developed computer-assisted reading materials in the computer lab. Materials were developed through Microsoft PowerPoint, along with the multimodal presentation of the content. PowerPoint highlights the power of inferring images from the verbal form (Martindale, Whitfield, & Jeremiah, 2016), and helps in improving the working memory of the dyslexic children through readability as well as the visibility of the text (Naik, 2017). The variety of exercises was developed through Quiz Faber software.

Research Procedure

Before the start of treatment, the purposively selected students appeared in a pretest where students had to undergo a reading comprehension passage followed by ten multiple-choice questions worth ten marks. Afterward, these students underwent through treatment phase.

The treatment phase for the present study continued for two weeks and took place in the computer laboratory where the students had the exposure of learning the English language through indigenously developed computer-assisted reading materials for forty minutes per day in a week. The students had the opportunity to learn the textbook content through the multimodal presentation of the content, and the variety of exercises helped them master the concepts.

After two weeks of the treatment phase, the students appeared for the post-test, which was on the same pattern as the pretest. The difference in the scores in the students' performance in the pretest and post-test helped gauge the effectiveness of the potential of indigenously developed computer-assisted reading materials for teaching the English language to students with dyslexia.

Data Collection

The data for the present study was collected from the Pretest score and Posttest score of the students.

Research Variables

Teaching through computer-assisted reading materials was the independent variable, while the difference in the students' performance was the dependent variable.

Ethical Considerations

Informed consent of the Principal, headteacher, and English language teachers were sought for the present study. For the grade VI participants, parents were informed about the study and their consent for the active participation of their children in the study was ensured. The participants were assured that the present study would be conducted only for the academic purpose, and the data would be kept anonymous.

Data Analysis

The data for the present study were analyzed quantitatively through SPSS using descriptive statistics and paired sample t-test. A probability level of 5% was used for statistical significance. A paired sample t-test was conducted to find out any difference in the performance of the students before and after the intervention. The pretest scores of the participants were analyzed using descriptive statistics where the mean and standard deviation of all the participants were calculated, as shown in table 1.

Table 1. Pretest Mean Score and Standard Deviation

Mean	Standard Deviation
03.50	1.47

Table 1 shows the students' pretest scores out of 10 marks with a mean score of 03.50 and SD 1.47.

Keeping in mind the pretest's findings, the indigenous computer-assisted reading materials were designed from the Punjab textbook board's English for class VI. The treatment phase continued for two weeks, where the students were taught through the materials along with the variety of activities for practice. Afterward, the students appeared in the post-test to see if there is any difference in the performance of the students, as shown in table 2.

Table 2. Posttest Mean Score and Standard Deviation

Mean	Standard Deviation
04.60	1.53

Table 2 shows the improved performance of the participants understudy with a mean score of 04.60 and SD 1.53. The significant difference in the mean scores of the students proves that the materials were designed exclusively according to the needs of the students. To find a statistically significant difference in the students' performance, a paired sample t-test was applied to the data. The findings proved a significant difference, as shown in table 3.

Table 3. Paired Sample t-test

Standard Deviation	95% Confidence Interval t of the Difference		df	Sig. (2-tailed)	
	Lower	Upper			
0.87	3.55	4.50	17.35	19	.000

The significant decrease in the mean score of 1.10 in the pretest and post-test score of the students indicates that the indigenously developed computer-assisted reading materials had the potential to meet the objective of the study as discussed in table 3 with $t(19) = 17.35$, $p = .000$, $\alpha = 0.05$. The null hypothesis was rejected in the light of the result of the paired sample t-test ($p < 0.005$). The multimodal presentation and the English reading and the oral Urdu translation of the content helped the students learn and memorize the content, which resulted in gauging the efficacy and efficiency of the indigenous computer-assisted reading materials dyslexic students. So, it can be proposed that the interaction of the students with the indigenous materials during the two weeks may have developed a positive connection with the participants.

Conclusion

The pretest score of the participants with a mean score of 03.50 represents the critical situation of Pakistani ESL learners with reading difficulties which are in line with the findings of the several studies conducted on the prevalence of dyslexia in Pakistan (Ashraf and Majeed, 2011; Malik, Mufti, & Akhtar, 2013; Naeem, Mahmood & Saleem, 2014; Khaliq, Ramzan & Aslam, 2017). This situation also represents the awareness level of Pakistani English language teachers who have low or no knowledge of dyslexia. Their indifference approach to students with reading difficulties further complicates the situation, often leading to failure in academic achievement tests. Although Pakistan has established a computer laboratory in every high school, Pakistani ESL mainstream teachers are unable to use it to teach the English language. Two weeks exposure of the students with indigenously developed computer-assisted reading materials may have brought an improvement in the performance of the students, as revealed in the post-test score which is supported by many pieces of research (Jumani et al., 2011; Tariq & Latif, 2015, 2016; Tariq & Naz, 2017). The obtained results suggest that the indigenously developed computer-assisted reading materials brought the students' performance change.

The present study results indicate that computer-aided resource is useful for the teaching and learning of English language. The results also suggest that the indigenously developed materials have the potential of improving the English language performance of Pakistani ESL learners with specific reading difficulties. The findings are also supported by a study conducted by Irshad and Ghani (2017), where the indigenously developed computer-assisted reading materials were found helpful in enhancing the reading skills of Pakistani ESL learners. It can also be inferred from the findings that teaching through indigenous computer-assisted reading materials is a better strategy than the traditional method for teaching the English language to dyslexic students, and these findings are in line with the several research studies (Slavin, Cynthia, Susan & Nancy, 2011; Björn & Leppänenb, 2013; Franceschini et al., 2013; Rahimi, 2015; Kochva, 2016).

Limitations of the Study

The current study's purpose was to explore the potential of indigenously developed computer-assisted reading materials in teaching English to Pakistani mainstream ESL learners with reading difficulties, and the present study takes the first step in this direction. Owing to time and space limitations, the researcher could not develop computer-assisted reading materials of the whole book, and the present study continued for two weeks only.

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