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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; Ashraf & 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; Ashraf & 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; Ashraf & 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 21<sup>st</sup> 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.

## **Methodology**

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 under study 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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### **References**

- Ahmad, S. R. 2016. Importance of English communication skills. *International Journal of Applied Research* 2(3): 478-480.
- Akram, M. 2017. Learning and teaching English in Pakistan: Predicaments and solutions. *International Journal of Educational Science* 19(1): 10-14.
- Al Otaiba, S., Rouse, A. G., and Baker, K. 2018. Elementary grade intervention approaches to treat specific learning disabilities including dyslexia. *Language Speech and Hearing Services in Schools* 49(4): 829-843.

- American Psychiatric Association. 2013. *Diagnostic and statistical manual of mental disorders*. (5th ed.). Washington, DC: Author.
- Anjum, M. A. I. 2012. *Computer assisted language learning to teach English at intermediate level: An exploration of its effectiveness*. (Unpublished M. Phil Thesis). GC University, Faisalabad.
- Ansari, S., Panhwar, A. H., and Umran, S. 2016. Investigating ESL learners' reading habits in a Pakistani University. *ELF Annual Research Journal* 18(1): 85-102.
- Ashraf, M. and Majeed, S. 2011. Prevalence of dyslexia in secondary school students in Lahore. *Pakistan Journal of Psychological Research* 26(1): 73-85.
- Ashraf, F. and Najam, N. 2014. Validation of learning disability checklist in public sector schools of Pakistan. *Pakistan Journal of Psychological Research* 29(2): 223-244.
- Ashraf, F. and Najam, N. 2017. Identification of learning disabilities in students: A gender perspective prevalence of dyslexia in secondary school students in Lahore. *Pakistan Journal of Social and Clinical Psychology* 15(1): 36-41.
- Bachmann, C., and Mengheri, L. 2018. Dyslexia and fonts: Is a specific font useful? *Brain Sciences* 8: 5-19.
- Bhatti, T., M. 2013. Teaching reading through computer assisted langauge learning. *The Electronic Journal for English as a Second Language* 17(2): 1-10.
- Billington, T. 2017. Critical educational psychology: To what extent can (or should be) the discourse unit work for practitioners?, *Annual Review of Critical Psychology* 13(1): 1-15.
- Björn, P. B., and Leppänen, P. H. T. 2013. Accelerating decoding-related skills in poor readers learning a foreign language: A computer-based intervention, *educational psychology. An International Journal of Experimental Educational Psychology* 33(6): 671-689.
- Bonacina, S., Cancer, A., Lanzi, P., Lorusso, M., and Antonietti, A. 2015. Improving reading skills in students with dyslexia: The efficacy of a sublexical training with rhythmic background. *Frontiers in Psychology* 10(1): 1-18.
- Brenchley, C. and Costello, S. 2018. A Model of Assessment and Intervention for Non-Verbal Learning Disability (NVLD) in the Australian education system: An educational and developmental psychologist perspective. *Australian Journal of Learning Difficulties* 23(1): 67-86.
- Buckingham, J., Beaman, R., and Wheldall, K. 2012. A randomised control trial of a MultiLit small group intervention for older low progress readers. *Effective Education* 4(1): 1-26.
- Caute, A., Cruice, M., Marshall, J., Monnelly, K., Wilson, S., and Woolf, C. 2016. Assistive technology approaches to reading therapy for people with acquired dyslexia. *Aphasiology* 32(1): 40-42.
- Colling, L. J., Noble, H. L., and Goswami, U. 2017. Neural entrainment and sensorimotor synchronization to the beat in children with developmental dyslexia: An EEG study. *frontiers in neuro science* 11(1): 360-376.
- Duff, J., and Clarke, J. 2016. Practitioner review: Reading disorders – What are effective interventions and how should they be implemented and evaluated? *Journal of Child*

- Psychology and Psychiatry* 52(1): 3–12.
- Duranovic, M., Senka, S. and Gavric, B. 2018. Influence of increased letter spacing and font type on the reading ability of dyslexic children. *Annals of Dyslexia* 68(3): 1- 11.
- Farris, E. A., Ring, J., Black, J., Lyon, G. R., and Odegard, T. N. 2016. Predicting growth in word level reading skills in children with developmental dyslexia using an object rhyming functional neuroimaging task. *Developmental Neuropsychology* 41(3): 145–161.
- Farukh, A. and Vulchanova, M. 2014. Predictors of reading in Urdu: Does deep orthography have an impact? *DYSLEXIA* 20(1): 146-166.
- Firth, N., Frydenberg, E. and Bond, L. 2012. An evaluation of success and dyslexia – A multi component school-based coping program for primary school students with learning disabilities: Is it feasible?, *Australian Journal of Learning Difficulties* 17(2): 147-162.
- Flaugnacco, E. Lopez, L., Terribili, C., Montico, M., Zoia, S., and Schön, D. 2015. Music training increases phonological awareness and reading skills in developmental dyslexia: A randomized control trial. *Frontiers in Neuro Science* 8(1): 392-407.
- Franceschini, S., Gori, S., Ruffino, M., Viola, S., Molteni, M., and Facoetti, A. 2013. Action video games make dyslexic children read better. *Current Biology* 23(6): 462- 466.
- Francis, D., Caruana, N., Hudson, J., and McArthur, G. 2019. The association between poor reading and internalizing problems: A systematic review and meta analysis. *Clinical Psychology Review* 67(1): 45–60.
- Gori, S., and Facoetti, A. 2014. Perceptual learning as a possible new approach for remediation and prevention of developmental dyslexia. *Vision Research* 99: 78– 87.
- Greene, N. 2013. *Computer Assisted Language Learning (CALL) for the Inclusive Classroom*. (Unpublished Ph.D. Thesis). Dublin City University.
- Handler, S. M., and Fierson, W. M. 2011. Learning disabilities, dyslexia, and vision. *Pediatrics* 127(3): 818-856.
- Hashmi, N., A. 2016. Computer-Assisted Language Learning (CALL) in the EFL classroom and its impact on effective teaching-learning process in Saudi Arabia. *International Journal of Applied Linguistics & English Literature* 5(2): 202-206.
- Higher Education Commission, Pakistan. 2007. *Computer Assisted Language Learning*. Retrieved from <http://www.hec.gov.pk/insideHEC/Division/QALI/CALL>
- Hussain, R. 2016. *Effect of spoken indigenous CALL materials on Pakistani learners*. (Unpublished Ph.D. Thesis). Islamia University, Bahawalpur.
- Irshad, S. 2008. *The Pedagogical Benefits of Computers in ESL: Implications of Computer Assisted Language Learning (CALL) in Pakistan in the Current Millennium*. (Unpublished M. Phil dissertation). The Islamia University of Bahawalpur.
- Irshad, S. and Ghani, M. 2017. Benefits of CALL in ESL pedagogy in Pakistan: A case study. *ELF Annual Research Journal* 17(1): 1-22.
- Jaka, F. S. 2015. Head teachers and teachers as pioneers in facilitating dyslexic children in primary mainstream schools. *Journal of Education and Educational Development* 2 (2): 172–190.

- Jumani, N. B., Rahman, F., Dilpazir, N., Chishti, S., Chaudry, M. A., and Malik, S. 2011. Effectiveness of remedial techniques on the performance of special students in the subject of english. *Journal of Language Teaching and Research* 2(3): 697- 704.
- Khalid, M., and Anjum, G. 2019. Use of remedial teaching approaches for dyslexic students: Experiences of remedial teachers working in urban Pakistan. *Cogent Psychology* 6(1): 1-18.
- Khaliq, S., Ramzan, I., and Aslam, J. 2017. Study about awareness of dyslexia among elementary school teachers regarding Pakistan elementary educational institutes. *International Journal of Research in Business Studies and Management* 4(5): 18-23.
- Khan, M. J. 2013. *Adaptation and Validation of an Intervention Plan for Behavioral Problems among Children and Adolescents with Depressive Parents*. (Unpublished Ph.D. Thesis). GC University, Lahore.
- Kochva, I. 2016. An examination of an intervention program designed to enhance reading and spelling through the training of morphological decomposition in word recognition. *Scientific Studies of Reading* 20(2): 163-172.
- Knight, C. 2018. What is dyslexia? an exploration of the relationship between teachers' understandings of dyslexia and their training experiences. *Dyslexia* 24(3): 207– 219.
- Krafnick, A. J., Flowers, L., Luetje, M., Napoliello, E., and Guinevere, E. 2014. An investigation into anatomical differences in dyslexia. *The Journal of Neuroscience* 34(3): 901–908.
- Lam, S. S., Au, R. K., Leung, H. W., and Li-Tsang, C. W. 2011. Chinese handwriting performance of primary school children with dyslexia. *Research in Developmental Disabilities* 32(5): 1745-1756.
- Leong V., and Goswami U. 2015. Acoustic emergent phonology in the amplitude envelope of child directed speech. *PLoS One* 10(12): 1-37.
- Liu, X. 2013. *Action Research on the Effects of an Innovative Use of CALL (Computer Assisted Language Learning) on the Listening and Speaking Abilities of Chinese University Intermediate Level English Students*. (Unpublished Ph.D. Thesis). University of Exeter.
- Livingston, E. M., Siegel, L. S., and Ribary, U. 2018. Developmental dyslexia: Emotional impact and consequences. *Australian Journal of Learning Difficulties* 23(2): 1- 30.
- Lyon, G. R., Shaywitz, S. E., and Shaywitz, B. A. 2003. A definition of dyslexia. *Annals of dyslexia*, 53(1): 1-14.
- Malik, T. A., Mufti, S., and Akhtar, P. 2013. Screening for dyslexia among school children of Allama Iqbal Colony Rawalpindi. *Pakistan Armed Forces Medical Journal* 3(3): 93-99.
- Martindale, P., Whitfield, D., and Jeremiah, D. 2016. Structural evaluations of bridges with smartphones. *UCARE Research* 1-9.
- Mayer, R. 2005. Cognitive theory of multimedia learning. In R. Mayer (Ed.), *The Cambridge Handbook of Multimedia Learning* (pp. 31–48). New York, NY: Cambridge University Press.
- Mayer, R. E. 2005. Cognitive theory of multimedia learning. In *Cambridge handbooks in psychology*, ed. R. E. Mayer. *The Cambridge handbook of multimedia learning* (p. 43–

- 71). Cambridge University Press.
- Ministry of Federal Education and Professional Training Government of Pakistan. 2017. *National education policy 2017*.
- Molfese, P. J., Fletcher, J. M., and Denton, C. A. 2013. Adequate versus inadequate response to reading intervention: An event-related potentials assessment. *Developmental Neuropsychology* 38(8): 534–549.
- Muhammad, S. 2013. Second language reading instruction in Pakistan. *Procedia-Social and Behavioral Sciences* 70(1): 1403–1412.
- Naeem, F., Mahmood, Z. and Saleem, S. 2014. Dyslexia a myth or reality: Identification of dyslexia in school children of grade fourth and fifth. *FWU Journal of Social Sciences* 8(1): 1-9.
- Naik, N. 2017. Dual powerpoint presentation approach for students with special educational needs. *European Journal of Special Needs Education* 32(1): 146-152.
- Naz, F., and Habib, A. 2015. Cognitive failure, teacher's rejection and interpersonal relationship anxiety in children with dyslexia. *Pakistan Journal of Medical Sciences* 31(3): 662-666.
- Norris, M., Hammond, J., Williams, A., and Walker, S. 2019. Students with specific learning disabilities' experiences of pre-registration physiotherapy education: A qualitative study. *BMC Medical Education* 20(1): 27-39.
- Paivio, A. 1991. Dual coding theory: Retrospect and current status. *Canadian Journal of Psychology/Revue canadienne de psychologie* 45(3): 255–287.
- Perea, M., Panadero, V., Moret-Tatay, C., and Gómez, P. 2012. The effects of inter-letter spacing in visual-word recognition: evidence with young normal readers and developmental dyslexics. *Learning and Instruction* 22(6): 420–430.
- Rahimi, A. 2015. The impact of CALL on Iranian EFL learners' autonomy. *Procedia - Social and Behavioral Sciences* 644-649.
- Rehman, N. and Arif, R. 2006. Relationship between mental health and parent-child relationship. *Journal of psychology* 14-23.
- Reynolds, M., Wheldall, K., and Madelaine, A. 2011. What recent reviews tell us about the efficacy of reading interventions for struggling readers in the early years of schooling. *International Journal of Disability, Development and Education* 58(3): 257–286.
- Seifi, P. 2015. Language policy in multilingual and multicultural Pakistan. *Advances in Social Sciences Research Journal* 2(3): 32–37.
- Siegel, L. 2012. Confessions and reflections of the black sheep of the learning disabilities field. *Australian Journal of Learning Difficulties* 17(2): 63-77.
- Skues, J. L., and Cunningham, E. G. 2011. A contemporary review of the definition, prevalence, identification and support of learning disabilities in Australian schools. *Australian Journal of Learning Difficulties* 16(2): 159-180.
- Slavin, R., Cynthia, L., Susan, D. and Nancy, A. 2011. effective programs for struggling readers: A best-evidence synthesis. *Educational Research Review* 6(1): 1-2.
- Smith, C. 2013. Improving reading skills for dyslexic students in the English classroom. *Examensarbete*, 1-41.

- Smith, E., H. 2018. CALL (Computer-Assisted Language Learning) materials development. In Liontas, I. M, DelliCarpini, M. (Eds.) *The TESOL Encyclopedia of English Language Teaching*. Milton, Australia: John Wiley & Sons.
- Stark, H. L., Snow, P. C., Eadie, P. A., and Goldfeld, S. R. 2016. Language and reading instruction in early years' classrooms: The knowledge and self-rated ability of Australian teachers. *Annals of Dyslexia* 66(1): 28–54.
- Sun, S. Y. H. 2017. Design for CALL – possible synergies between CALL and design for learning. *Computer Assisted Language Learning* 30(6): 575-599.
- Tabassum, M. and Parveen, S. 2013. A study on perceptions of EFL teachers on efficacy of CALL in Pakistan. *Language in India* 13(6): 631-641.
- Tariq, R., and Latif, S. 2015. Designing an assistive learning aid for writing acquisition: A challenge for children with dyslexia. *Assistive Technology* 217(1): 180-190.
- Tariq, R., and Latif, S. 2016. A mobile application to improve learning performance of dyslexic children with writing difficulties. *Educational Technology & Society* 19(4): 151–166.
- Tariq, S. and Naz, S. 2017. Assessing the impact of Pakistan Early Learning System (PELS) Urdu alphabet learning in children with hearing impairment using computer assisted web based program. *Annals of PIMS* 13(1): 99-102.
- Teevno, R. A., and Raisani, R. B. 2017. English reading strategies and their impact on students' performance in reading comprehension. *Journal of Education & Social Sciences* 5(2): 152-166.
- Tobia, V. and Marzocchi, GM. 2014. Predictors of reading fluency in Italian orthography: Evidence from a cross-sectional study of primary school students. *Child Neuropsychology* 20(4): 449-69.
- Tomlinson, B. 2012. Materials development for language learning and teaching. *Language Teaching* 45(2): 143-179.
- Trautmann, M. 2014. A Neuro constructivistic research strategy to study the underlying causes of dyslexia. *Translational Developmental Psychiatry* 2(1): 1-4.
- Waheed, S. 2012. *The Development and Efficacy of CALL Materials at Graduation Level in Pakistan*. (Unpublished M. Phil Thesis). GC University, Faisalabad.
- White, H., and Sabarwal, S. 2014. *Quasi-experimental design and methods, methodological briefs*: UNICEF office of research, Florence