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Dyslexic Arabic Students in the Arab Countries: A Systematic Review of Assistive Technology Progress and Recommendations

Abstract

Dyslexia is quite possibly the most widely recognized learning troubles. Literacy is a critical life skill; low literacy skills inhibit educational advancement. Even a few dyslexic students may affect the broad educational experience of all students. Unfortunately, dyslexia is a relatively unknown phenomenon in Arabic academic communities. Arab countries are experiencing a rapid increase in dyslexic students; consequently, there is an urgent need to investigate dyslexia and its associated student assistive technology (AT). A systematic review was conducted on AT developed for dyslexic Arabic students to understand AT's benefits and challenges. Our research found that in addition to learning strategies, several other factors contributed to the adoption (or lack thereof) of AT in Arab classrooms, including environmental, social and cultural factors. This study's findings can assist AT developers and educational policymakers in efficiently designing and implementing AT.

Keywords: Dyslexia, Students, Arab Countries, Assistive Technology, Education.

Introduction

Reading well is a critical skill that supports all future learning regardless of discipline. Students with untreated dyslexia will struggle to perform well at school or in a future career. Reading teaches communicative skills that are fundamental importance to the learner's development, both in school and in the community (Dawson, Antonenko, Lane, & Zhu, 2019). However, dyslexia is a broad term with a basis in culture, medicine, psychology, education, linguistics and technology. Dyslexia is a neurological disease related to difficulties in reading, working memory, spelling and writing (Al Rowais, Wald, & Wills, 2013). People mistake dyslexia and think that those who are affected have impaired intelligence and vision, too, which is not the case. The centrally is correct.

Dyslexia in Arabic orthographies is not quite the same as dyslexia in English; unfortunately, few studies exist that address dyslexia, AT and the specific challenges inherent in the complex Arabic language. Today, AT helps dyslexic readers achieve independence and productivity, in turn helping them surmount challenges such as slow reading or note-taking (Caute et al., 2018).

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For dyslexic students, AT presents an opportunity to establish their knowledge in ways formerly inconceivable. Different factors in Arabic could be considered to indicate dyslexia among Arabic people.

Some numerous signs and symptoms are related with dyslexia, and they may be separated into three groups, that is: earlier school, school age, and teenage. A young kid may start viewing signs of dyslexia, particularly when they exceed the period when they are supposed to begin talking. However, some of the symptoms noticeable at this age are; late talking, being slow in learning new words, having problems in identifying and properly forming new words, especially in terms that sound alike. Again, these young children develop problems in recalling and naming numbers, letters, and colors. They also possess(have) trouble in learning playgroup rhymes and playing games of running words.

Key to understanding how to help dyslexic students is increasing the amount of research around AT in Arab countries (AC). Such research is vital to investigate the currently developed AT and what factors to consider in future design and evaluation. This study's findings can add to the recent development of AT adoption in AC and provide relevant recommendations for AT developers and educational policymakers. This paper is organised as follows: Section 2 introduce the methodology as well as how the review was planned and executed. Section 3 displays the study's findings. Section 4 discusses the study's findings, and Section 5 concludes the study.

Methodology

This review employed PRISMA methodology to investigate the answer the two research questions. 1) What is the recent development in implementing assistive technology across AC? and 2) What are the recommendations for designers, developers and instructional policy makers concerning the utilize of assistive technology in AC? The systematic review process consisted of four phases: The identification phase, the screening phase, eligibility and inclusion criteria phase. In the identification phase, we searched and collected the related articles using online databases searching. In the screening phase, we taken out the duplications of articles and recognized the number of articles. In the eligibility phase, we evaluated and omitted articles that do not meet the pivotal point of this study. Finally, the inclusion phase was directed to involve articles for the final analysis.

1) Search Strategy

PRISMA methodology was employed for a systematic review. Five databases were searched to find out the answers of research questions above. Springer, google scholar, PubMed, SAGE and IEEE. The first step was to find articles on assistive technology within AC. The references in each chosen article were also searched and checked to collect more related articles. Typical words were employed during the search process to retrieve associated papers involved 'Assistive technology' OR 'dyslexic' OR 'reading disabilities' OR 'Acceptance' and 'Adoption' AND 'Arab countries' (including Egypt, Kingdom of Saudi Arabia, Tunisia, Morocco, Kuwait, Lebanon, Sudan, Algeria, United Arab Emirates, Jordan, Qatar, Bahrain, Oman, Iraq, Syria, Yemen, Libya, Mauritania, Palestine, Somalia, Comoros and Djibouti). Searches were restricted to English language, peer-reviewed papers during the period January 2010 to June 2020. After this, inclusion and exclusion criteria were applied. Microsoft Excel used to analyze collected data. Figure 1 depicts the number of papers recognized in the systematic search.

- ***Eligibility Criteria***

The obtained articles associated to the study's emphasis on the development, design and adoption of AT were checked alongside inclusion and exclusion criteria.

- ***Inclusion Criteria***

Studies were conducted in the AC and All ages of participants have Dyslexia were included and use any category of assistive technology related to educational results. Studies in English language which are quantitative, qualitative, mixed methods and published in peer-reviewed journals published between January 2010– June 2020.

2) Exclusion Criteria

studies conducted at non-AC. verbal presentations, policy summarized, explanation, study records, and declarations and reports form a non-governmental association and communities. Also, papers published other than English and before January 2010 or after June 2020. The primary search recorded in 234

articles, without including the inclusion and exclusion criteria. The primary review of obtained articles resulted in the removal of 127 duplicates. This resulted in 46 articles. Next screening phase employed to assess the titles and abstracts of these articles, we additional removed 32 articles. The Full text articles the remaining 14 articles assessed for the inclusion and exclusion resulted in removing 4 articles that did not utilize or efficiently design, develop and discuss assistive technology in the Arab country. The total number of articles that achieve all the review criteria was 10. Out of these, 7 articles utilized quantitative method, 2 articles utilized qualitative method, and one article used a mixed-method design. Figure 1 illustrates the procedure of examining and collection prior studies.

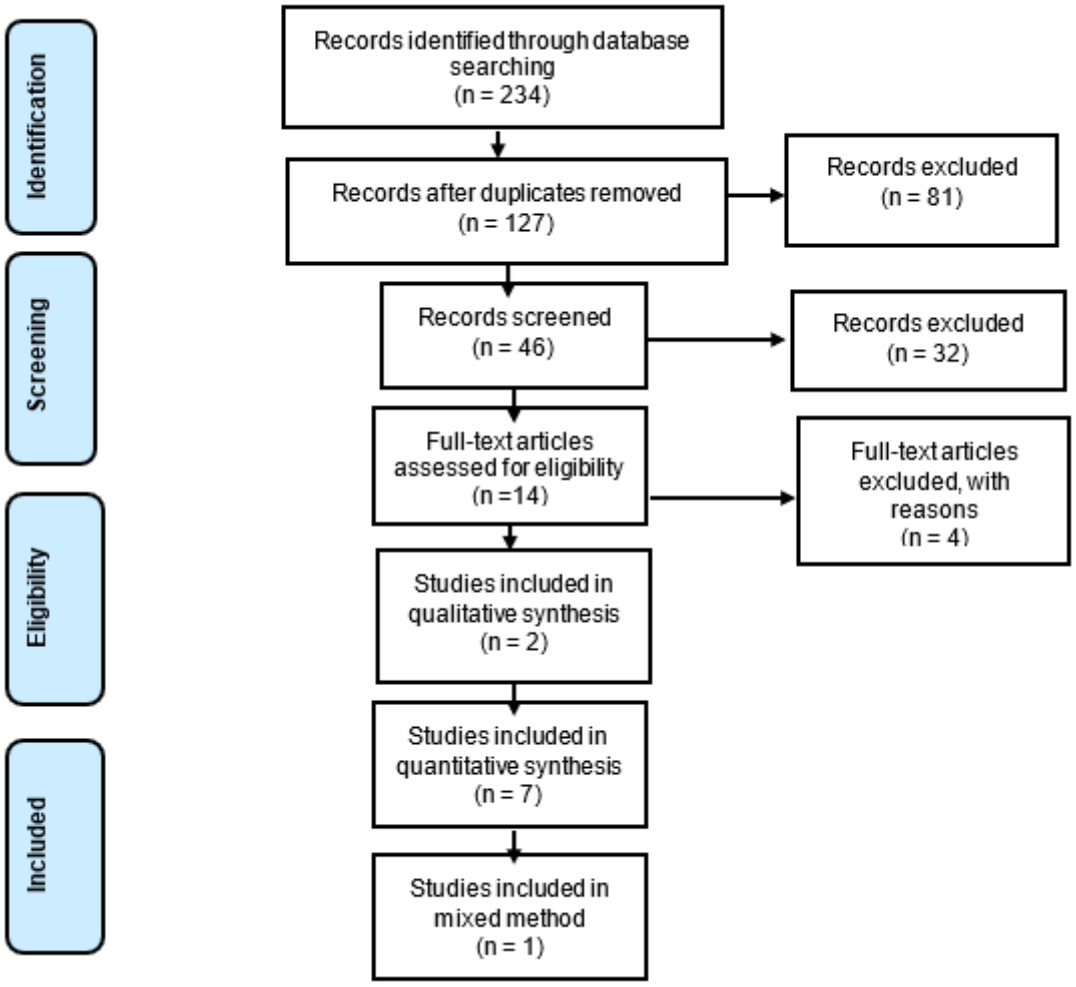

Fig. 1.
PRISMA phases

3) Coding Technique

1. Origin country of study: Studies carried out in AC.
2. Study design: Three categories of studies were measured in this review: qualitative, quantitative, and mixed-method.
3. Study Sample size: Studies that included small, (≤150), medium (>150 ≤ 250), and large. (>250) sample size.
4. Study Subjects: The sample in the designated studies was dyslexia students.

Results

The results section depicts a broad investigation and analysis of the results obtained. The first section deliberates the progress of design and use of AT across AC. The second section focus the light on the related policy

recommendations. The search of studies reported Ten studies were achieved inclusion criteria.

1) Progression in the Design and Utilize of Assistive Technology in AC

Since assistive technologies for dyslexia students were designed and adopted in various AC, we established to categorise the design and use of AT based on the country of origin (see Fig. 2). The purpose of this categorisation was to aid depict the main features concerning the development, design and use of AT in AC. Figure 2 depicts the main countries in the Arab world. The results depicted that there were 5 studies carried out on AT in Saudi Arabia, representing 50% of the overall studies. This was followed by Morocco with 2 studies, representing 20%. Followed by Jordan, Kuwait and Libya with 1 study each representing (10%). While the rest of the Arab countries have not registered any studies concerned with designing and developing AT for dyslexics' students, perhaps this is due to the lack of interest of the competent authorities in this category of students, as well as to economic and technical factors. The speedy growth in designing and using AT in some of these countries especially Saudi Arabia can be related to existing development in communication and technology and rise the number of dyslexia people. The key features obtained in previous studies concerning the design and use of AT in AC were commonly associated with difficulties of finding suitable user interface design meet the dyslexia students' needs especially when students are in an elementary stage in the schools.

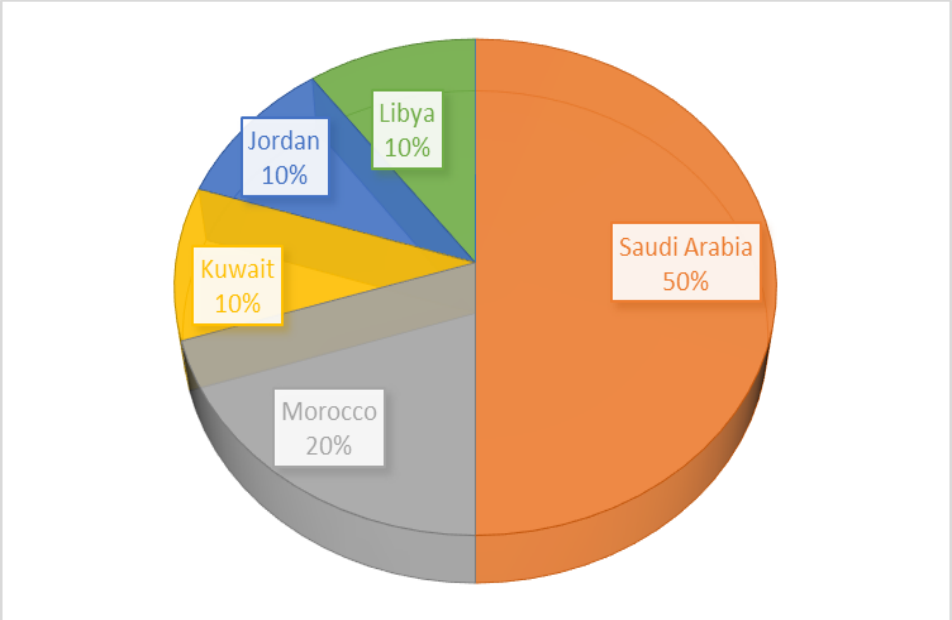

Fig. 2.
Progression of assistive technology utilize in AC

2) Recommendations for Educational Policy Makers

After revising the prior articles, some recommendations were depicted. First, more detailed studies are required to various cultural and social influences in AT design. Second, more consideration is required concerning the effect of environmental influences and singular variances and preference for specific learning styles which may affect to variance efficiency when using AT in a learning situation. Third, there is a necessity to deliver a deep vision regarding the influence of AT on dyslexic students' efficiency by considering a diversity of arithmetical analysis approaches to define the implication of factors and models influencing dyslexic students utilize of AT in AC. Fourth, there is a need to explore and link AT design with Multimedia cognitive theories that students involve in while learning.

Discussion

This study is the first to indicate the current evidence on progress of AT in the Arab countries. The AT developed has demonstrated dyslexia students' improvement in reading, educational

tasks, materials and learning. The result drawn from the systematic review showed the important role of AT in improvement students' reading skills. In addition, the results depicted a lack of experimental research in the field for evaluation carried out across AT in AC. The findings of the study also, indicated that AT studies were commonly placed around Saudi Arabia, followed by Morocco. This can be due to the government's interest in this category of people and the spread of centres that deal with this category of society. Other countries, such as Jordan, Libya and Kuwait depicted the lowest number of studies, while the rest of Arab countries not recorded any studies. Cultural variances and individual's differences were also stated in the prior studies to prevent the spread and utilize of AT in the AC. As stated by Alsswey, Al-Samarraie, El-Qirem, Alzahrani, and Alfarraj (2020), Arab cultural variances play an important role in the acceptance and utilization of technology in the Arab countries. The findings also, depicted that there is a lack in employing learning strategic approaches such as the cognitive theory of multimedia despite these strategies have presented some success in enhancing learning effects for dyslexia learners as reported by Hattie and Donoghue (2016) and Setiyadi (2016) studies.

In our review, the results showed that AT utilize also diverse broadly with some papers concentrating on a particular category of AT such as user interface, while others described on a diversity of different AT was used. The results obtained also, showed the sample size of studies diverse across studies ranging from 6 to 28 participants. All papers concentrated on singular category of diagnoses.

Moreover, some of the studies such as Al-Wabil, Dhir, Al-Musaaed, and Al-Sheaha (2012), Muftah and Altaboli (2020) found that considering visual aspects in AT design was not only increases performance for dyslexic users and enhance their learning abilities but also to users without disabilities therefor a common design for the learning process with individual AT requires to exploit the benefits for all users, therefore, the future research should navigate and consider the factors combined individual AT requirements with a universal design for the learning process. This result is in line with Hub (2018) and Messinger-Willman and Marino (2010) studies. Also, it was viewed, AT designed based on users, requirements enhance performance of educational tasks such as Benmarrakchi, El Kafi, Elhore, and Haie (2017) and Taileb, Al-Saggaf, Al-Ghamdi, Al-Zebaidi, and Al-Sahafi (2013). In conclusion, this systematic review depicts the AT developed progress in the Arab countries for dyslexia students. AT designers and developers should be aware of students needs to utilize more applications and systems to meet their AT needs. This gives a chance to dyslexia students of AT to promote the benefits of AT which influence positively on their lives.

Conclusion

Exploring and understanding the existing progress of using AT in AC can show a vital influence in its achievement. This systematic review reviewed studies published from the year 2010 to 2020 in the AC (Table 1). A total of 10 research studies were investigated and analyzed with the mainstream of studies carried out in Saudi Arabia. The study found that AT can encourage educational skills for dyslexia students. This study recommended AT developers and designers should consider some certain factors in AT design, that can hinder the impact of AT use and effect of engaging students.

Table 1.

Summary of the reviewed studies

	Author	Country	Study design	Sample size	Assistive technology	Findings
1	Al-Wabil, El Gibreen	Saudi Arabia	Mixed method	n/a	Online Multimedia Language Assistant for	Involving interaction elements in system design such as Audio, video and animation enhance the accessibility of users.

2	Al-Wabil, Dhir	Saudi Arabia	Quantitative	n/a	Arabic-Speaking	Involving interaction context, cultural aspects in system design is vital for guaranteeing to accept the designed system.
3	Al-Edaily, Al-Wabil	Saudi Arabia	Quantitative	14	Interactive user interface	Designing interfaces that are natural and reachable for individuals with learning disabilities would enable access to a broader population of children
4	Taileb, Al-Saggaf	Saudi Arabia	Qualitative	28	Screening system	Including appropriate and suitable environmental aspects in application design for the dyslexic Childs encourage the interaction with the application
5	El Kah and Lakhouaja	Morocco	Quantitative	46	Automatic speech recognition software	Including learning theories in the systems design improves the learning process.
6	Benmarrakchi, El Kafi	Morocco	Quantitative	28	Educative games	Considering students preferred learning style reflects positively on their learning process, adopt technology and enhance motivation and achievement
7	Alghabban, Salama	Saudi Arabia	Qualitative	28	Adaptive m-learning	Modifying user multimodal functionality to encounter students learning requirements improves the learning skills
8	Aldabaybah and Jusoh	Jordan	Quantitative	6	Adaptive system	Considering a set of usability features and design aspects related to the use could enhance the adopting of system.
9	Al-Ghurair	Kuwait	Quantitative	21	Interactive, multimodal interface	Involving interaction content in UI design enhance the learning abilities of dyslexic children by increasing their short-term memory.
10	Muftah and Altaboli	Libya	Quantitative	16	User interface	Considering adding visual content in user interface design such as icons increases performance for dyslexic users.

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Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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