

Challenges Faced by Visually Impaired Students in Writing with Lack of Assistive Technology

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Introduction

The term “Learning Disability” (LD) expresses a set of disorders that affect the individuals’ ability to listen, read, write, speak, or perform mathematic tasks. Ramaa (1992) defines LD as difficulties that affect one’s ability to learn. These limitations are due to mental retardation, known or unknown disorders, or delayed development of certain skills that occur before the developmental period. Most often, LD falls into three broad categories: (a) Reading disabilities (dyslexia), (b) Writing disabilities (dysgraphia), and (C) Math disabilities (dyscalculia) (Ramaa, 1992).

In a similar vein, visual impairment (VI) affects the learning process. This impact results in a dramatic sight loss, in turn, influences the learners’ literacy skills. However, using “Assistive Technology” (AT) technology can help students with visual impairments (SVI) meet their educational needs. Accordingly, AT represents a new requisite to integrate for both learners and teachers (Kelker, 1997). Hence, AT can compensate for a students’ limitations in improving their writing skills (Bryant & Bryant, 1998; Forgrave, 2002; Lewis & Lewis, 1998; Martinez-Marrero & Estrada-Hernandez, 2008; Raskind & Higgins, 1998).

In education, SVI often read and write using the Braille system as a mediator. Thus, they use it as a tool to access information for communication (Williamson et al., 2000). Nevertheless, it is not a guarantee for efficient writing ability. This situation requires an adaptation of educational tools such as AT. In this study, SVI from El-Oued University utilizes the conventional method of Braille with the slate and stylus. Hence, the lack of AT resources may result in critical difficulties, which may affect the writing skills.

This study highlights the significance of using AT to enhance the writing skills. Then, this accommodation would help SVI to meet their educational needs. Besides, this study shows the major barriers that hinder VI learners in writing when they lack AT devices.



Literature Review

The Writing Skills and Learning Disabilities

According to the World Health Organization (WHO, 2011), nearly 785 million (15.6%) of the world population ranging from the age of 15 years old and above have disabilities. Furthermore, more than one hundred million of them need help (WHO, 2011, p. 261). In education, this assistance is necessary to support and guide learners with LD, which affects the writing skills.

Accordingly, mastering these skills offers several benefits. According to Magrath, Ackerman, Branch, Clinton Bristow, Shade, and Elliott (2003), these benefits include: (a) successful educational inclusion where learners with LD compete with their fully able peers. Besides, (b) enhancing their literacy skills, and (c) pass rates on high-stakes academic testing (Magrath et al., 2003). Consequently, the writing skill is a strong indicator of educational success (Graham & Perin, 2007). Moreover, learners can develop thinking skills (The National Writing Project & Nagin, 2006).

First, transcription skills include illegibility of handwriting, spelling, punctuation, and grammar errors. Berninger, Fuller, and Whitaker (1996) state that transcription is the “process of transforming the words writers want to say into written symbols” (Baker, Gersten, & Graham, 2003). For students with dysgraphia, transcription difficulties result from the mechanical nature of writing skills (Baker et al., 2003). Handwriting, for example, is less legible than their counterparts without dysgraphia. This issue causes a slow rate in writing speed (50% compared with their peers), the frequent misspelling of words, and illegibility of written composition (Baker et al., 2003; MacArthur & Graham, 1987; Weintraub & Graham, 1998). Furthermore, Weintraub and Graham (1998) state that learners with dysgraphia face difficulties with capitalization, and punctuation as well as the structure of sentences (Saddler & Graham, 2005).

Second, Schumaker and Deshler (2003), view that the writing process including planning, organizing, and revising thoughts to communicate meaning adequately are critical challenges for students with LD. The authors state that these difficulties arise from certain aspects as follows (Schumaker & Deschler, 2003):

- a. *Generating coherent content*: Learners with LD generate ideas orally, but they often do not devote enough time for the planning stage to produce coherent content. The main reason behind this is the learners’ awareness because they underestimate the importance of the pre-writing phase. Consequently, they do not know how to behave with the time allotted for planning.
- b. *Organizing compositional structures*: Students with dysgraphia often begin their writing tasks with what comes to mind, or what they can easily remember. Because of this, they repeat short and straightforward sentences such as run-on sentences.
- c. *Revising the written text*: When learners revise their written composition, they focus on the extensive correction of punctuation, grammar, and spelling mistakes rather than the core content of their composition.
- d. *Understanding the goal behind written tasks*: Students may feel writing is a matter of a question that requires a specific answer. Therefore, they do a little effort in preparing to communicate meaning adequately.

Although impairment of vision, hearing, or motor development may not be the reason behind these difficulties, they can complicate, to some extent, writing challenges.

Visual Impairments and Writing

In the area of LD, visual impairment (VI) is more than a sensory disability. The term “visual impairment” refers to the loss of vision that ranges from low vision to blindness. On the one hand, low vision cannot be corrected even with medical interventions such as eyeglasses. On the other hand,

blindness occurs when a person has no light perception. In education, the Braille material represents the main tool, which students with visual impairment (SVI) mainly rely on for reading and writing (Mastropieri & Scruggs, 2017).

For VI learners, Braille equipment using the slate and stylus is a key tool for writing tasks (Figure 1). Freedman (1999) states that the term “Braille” refers to a worldwide-recognized system for reading and writing. This system consists of raised dots, which represent the alphabet letters, punctuation marks, numbers, and provide symbols to show their grouping. The basic unit of Braille is so-called the “Braille cell”. It consists of two columns of three dots for each. These dots are numbered from 1 to 6 (Freedman, 1999). To illustrate this system, Figure 2 shows a representation of the standard Braille cell with numbered dots.

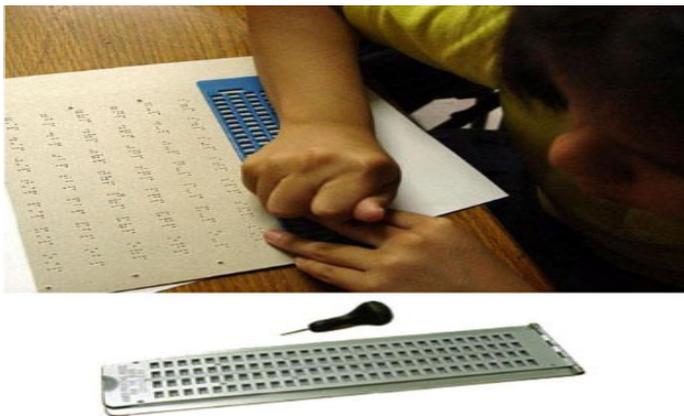


Figure 1. A Braille slate and stylus. (Source: Special Education Technology British Columbia, 2008, p. 10)

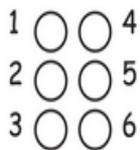


Figure 2. A standard Braille cell. (Source: Swenson & D’Andrea, 2002, p. 2)

Furthermore, the individual dots in the Braille cell can be combined in 63 different manners where each Braille cell represents one of the alphabet letters, or characters (Freedman, 1999). Thus, Figure 3 provides a representation of the English Braille alphabets.

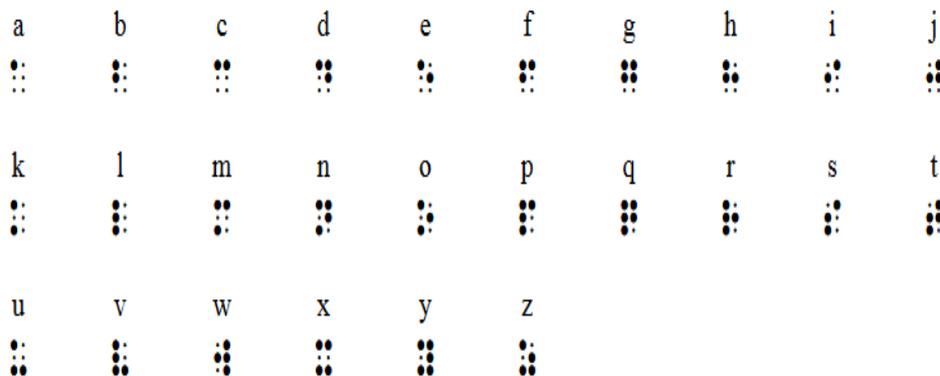


Figure 3. The English Braille alphabets. (Source: Risjord, Wilkinson, & Stark, 2000, pp. 1-3)

Unfortunately, the nature of the writing skills itself is one of the challenges that SVI experience. For instance, their slow writing speed is challenging for accomplishing writing tasks. This situation is due to the delayed motor skills development, which in turn influences the mechanical nature of handwriting using the Braille system. A student with low vision, for example, needs to grab their hand accurately when they write (Tulumović, Eškirović, & Husić-Džuzić, 2017). Another challenge is their poor spelling performance due to limited grammar knowledge (Tulumović & Huremović, 2012). These difficulties result from a disorder in spatial orientation, the structure of letters or words, visual perception capacity, and the lack of visual memory (Tulumović et al., 2017).

Assistive Technology for Writing

According to the National Council of Teachers of English (NCTE), technology integration enables creative writing by providing new sources to experience information (NCTE, 2004). Therefore, technology can change the nature of writing using new electronic tools, which involve a combination of media such as images, print, video, and sound (NCTE, 2004). These technologies do not replace good writing skills, but they can be utilized for students with dysgraphia (The National Writing Project & Nagin, 2006). In this light, integrating AT can provide an alternative solution to address writing difficulties.

The legal definition of assistive technology (AT) relates to the publication of the Technology-Related Assistance for Individuals with Disabilities Act of 1988 (the Tech Act of 1998). This act defines the term “assistive technology” as “any item, piece of equipment, or product system, whether acquired commercially, off the shelf, modified or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities” (The Assistive Technology Act, 1998, p. 6).

This act reveals that AT is any type of adaptive device or service that can enhance and promote functional abilities, especially for persons with disabilities. AT also refers to technologies or applications (hardware or software) that specifically aim to provide independence for people with disabilities and then reduces the need for formal assistance from other persons (Forgrave, 2002; Rose, 2000).

Additionally, AT has three main types: (a) No-tech, (b) Low-tech (c), and High-tech. First, No-tech assistive technologies refer to the use of non-electronic using strategies that provide an opportunity for learners instead of technology such as colored folders. Second, Low-tech assistive technology indicates using straightforward and inexpensive tools such as pencil grips and calculators. Third, High-tech assistive technology refers to sophisticated and expensive computer components such as specialized software and advanced hardware devices (Coleman, 2011; Floyd et al., 2008; Poel, 2007). In this context, Figure 4 presents some examples of AT devices for students with disabilities.

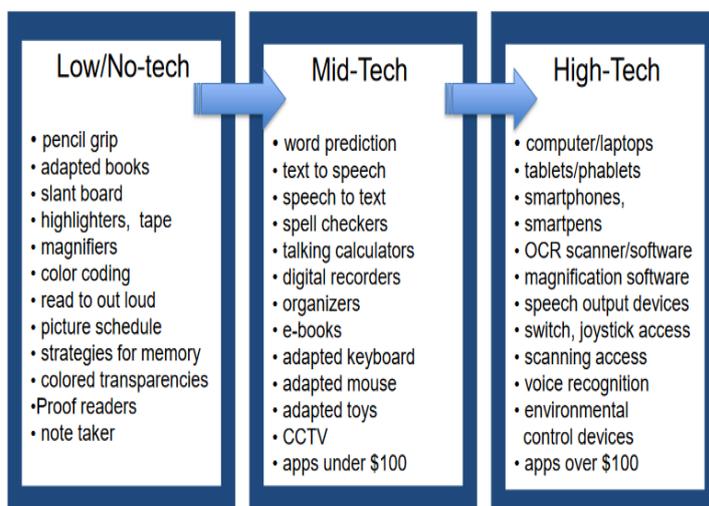


Figure 4. An illustration for AT tools for writing. (Source: Phillips, 2015, p. 9).

In the areas of writing, there is a wide range of AT tools. Braille Notetaker is one of the recommended Braille displays to use for writing by SVI (Figure 5).



Figure 5. A Braille notetaker. (Source: Special Education Technology British Columbia, 2008, p. 17).

In sum, the need to improve writing skills for learners with disabilities in general and VIS, in particular, is a significant issue. In this vein, using AT devices can help SVI to convey their knowledge effectively and proactively (National Commission on Writing, 2006; National Writing Project & Nagin, 2006; Graham & Perin, 2007).

Method

This study adopts a quantitative design. Accordingly, a questionnaire was administered by distance communication with six visually impaired students (VIS). The VIS participants represent a purposive sample. The reason behind this choice results from the need to clarify the nature of writing difficulties that SVI experience when they lack AT tools. In this study, the six visually impaired students (n = 6) are the focus of this study, in which there are four blind learners (n = 4), and two students with low vision (n = 2). All of them were enrolled in the LMD system (License, Master, and Doctorate) in the academic year 2018-2019 at El-Oued University in Algeria.

The questionnaire represents the data collection tool for this study. This questionnaire consists of two sections with ten items. The first section includes four items about the personal, academic, and medical information of the SVI participants (Table 1).

TABLE 1
 Summary of Participants' Demographic Data (Section 1)

| Participant No. | Age | Gender | Educational Level | VI Level |
|-----------------|-----|--------|-------------------|------------|
| P1 | 23 | F | Postgraduate | Blind |
| P2 | 29 | M | Undergraduate | Blind |
| P3 | 20 | F | Undergraduate | Blind |
| P4 | 21 | M | Undergraduate | Blind |
| P5 | 21 | M | Undergraduate | Low Vision |
| P6 | 20 | M | Undergraduate | Low vision |

Note. P = Participant, F = Female, M = Male, VI = Visual Impairment.

While the second section of this questionnaire estimates the frequencies of the major writing difficulties that the SVI face with regards to a lack of AT. This section (Table 2) consists of six items

with three multiple-choice options to answer (*Yes*, *No*, and *To Some Extent*). For this purpose, this study used SPSS-26v (version 26) software for analyzing the results.

First, the telephone numbers of the six (06) SVI have been collected with the help of a dedicated VI learner from the sample. Then, the participants invited to participate through phone calls to share their views. They had 15 to 20 minutes to answer the questionnaire orally. Besides, this study has assured the anonymity of the six visually impaired students.

Results

The results in Table 2 demonstrate that the respondents' answers are homogeneous. Accordingly, 60% of the respondents emphasize that they use Braille equipment as the primary resource for writing tasks. This result is not surprising because the SVI use the slate and stylus and Braille papers. This confirms that the Braille equipment is often the available tool, which they can access. Under this, they are not familiar with digital Braille devices such as the Braille Notetaker.

TABLE 2
Frequency Distribution of Responses (Section 2):

| Questions | Responses | | |
|---|-----------|-------|----------------|
| | Yes | No | To Some Extent |
| Do you use Braille as your prime tool for writing? | 60.0% | 20.0% | 20.0% |
| Do you encounter difficulties with writing by Braille under dictation? | 60.0% | 20.0% | 20.0% |
| Do you face challenges with taking notes during your lectures? | 80.0% | 00.0% | 20.0% |
| Are you allowed to use any other technology tools for writing your tasks? | 00.0% | 80.0% | 20.0% |
| Are you allowed to use any other technology tool for writing your tasks? | 80.0% | 00.0% | 20.0% |
| Do you get any help from others for writing your assignments? | 80.0% | 00.0% | 20.0% |

While 60% of the participants also agree that transforming an oral text into a written Braille text is a challenging task. This is because the nature of writing mechanisms using the Braille system is not relevant to the writing system of sighted learners. This issue makes the transcription skills a major undertaking issue instead of a sequential step.

80% of the respondents stated that they get support from their sighted peers to be an assistant writer. This help is not usually available to them. Unfortunately, their sighted counterparts often neither have a background of the requirements of the Braille writing system nor use it. Moreover, more than two-thirds of the respondents (80%) face challenges to take notes during lectures because the use of slate and stylus is time consuming. Therefore, they are slower than their sighted counterparts.

Additionally, the lack of accessibility to the use of assistive technologies is another critical concern. The results confirm that a large number of participants (80%) do not use any type of Mid-tech or High-tech AT devices for writing. However, technologies such as AT applications on smartphones (software), for some, are not familiar to them. This result reveals that the VI learners have limited knowledge about the available AT hardware as well as software for the writing skills.

Furthermore, the lack of training to use AT tools represents an interesting result. Hence, most of the visually impaired learners (80%) are unprepared to use AT because they do not receive the appropriate training to use AT for writing.

Discussion

This study highlighted the need to address the writing challenges that SVI experience in light of the lack of AT. These adaptive technologies are not necessarily a guarantee for efficient writing, but it can enhance writing skills. The results indicate that the slate and stylus are the most available tools that the

respondents from El-Oued University use for writing. However, these tools are one of the AT devices; they represent the low-tech adaptive tools.

Another interesting challenge is the nature of the educational setting. In this study, El-Oued University represents inclusive education, in which the SVI study side by side with their sighted counterparts. This results in crucial issues at the level of writing skills. First, the conventional method of the Braille writing system does not often present an alternative solution because this method decreases the rate of the writing speed. Then, SVI devote more time to perform a written task or to take notes. These findings reveal that it is not because of the nature of the Braille system itself, but because using slate and stylus is a conventional method, which significantly reduces the speed of the SVI in the writing skills. Second, the data here show that the VI learners who use the slate and stylus tend to make more errors in spelling under dictation using the Braille writing system. This is because of the lack of using the appropriate adaptive technology tool for SVI deprives them of the opportunity to improve their writing skills. Unfortunately, this results in limited access to use these educational resources. Consequently, students with LD are unable to improve their academic achievement (Mwakyjeja, 2013).

Furthermore, the issue of the lack of AT devices for visually impaired learners is almost due to the absence of clear policies in the University of El-Oued that should meet the educational needs of SVI. Therefore, the lack of such formulation and legal procedures leads to the marginalization of integrating these adaptive technologies. This factor affects the ability of VIS because they should ask for help everywhere from their sighted peers to get assistance for accomplishing their writing tasks or assignments. This need is often difficult to meet because their sighted counterparts often have not good competence in the Braille writing system or full readiness to coordinate with them.

Besides, the limitation of VI learners' knowledge in terms of the requirements of effective writing results from their limited visual ability that, in turn, results in difficulties to improve their academic achievement. In this vein, the need to acquire adequate knowledge is one of the major challenges that VI learners experience during writing (Mwakyjeja, 2013). With these considerations, this study shows that the lack of using assistive technologies, as educational tools, is one of the main reasons behind these challenges. As such, it is important to recognize that these data could not draw firm conclusions about all aspects of writing challenges faced by visually impaired learners at El-Oued University.

Conclusion

This study showed that the challenges that visually impaired learners experience in writing do not necessarily result from their visual deficits. Nevertheless, their visual impairment can complicate their writing difficulties. Therefore, visual deficiency can affect the nature of writing skills. This impact is due to the limited ability of VI learners to communicate meaning in a typical manner of the writing system for their sighted counterparts. Consequently, they struggle to convey their knowledge by using the conventional method of writing using the Braille system (using a slate and stylus).

Interestingly, the technology revolution provides VI learners with the opportunity to overcome the difficulties that they may encounter while they write their assignments. In this light, assistive technology for students with visual impairment can help them enhance the efficiency of their writing performance. Furthermore, assistive technology can increase their legibility and the quality of their writing skills.

Consequently, we can conclude that El-OUED University has not a clear vision for adopting the use of AT, which can assist VI learners to improve their learning, especially writing skills. Thus, students with visual impairments still use a conventional method using the Braille system for writing using affordable devices such as a slate and stylus. This method is the only available one for them to write, but it is not a guarantee that enables them to write effectively. With these considerations, there is an urgent need for integrating these educational tools, which can improve the VI learners' writing achievement with minimal hindrance.

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