

## Multiple Literacies for Individuals who are Blind or with Visual Impairment: A Quantitative Comparison on Print, Braille, and Auditory Literacies

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Rec Date: April 24, 2017, Acc Date: Jun 8, 2017, Pub Date: Jun 12, 2017

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### Abstract

The use of Braille by individuals who are blind or with visual impairment (VI) is often referred to as default, although the social dynamics of this population is not always intimately entwined with Braille. This study is a quantitative comparison on Braille literacy and auditory literacy to investigate if these two forms of captured information are equivalent to each other. Fifteen college graduates between the ages of 22 and 55 participated in the study: 5 of them were blind or with VI and preferred the use of Braille to access text material; 5 of them were blind or with VI and preferred to process textual material through audition; and 5 of them were individuals without VI and preferred to access textual material through visual print. The results showed that there were no differences among the three groups in their recall of propositions from the texts based upon their preferred method of accessing print (Braille, audition, or print), or in their recall of propositions from the text after having listened to an auditory rendition of an equivalent text. When the scores on the two tasks were compared with each other for individuals, there were no differences for either group of individuals who were blind or with VI, but the group of individuals without VI did better on recalling propositions when they read as opposed to when they listened to the text. Empirical suggestions for a more inclusive definition of literacy are provided to empower individuals with blindness and VI as well as other disabilities.

**Keywords:** Visual impairment; Psychology; Anthropology; Child psychology

### Introduction

The discourse on literacy has been and remains complex. Historically, there is no one definition that can define literacy, or literacies, due to its fluidity [1-4] within different fields of studies such as history, sociology, anthropology, psychology, education, linguistics, and so on, each has its own definitions, interpretations, and beliefs as to how literacy or literacies should be defined. Identity, as a concept and as a lens through which to understand literate practices, has further complicated the discourse on literacy [5]. Can or should literacy or being literate mean different things for different people? For example, what about individuals who cannot see?

The majority of the reading research on children with visual impairment (VI) is on legally blind children who use Braille as their literacy medium [6]. Legal blindness is a level of VI for both children and adults, which has been defined by law to determine eligibility for benefits. It refers to a visual acuity of 20/200 or less in the better eye with the best possible correction, as measured on a Snellen vision chart, or a visual field of 20° or less [7]. Most children with blindness and VI have low vision and use vision for reading along with some tactile and auditory adaptations. Interestingly, based on the most comprehensive data available on legally blind children aged 0-21 in the United States, American Printing House for the Blind [8] reported only roughly 9% of them were Braille readers. What about the other

children? 27% of them were visual readers, 8% of them were auditory readers, 21% of them were pre-readers, and the highest percentage (34%) went to non-readers. American Printing House for the Blind uses the pre-reader label for children who are working on or toward a reading readiness level, including infants, preschoolers, or older students with reading potential. Non-readers are children who show no reading potential and do not fall in any of the other categories.

Consisted of 6-dot rectangle set, a Braille cell represents alphabets in a symbolic form just as print in representing language [9]. In Grade I Braille, each letter of a word is represented by a single configuration. In order to increase reading speed, many words and clusters of letters are represented by one or two tactile symbol(s) (i.e., contractions) in Grade II Braille. One would read Braille by using his/her fingers and write by a Braille writer. The development of Braille was seen as an innovation that would allow people with blindness and VI to have access to education, economy, and social well-being [10]. Braille was institutionalized and used widely within the North American education system in schools. For example, in order to legitimize the goals set by the no child left behind act (NCLB) in the United States, the Blind Student's Literacy Rights and Education Act was signed by the Governor of New York in 2000, which institutionalized the notion of Braille as the measuring factor of what it means to be literate for the blind. That is, a student who is blind or with VI has to be Braille-literate, and if not, other rigorous measures would have to take place to assist one's need. In 2006, the convention on the rights of person with disability (CRPD) further promoted access to information by using the Braille.

However, Braille is not practical for everyone with VI, particularly those who are legally blind. Children with VI often have delayed development in their fine motor and object manipulation skills [11] and approximately 60% of them have multiple disabilities including physical disabilities with motor control [12], which might lead to their difficulties and frustrations with tactile processing in Braille. Another challenge for Braille learners is that the Braille letter shapes are less distinctive than those in the Roman alphabet [9], which leads to the fact that tactual acuity of Braille is significantly lower than that of vision and can resemble blurred vision [13]. To obtain Braille reading readiness, children with VI need to engage in tactual discrimination and fine motor activities, which may take them longer to reach readiness for formal reading instruction, particularly compared with their peers without VI [14]. The third challenge for Braille learners is that the different encoding strategies and redundancy characteristics in Braille and print make the reading speed of Braille much slower comparing with that of print reading [13]. For example, the tactual input of Braille tends to be successive; whereas visual encoding of print may process several letters almost simultaneously because the perceptual span (i.e., the amount of information that can be acquired in one eye fixation) is estimated to be between 10 and 20 characters in reading print [15]. Furthermore, while print can be read even with parts of letters missing, there is little redundancy in the Braille orthography, which makes it harder to read and requires more attention to the letter recognition processes than print reading does [12,13].

Other than the tactical component of Braille, reading Braille is similar to reading print in terms of the similar factors affecting the reading time, for example, word length, word frequency, repetition, and semantic priming [13,16]. However, even with the use of contractions, experienced Braille readers read Braille for an average of 70-100 words per minute, which is significantly slower than readers without VI who generally read print for just under 300 words per minute [16]. Furthermore, based on a study with 30 adolescent Braille readers [17], it was found that the most significant factor in Braille reading speed was age of first exposure to Braille, which highlights the importance of learning Braille early.

Last, but not the least, in addition to the unique characteristics of Braille orthography, many other obstacles existed regarding the literacy experience of children with VI: there are less Braille materials available to Braille learners; many children with VI do not have any literacy experience until school age; due to lack of incidental learning, they tend to have less contact with written words; and because of slow reading speed, they read less extensively [9]. All of these difficulties inherent in acquiring literacy through the medium of Braille can be potential risk factors for literacy delays of children with VI. If print literacy, including Braille, is not accessible for everyone with VI, should it still be considered the golden standard of literacy for this population? That is, if individuals with VI cannot fully benefit from visual medium (i.e., standard or enlarged print) and there is inherent disadvantage of tactile medium (i.e., Braille), shouldn't we include other medium (i.e., auditory) in defining literacy?

Many researchers open up insights into what literacy means, particularly, if the definition of literacy fluctuates depending on the localized population, time, space and so on. For example, as a social anthropologist, Brian Street [18] brought forth local/indigenous literacy practices and skills in the discourse of literacy through his empirical research in Iran in the 1970s. His research solidified the theoretical discussions on the autonomous and ideological models of

literacy. The autonomous model of literacy is a universalized concept of literacy that is based on reading and writing, standardized curriculums, and structuralized programs that are governed by a given state. This model of literacy is strongly based on an ethnocentric view of what literacy is. The ideological model of literacy, on the other hand, involves bringing awareness to the mainstream education systems on local literacies and knowledge base. The ideological model of literacy takes in consideration all factors and influences of one's daily practices; it is based on the social, economic, political, cultural, religious and so on. This model of literacy, as demonstrated by Street in the discussion of Cheshmeh, is what enabled its villagers to grow into commercial literacy from Maktab literacy and into an economic growth that was not necessarily the same as in the plains villages.

The autonomous model of literacy has historical roots in the Enlightenment and the Industrial Revolution era, where print was the only available medium for providing, storing, and retrieving information. In America, literacy was institutionalized with the common school movement of the 1840s. People mandated a free elementary education that was accessible to everyone and financed by public funds. As time went on, reading and writing became skills that everyone needed to have. Eventually standardized testing was introduced in order to measure these skills. Standardization of the curriculum led to mass education models that were eventually introduced world-wide. All of this led to a deeper and wider acceptance of reading and writing as the literacy that would provide economic and social mobility. It was believed that the more educated people were, the more productive they could be, hence bringing up the economy of the country [19].

It is these notions that are institutionalized and implemented through numerous policies like the NCLB in the United States, which is an adequate example of an institutionalized autonomous model approach to literacy. It is evident that policymakers who devised the NCLB view literacy as a skill set unaffected by social, political, and economic influences and mainly focused on the cognitive skills [18,20-22] work on critical literacy also challenged the idea of defining literacy in service of the competitive marketplace. According to Freire, the brutal competition in capitalist societies means some individuals have to lose in order for others to win and the social inequity would exist forever. He believed that the dominant culture defines literacy and that reading and writing skills are accepted by the mainstream society as tools to reinforce social status. Minority groups have to passively accept the dominance of mainstream culture by learning their literacy in order to survive in the competition. "By reducing literacy to a 'neutral' set of reading and writing skills, literacy is defined apart from a social context and becomes, then, a content to be taught through authority structures whereby pupils learned the proper roles and identities they were to carry into the wider world" [23].

In today's digital world, the narrowly defined autonomous model of literacy faces the challenges from the emergence of new digital literacies that is plural in nature and enables complex way of accessing and utilizing information from multiple textual and symbolic sources [24]. In Paul and Wang's view, print literacy (i.e. reading and writing) is not the only road to the development of literacy. They connect the concept of being literate or the goal of literacy development with literate thought, which is the ability to think creatively, critically, logically, rationally, and reflectively on information presented in either a through-the-air mode or captured or preserved as in print, CD, or DVD. Instead of narrowly defined as the mechanic skills (i.e., reading and writing) involving typographic and chirographic materials, literacy

is defined broadly as all captured information. Thus, in order to maximally benefit from literacy, individuals in the information age need to have access to the information (i.e., the ability to decode information in various forms) and know how to interpret or utilize the information (i.e., manipulate and understand the processes to create messages and distribute them). They argue that print literacy is not a general, global change agent; rather, it is only one form of captured information, which can and does influence the way individuals think and use their memory processes. There are other forms of captured information, not involving print, such as the use of audiobooks (on CDs or DVDs) or the use of videobooks (i.e., signing books on DVDs). Whether these forms of captured information are equivalent to print is an open debate. If so, then they can also serve as external aids for thought and memory, and this would have enormous educational or instructional implications for children and adolescents, who struggle immensely with information presented in print [24-28].

Researchers and practitioners for individuals with VI have demonstrated through their work in narratives that there is a shift and demand in providing multimedia/computer literacy within the literacy discourse for this population. For example, Deborah Hartz [29,30], an English teacher at the Arizona School for the Blind in Tucson who taught English to students with blindness and VI, told a story of one of her students, Beth, who was blind and suffered from cerebral palsy.

Beth is maneuvering her wheelchair between several student desks and a printer table. She is heading for a computer equipped with voice output to take a test on a book she has finished.... Four years ago, she read Braille, as she describes it, "at about a kindergarten level." She had learned the contractions needed to read Braille, but her reading skills had not yet become automatic. After physical therapy and further Braille instruction, Beth is able to read seventh grade materials independently and eighth and ninth grade materials with the help of Franklin language master-a speaking, electronic dictionary....Over the weekend she logged onto several online databases using her home computer and screen reading software, JAWS (Job Access with Speech) for Windows. She downloaded the files for several books and accessed the material using her Braille note taking device. All of this was done independently, thanks to technology (p. 1).

This was an example of the learning choices that multiple literacies could offer. Even though Beth knew Braille, her advanced reading skills were made possible by other technological advancements, such as the Franklin dictionary and JAWS speech output. The computer technology acted as a tool in providing access to numerous online databases to enhance her reading choices. Hence, digital literacy can be beneficial to students with blindness or VI who have access to voice activation output and input programs [31].

Denise Robinson [32] conducted a Delphi study on literacy education for students with blindness and VI to "revolve around finding a solution to the blind's lack of access to the printed word" (p. 15). She provided an example of a fourth-grade student who was unwilling to learn Braille and do class work, though she showed interest in computers. Her teacher realized this and introduced her to a typing game through a voice output computer. The student's confidence grew, and her typing skills improved. She learned to type and was able to finish her class work on time. Her teachers began introducing her to Braille games to increase her reading skills. As the teacher investigated how to inspire a child to learn through using Braille, the teacher realized the power of technology as a tool to use in educating the student. Thus, the computer became a catalyst in achieving literacy at least for this child and possibly other children in

the future. Based on this anecdote, Robinson suggested that the systematic attempt to determine the needs of learners, where problems with student learning may be adjusted at the beginning of lessons, would be beneficial for students with blindness and VI.

One of the major challenges for parents and teachers of young children with VI is to determine the most effective literacy medium or media for each individual child: Braille, print, or both (i.e., dual media) [12,33]. Such a decision typically is made based on a series of data-driven and ongoing learning media assessment (LMA) as required by The Individuals with Disabilities Education Act of 2004:

In the case of a child who is blind or visual impaired, provide for instruction in Braille and the use of Braille unless the IEP Team determines, after an evaluation of the child's reading and writing skills, needs, and appropriate reading and writing media (including an evaluation of the child's future needs for instruction in Braille or the use of Braille), that instruction in Braille or the use of Braille is not appropriate for the child (Section 614 (3)(B)(iii)).

However, a recent survey of 29 students with VI, aged 3 years 3 months to 21 years 10 months [34], revealed an alarming finding that only 13.8% of these students had a completed LMA. Another survey study of 108 students with VI and 95 teachers [35] found that the decision regarding a student's literacy medium or media was affected by the teachers' philosophies, the teachers' subjective judgments in conducting informal LMA, and, lastly, the students' reading speed and stamina.

Collectively, the use of Braille by individuals who are blind or with VI is often referred to as default for this population, that is, an individual who is blind or with VI has to be Braille-literate, and if not, other measures would have to take place to assist one's need, partially because Braille is an analog system of visual print and allows one to interact with print directly. Thus, it is considered a better medium of accessing print than audition alone, and those who do not use Braille are often considered illiterate. Furthermore, the decision on the literacy medium or media for students who are blind or with VI is heavily dependent on the teachers, instead of the individual needs of the child. On the other hand, we consider print literacy, including Braille literacy, simply as the vehicle by which to access information, as opposed to being the content itself or adding to the content. As far as we know, there has been little quantitative comparison on Braille literacy and auditory literacy to investigate if these two forms of captured information are equivalent to each other. If so, why is Braille literacy the only gold standard of literacy for individual who are blind or with VI? Shouldn't the literacy medium or media for students who are blind or with VI be based on the individual needs of the student if the different media are equivalent? The empirical questions asked in this study are:

- Given access to print in their preferred method (Braille, audition, or print), would three groups of individuals (individuals who were blind or with VI and preferred the use of Braille to access text material, individuals who were blind or with VI and preferred to process textual material through audition, and individuals without VI that preferred to access textual material through visual print) retain equal amounts of propositional information from the same piece of expository text?
- Given a piece of expository text, presented in the auditory mode only, would the three groups of individuals, as defined above, retain equal amounts of propositional information from the same piece of expository text?

- Given two pieces of expository text of equal readability with the same number of propositional units and overall length, would individuals who are blind or with VI and preferred the use Braille do equally as well in retaining information presented auditorily as they would in Braille?
- Given two pieces of expository text of equal readability with the same number of propositional units and overall length, would individuals without VI do equally as well in retaining information presented auditorily as they do in reading print?
- Given two pieces of expository text of equal readability with the same number of propositional units and overall length, would individuals who are blind or with VI and process print auditorily retain equal amounts of information in these two passages?

## Method

### Participants

Fifteen individuals participated in this experiment—three groups of 5 individuals each. One group consisted of 5 adults who were blind or with VI and were Braille readers; the second group consisted of 5 adults who were blind or with VI and were not Braille readers, but preferred to listen to text; and the third control group consisted of 5 adults without VI and read visual print. All participants were college graduates between the ages of 22 and 55. With prior approval from the Institutional Review Board, participants were recruited by word-of-mouth and through email list-serve within Teachers College, Columbia University. All participants signed a consent form to maintain the ethical code of research conduct and privacy.

### Materials

Two pieces of expository text not familiar to the participants were used in this study. The first piece of text was entitled the Rise and Fall of Rome and was drawn from Mazour, Rabb, and Peoples (1987). It consisted of 6 paragraphs, 25 sentences, and 398 words and was written at the 12th grade level, according to the Flesch Kincaid readability formula. The second passage was entitled Ancient Indian Civilization, also drawn from Mazour [4], and consisted of 6 paragraphs, 25 sentences, and 398 words and was written at the 12th grade level, according to the Flesch-Kincaid readability formula. The sentences of each passage were parsed into propositional units using these rules:

- Each predicate was considered a proposition.
- Relative clauses, reduced relative clauses, appositives, and infinitives were considered as separate propositions, since each inherently entails a predicate verb.
- Each item within a list was considered a separate proposition, since they inherently were a series of reduced coordinate sentences each with its own predicate verb, even if they were the same predicate verb.
- Prepositions of time (dates) were considered separate propositions, and
- All nominalized predicates, such as gerunds, were considered separate propositions.

A key was developed by expanding the propositional fragment within a sentence into a full propositional sentence. This was done to assist in tallying the results, since the participants, in completing the two tasks described below, could very well recall the propositions as

separate sentences or could combine them in various kinds of compound or complex sentences. For the Rise and Fall of the Roman Empire, 85 propositions were identified, and in The Ancient Indian Civilization passage, an equal amount of propositions were identified, 85.

### Procedure

Each participant was met individually. Two tasks were presented to each person. The first task involved processing the Rise and Fall of the Roman Empire text by means of the individual's preferred method of accession. In the case of Braille readers, they read the passage in Braille; Non-Braille readers heard the passage; and individuals without VI read the visual print version. The Braille and Print readers were allowed to read the text at their own pace. Since it was possible for these individuals to backtrack and re-read portions of the text for clarification whereas the audio text was transitory, the Non-Braille readers were allowed to listen to the text twice. The audio text was delivered by means of audio recording (so the audio listeners were listening to a tape recorder that had a voice reading the text). The person who did the audio recording was female, whose native language was English. The reader was fluid in her reading and paused where necessary. The researcher was in control of the tape recorder where upon completion of the first listening, the participant was given a chance to listen for the second time (the researcher rewound the recording and played back the tape). Once the passage was read or listened to, the individual was asked to recall the passage in as much detail as possible and his or her responses were audio-recorded. The second task was essentially the same as the first, except all three groups listened to the text The Ancient Indian Civilization twice and then subsequently tried to recall as much of the text as possible. Once the session was completed, a verbatim transcription of the individual's recalls was completed.

### Scoring

Once the individual's responses were transcribed, they were compared with the propositional parsing key created for these two passages. The participant was given one point for each proposition recalled whether it was a sentence fragment, phrase within a sentence, or expressed as a full propositional sentence as it existed in the key. All the points were tallied a total of 85 point, and the total number of propositions recalled was used as the dependent measure for purposes of statistical analysis.

### Analysis

Given that the number of participants was very small, 5 individuals per group, 15 in all, it was not possible to determine whether the scores obtained were normally distributed, though the scores themselves were at least ordinal if not interval data. As a result, a series of nonparametric analyses of the data were performed. More specifically, when comparing the scores on the Rise and Fall of Rome, whereby the individuals were to access the print in their preferred way, the Kruskal-Wallis Analysis of Variance by Ranks was performed, as were the scores obtained on the Ancient Indian Civilization passage, which was heard by all. With each group, the scores obtained by using their preferred mode of print access were compared to their scores obtained on the listening task by means of the Wilcoxon Paired Sample Signed Rank Test. Meanwhile, the p value for the chi-square approximation test is fairly accurate if the number of cases is greater than or equal to 30 [36]. Our sample of 15 subjects might not be enough for a powerful



test. Thus, we calculated the effect size even though it is typically provided when statistical significance is found. SPSS software (v.20) was used to calculate the descriptive statistics and the aforementioned two nonparametric tests. The level of significance was set at  $p \leq 0.05$ .

## Results

When allowed to access *The Rise and Fall of Rome* in their preferred manner, the participants received the following mean rank of scores:  $M=8.20$  for Braille readers,  $M=8.80$  for Non-Braille readers who listened to the passage, and  $M=7.00$  for readers without VI who read the printed version of the passage. The results of the Kruskal-Wallis Analysis of Variance by Ranks reveal that there is no significant difference in the medians among the three groups,  $\chi^2(2, N=15)=0.42$ ,  $p=0.81$ . We calculated  $\eta^2$  (eta squared or the effect size) to be 0.03 using  $\eta^2 = \chi^2 / (N-1)$  [36] where  $N$  is the total number of subjects. This suggests that the proportion of variability in the ranked outcome variable accounted for by the reader groups was 0.03, indicating a small to zero effect size. Given the hypothesis test and effect size, it is with confidence that the null hypothesis should be retained, that is, that there are no differences in immediate recall of a text among the three groups of participants when allowed to process the information in their preferred manner (Braille, Listening, or Print).

With respect to question 2, i.e., is there a difference in the amount of propositions recalled after listening to the text *Ancient Indian Civilization* for these three groups, a similar Kruskal-Wallis Analysis of Variance by Ranks test was performed. When allowed to listen to the text *Ancient Indian Civilization*, the participants received the following mean rank of scores:  $M=8.00$  for Braille readers,  $M=8.10$  for Non-Braille readers, and  $M=7.90$  for readers without VI. The results of the Kruskal-Wallis Analysis of Variance by Ranks reveal that there is no significant difference in the medians among the three groups,  $\chi^2(2, N=15)=0.005$ ,  $p=0.997$ ,  $\eta^2=0.0003$ . As a result, it is with confidence that the null hypothesis -that there are no differences among the groups in their immediate recall of information provided through audition alone -can be retained.

In order to see if Braille and Print readers without VI would perform better when provided with Braille and Print texts, respectively, which presumably was their preferred method of accessing print that when listening to texts, a series of Wilcoxon Signed Ranks Tests, a nonparametric statistic compared the median differences between 2 related samples, in this case Braille vs. Auditory and Print vs. Auditory performance. This test was chosen for much the same reason as was discussed on the use of the Kruskal-Analysis of Variance by Ranks test, i.e., the underlying distribution of scores is unknown.

Before the above-mentioned analyses were performed, however, a form of reliability check was needed in order to accurately interpret the results reported below. It was important to establish that there was no text bias. It was reasoned that this could be established by comparing the scores on the first passage with scores on the second passage for those individuals who typically accessed print by means of audition. In other words, if there were no text bias, then it would be expected that the null hypothesis that there were no differences between the two auditory tasks would be accepted. A Wilcoxon Signed-ranks test indicated that there was no significant difference in the scores between the two passages,  $Z=0.41$ ,  $p=0.69$ ,  $r=0.11$ . Thus, there is a sufficiently high enough degree of reliability across the two tasks, such that it would be reasonable to proceed with the other analyses.

The Wilcoxon Signed Test by Ranks indicated that there is no statistically significant difference on the scores between listening to text and reading text by Braille for individuals who are blind or with VI,  $Z=0.74$ ,  $p=0.46$ ,  $r=0.19$ .

The Wilcoxon Signed Rank Test for individuals without VI in terms of their performance in listening to and reading the two passages indicated no significant difference,  $Z=0.94$ ,  $p=0.34$ ,  $r=0.24$ .

## Discussion and Conclusion

The impetus for this quantitative analysis was to find out whether there would be any differences among and within three groups of individuals (individuals who were blind or with VI and primarily accessed print by means of Braille, individuals who were blind or with VI and accessed print primarily by means of auditory means, and individuals without VI who primarily accessed print by means of visual print) on two pieces of texts-one presented auditorily and the other by means of the individual's primary way of accessing print. The assumption was that there would be no differences among and within these three groups in their ability to recall propositions of the passages presented under the two different conditions. Based upon the analyses performed on the data, the following can be concluded:

- There were no differences among the three groups-individuals who were blind accessing print by means of Braille, individuals who were blind and access print by listening to the text, and individuals without VI who access print by reading the print-in their recall of propositions from the texts based upon their preferred method of accessing print.
- There were no differences among the three groups, as defined above, in their recall of propositions from the text after having listened to an auditory rendition of a piece of text.
- When the scores on the two tasks were compared with each other for individuals, there were no differences for any group of individuals.
- It also should be noted that for the individuals with blindness or VI who listened to both texts, there was no difference found in the analysis. This group was constant throughout the procedure, thus propositions recalled did not differ in both listening.

The findings that there were no differences among the three groups in recalling propositions in their preferred method of accessing print or when listening to text are consistent with the results of previous studies on individuals without VI. For example, in a study on individuals without VI [37] found that there were no differences with respect to understanding the main facts of a story nor in constructing a visuo-spatial representation of the text when presented auditorily as opposed to reading print, suggesting that listening to print information is viable. Similar results were reported for children without VI in as well [38].

However, previous studies on individuals with blindness or VI provide a mixed picture. For example, Roder, et al. [39] found that congenitally blind adults processed auditory material faster and better than individuals without VI. It should be kept in mind, however, that their task was at the sentential level and not at the textual level, and the current listening task did not look at the speed at which individuals with blindness or VI and individuals without VI processed auditory information, but the number of propositions recalled from the text. It is also possible that individuals who are blind or with VI may process auditory information more quickly than individuals without VI, but when given large amounts of auditory information to be processed, the

amount retained may be equal. Meanwhile, it is distressing that there is scarcely any research on auditory literacy skills (i.e., literacy skills of auditory materials) of children with VI, although studies have found that they performed equally well [40] or even better than their peers without VI [16] when oral method was used to measure their literacy skills [26].

Educators and scholars of students who are blind or with VI have researched, documented, and demonstrated through narratives the need for an expanded definition of literacy or teaching literacy for students with blindness or VI. The current study provides quantitative data to support the use of multiple literacies, such as auditory literacy, for the literacy development of this population. Braille, fundamentally, is a coding system that is based on print literacy. Although Braille literacy has become the universal statement in attaining literacy for students who are blind or with VI [10], it is important to note that the social dynamics of this population is not always intimately entwined with Braille literacy, especially now with the advent of technology. There are various hidden literacies and skills that exist for students who are blind or with VI that need to be investigated, tested, and encouraged in the literacy discourse. Literacy does not need to be only one-sided, but rather open in order to accommodate all the different pedagogies that exist.

Technology is particularly important for students with disabilities, particularly the ones with sensory and physical impairment [41], such as VI, because their VI might create barriers for them to retrieve or consume the information in print. The advance of technology makes it feasible for literate information to be restored in a CD, DVD, or MP3. For instance, Scholastic Storybook Treasures series includes hundreds of award-winning and classic children literature (e.g., *Click, Clack, Moo, Where the Wild Things Are*, and *Why Mosquitoes Buzz in People's Ears*) on DVD, featuring celebrity narration (e.g., Sarah Jessica Parker, and James Earl Jones). A bona fide language is the prerequisite for literacy development, regardless the mode of the literacy. Children with VI generally have an intact spoken language development, although some of them might experience late start during early ages [25]. They should be able to understand and/or produce oral information that is equivalent to, or might even better than, the print information their peers without VI comprehend and/or generate. If children with VI can reflect upon the captured information in oral form from DVD just as the way people without VI analyze the acquired information in print, what is the exquisite power of print?

Guided by Street's [18] ideological model of literacy and Freire's [20-22] work on critical literacy, we challenge the practice of using Braille literacy as the default literacy for students who are blind or with VI, and considers the practice as an inequity that one set of values holds sway over another. We believe that Braille literacy is just as important as oral forms of communication and learning for this population, that is, auditory literacy is as viable as Braille literacy, and with the advancement of technology, auditory literacy for individual without VI, as well as for individual with blindness and VI, has become much more accessible and attainable and should be included in the current definition of literacy. We believe that it is possible to develop literate thought, or to become literate, in the through-the-air or face-to-face mode using primary forms of verbal languages, such as spoken or sign communication languages [24-26]. Literate thought is mode independent. After all, secondary representations such as written language or Braille are based on the through-the-air mode, which is the real engine for thought and communication. Meanwhile, modes of literacy should not be construed as an either-or dichotomy, that is, it is

important to develop high levels of thought in both through-the-air and secondary (or captured) modes.

We agree with Leander's [42] parallel pedagogy that old (e.g., print or Braille) and new (e.g., auditory) literacy practices should be effectively taught equally in the classroom, instead of the old being a precursor to the new or being placed by it. Assistive technology is especially important for children with sensory disabilities, but as discussed previously, many teachers of children with sensory disabilities do not have the most up-to-date knowledge on the use of technology. University teacher training and in-service staff development programs should resolve this gap. Meanwhile, access to the information captured in multiple literacies is only part of the literacy development; equally important, children need to be able to utilize the information, that is, to discuss and analyze the captured information, as well as to produce new information. Children with VI can listen to an audio book, contribute in class/group discussion, and be assessed based upon the recorded oral performance on the understanding of the text. Furthermore, the decision on the literacy medium or media should be based on the individual needs of the child. Regardless of the mode, an effective literacy instruction should be research-based, systematic, and consistent.

The limitation of the study includes, first of all, a small number of participants. Second, the participants were adults instead of children. Third, some of the participants' demographic information was not available, for example, information such as the duration of the disability for the participants, or if they were congenitally or adventitiously blind. Fourth, only expository texts were used as the testing materials. Collectively, this is a pilot study and the audience should be cautious in generalizing the results of the study.

This research contributes to the growing body of literature that engages educators and scholars in the discourse of literacy for students who are blind or with VI. It adds to a view of literacy suggesting that current definitions of literacy are too narrowly defined. We provide the following suggestions for a more inclusive definition of literacy, which will become a vehicle to empower individuals with blindness and VI as well as other disabilities:

- University teacher preparation programs should (re-)educate educators to be able to accommodate students with blindness and VI especially with the current influx of new technological gadgets on literacy. Both regular teachers and special education teachers need to be guided in the usage of technologies to provide appropriate accessibility for students with disabilities, including students who are blind or with VI.
- Professional development programs should assist current teachers in learning the emerging technologies and various pedagogies that are based on multiple literacies techniques. Administrators and boards of education should support these professional development programs, equipment, and hiring of assistive staff to assist in the diverse needs of the students.
- There should be a concerted effort from the society at large to understand that employment and advancement should not be linked to the ability to read print by means of sight or Braille, particularly for individuals who are blind or with VI. The larger, more important issue has to do with one's competence, knowledge base, and ability to communicate in a variety of social contexts, which can be accomplished through the use of current technology as well as traditional approaches to literacy, i.e., visual print and Braille.

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