TRADITIONAL VERSUS MODERN WAYS OF TEACHING READING AND WRITING BRAILLE IN SLOVAKIA[1]

Tradičné verzus moderné spôsoby výučby *čítania* a písania Braillovho písma na Slovensku

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Abstract: *Braille has been one of the most important communication tools for blind people around the world for 200 years. It is an essential mean of literacy for the blind. Braille teaching has undergone significant changes since its inception. Currently, there are several approaches to braille teaching methods, which can be divided into traditional and modern methods. The aim of this article is to analyse and compare traditional and modern methods of teaching braille reading and writing, with an emphasis on their effectiveness, accessibility and a description of their use in an educational context. Taking into account technological advances and changes in didactic approaches, the authors are primarily concerned with examining the latest trends in teaching and learning for blind pupils in the use of braille. The article presents clear arguments for the position of braille and tactile graphics in the educational process of blind pupils to be strengthened, especially in terms of the use of digital technologies. The authors identify the problems arising from the low level of use of braille and assistive technologies, which are currently able to bring braille and tactile graphics into the educational process much more effectively.*
Keywords: *Braille, tactile graphics, literacy, reading skills.*

Abstrakt: *Braillovo písmo je už 200 rokov jedným z najdôležitejších komunikačných nástrojov nevidiacich ľudí. Je základným prostriedkom gramotnosti nevidiacich. Výučba Braillovho písma prešla od svojho vzniku významnými zmenami. V súčasnosti existuje niekoľko prístupov k metódam výučby Braillovho písma, ktoré možno rozdeliť na tradičné a moderné metódy. Cieľom tohto článku je analyzovať a porovnať tradičné a moderné metódy výučby čítania a písania Braillovho písma, s dôrazom na ich efektívnosť, dostupnosť a opis ich používania v edukačnom kontexte. S ohľadom na technologický pokrok a zmeny v didaktických prístupoch sa autori zaoberajú skúmaním najnovších trendov učenia nevidiacich žiakov v oblasti používania brailu. Článok prináša jasné argumenty pre to, aby sa postavenie brailu a hmatovej grafiky vo vzdelávacom procese nevidiacich žiakov posilnilo najmä v rovine používania digitálnych technológií. Na analýze súčasného stavu autori identifikujú problémy vyvstávajúce z nízkej miery využívania brailu a asistenčných technológií, ktoré sú v súčasnosti schopné brail a hmatovú grafiku vnášať do vzdelávacieho procesu oveľa efektívnejšie, ako tomu bolo v minulosti.*
Kľúčové slová: *Braillovo písmo, brail, hmatová grafika, gramotnosť, čitateľské zručnosti.*

Introduction

It is clear that the ability to read and write in braille is a cornerstone for the development of literacy for any blind person. It is only with a real grasp

[1] Prijaté do redakcie/Paper submitted: 19. 01. 2025

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of letters, numbers, symbols or punctuation that it is possible to achieve a knowledge of grammar, and ultimately the ability to edit text effectively to meet the required quality standards. Therefore, these skills cannot be limited to the recognition of braille cells, the six dots that represent braille. Nor is it enough to learn the braille code applicable to a particular country. It is equally important to pay attention to reading technique, hand movement, speed and fluency when developing reading skills. Equally important is the development of the sense of touch to such an extent that blind pupils can easily recognise not only braille but also tactile graphics.

Not surprisingly, one of the most important keys to achieving high levels of reading comprehension skills is practicing reading from early childhood. It is through the practical use of braille, prolonged reading and writing that this skill can be fully developed and improved. The goal of braille reading skills training is to reach a level that represents maximum use of the reader's tactile potential and effective work with text and textual information. All auditory forms of perception are passive access to information, whether it is an audio book, the synthetic voice of a computer or smartphone, or the voice of the person reading the information to us (Englebretson et al., 2022). Blind pupils need to be motivated and brought to a point where all ways of perceiving information, tactile and auditory, are equally well developed and they can decide for themselves which form of working with text is more effective for them at any given moment.

Developing good reading skills will enable a blind person to learn and acquire knowledge, deepening their understanding in different areas such as science, foreign languages, music notation and correct grammar and vocabulary. "Braille literacy is associated with achieving higher levels of educational attainment, personal satisfaction, independence, and employment" (Eldridge; Lund, & Cmar; Ryles; Schroeder; Schroeder; Silverman, & Bell; Stephens, as cited in Englebretson et al., 2022). In a 1990s survey from Washington, D.C., it was found that the effect of the ability to read Braille on participants' employment rates was significantly positive, particularly with respect to employee qualifications and long-term employability (Ryles, 1996). Silverman and Bell's study found that "Braille readers who have used Braille since childhood had higher levels of satisfaction, self-esteem, and employability compared to other blind people, and also, the people , who learned to read Braille later in life also had higher rates in these areas compared to people who never learned to read Braille" (Silverman and Bell, in McDonnald; Sessler-Trinkowsky and Steverson, 2024).

Nowadays, when this form of communication for the blind and at the same time a means of their literacy is to some extent displaced or replaced by modern digital technologies, we considered it important to carry out an analysis that would be a simplistic indicator of where the use of braille has moved from the traditional way of writing and reading, and what is its justification and relevance in the education of blind pupils, primarily with regard to technological advances and changes in didactic approaches.

Traditional methods of teaching reading and writing Braille

Traditional methods often include physical aids, such as:

- One-cell board – with holes in the shape of one braille cell (six dots pattern), into which the blind pupil inserts pins usually according to the braille character pattern and thus gradually begins to learn and get acquainted with the individual letters of the braille alphabet.
- One-line/three-line peg – in the shape of a plate with holes forming individual six-dots braille patterns (cells), in which the pupil can also compose a syllable, word or short sentence. There are several versions of pegs made of wood or plastic. The one-cell board and the pegs are suitable for blind children and pupils in pre-school and first grade and are primarily intended for teaching writing and familiarising with braille. However, they can also be useful when starting to learn braille at a later age.
- Slate and stylus – the slate consists of two plates, with holes punched in the lower plate, the upper plate forms a grid of six-dots braille cells as a matrix. The paper is inserted between two plates. The dots are punched to the paper (dot by dot) with stylus using the holes in the lower plate and the grid of upper plate as a guiding boundaries for each cell. The braille is written on the slate in a mirror image, from right to left. The text will only be legible when the paper is removed from the slate and the dots are turned upwards. It is a very effective aid for braille writing and is easily portable. It comes in different sizes depending on the number of braille characters that can be written. Because mirror writing requires increased concentration and imagination, it can be accompanied by other simpler aids that do not require mirror writing. The slate and stylus are one of the most effective ways of labelling products in household, and every blind student should be proficient in this writing method. It is also a good preparation for future use of braille on mobile devices.
- A mechanical typewriter for writing Braille – in Slovakia also often referred to as a Picht machine. It consists of 7 keys, 6 of which represent the individual dots of the braille character, and usually a space in the middle. By simultaneously pressing the appropriate keys, the head embosses dots representing a particular letter into the paper instead of individual dots. Special paper rolls into the typewriter on a metal roll-in mechanism. It comes in different sizes, types (right-handed, left-handed, ambidextrous), and markings according to the size of the keys or paper being loaded into the machine. The mechanical typewriter is used for braille writing and word processing from the first year of primary school onwards.
- The DYMO Braille Labeller – is a simple mechanical device for writing Braille on a thin adhesive strip (DYMO tape) that is easily portable. The tape is inserted into the machine, into which the letters of the Braille alphabet are pressed by a small roll. On the reel, the characters are displayed in Braille, but also in Latin script. Once written, the tape can be

stuck to the place to be marked, such as a book, work folders, objects in the classroom, etc.
- Lego® Braille bricks, POP IT Braille and other braille games and educational aids and braille books
- Tactile graphics – images in braille, dot or relief graphics, maps, geometric images and shapes, etc., created using printers, embossers or other methods such as Swelling paper technology.

Modern methods of teaching Braille and developing reading and writing skills

These methods include several digital aids, such as:
- Braille keyboard – is a standard USB device that can be connected to a computer or mobile phone. Unlike a standard external keyboard, this keyboard has only seven keys for text entry, six braille dots and a space. However, it can also be used to enter text and various commands (chord commands) to control the connected device.
- Braille display (single line/multi-line) - this is a hardware device that connects to a standard computer, tablet or mobile phone. The tactile part displays part of the line from the screen in braille (dots). It has buttons that allow the user to control the computer to some extent (perform frequent actions), but also to move the cursor to determine what is currently displayed on the line. The braille display is another output device that the screen reader uses to convey information to the user. It can be combined with voice output or used alone.
- Electronic notebooks - these are special devices used by blind people to write text in Braille. Electronic notebooks for the blind do not have a display but are usually equipped with a braille keyboard or a standard QWERTY keyboard. Most are voiced (voice output) and some models also include a braille display. These modern electronic notebooks can be connected to a computer and include a number of functions such as a word processor, a telephone directory, a diary, an alarm clock, a calculator, mail and Internet browser, data backup, etc., making their comprehensive equipment partly similar in functionality to the tablets used by individuals without vision loss. However, the big disadvantage of these electronic notebooks is the high price and the lack of Slovak language mutations. Electronic notebooks are small, silent devices (with small dimensions and low weight) that blind people can carry with them and use anywhere.
- Tactile displays - providing multiple lines of braille or the ability to display images in dot graphics. The use of these tactile displays has potential in the educational process for displaying graphs, diagrams, charts, maps, pictures, etc.
- Digital books in an accessible format for screen readers and braille displays

- Modern digital technologies (hardware devices and software solutions) that immediately enable transcription of ink-print text into braille and also compatibly convert text from braille to printed text include:
    - braille printers (embossers),
    - braille translation equipment,
    - braille text editing software.

The aids designed for the creation of tactile graphics, for drawing or sketching should also be a solid part of education. In addition to the various relief-tagging scales, rulers and other tagging aids, relief drawings or alternative solutions for relief drawing and tactile representation using commonly available materials (paper, wood, fabric, etc.), contouring paints for glass or modelling materials should be considered.

Pupils need to be provided with as many tactile graphics in each subject as are necessary for understanding whole knowledge curriculum, including visual ones such as maps, graphs and so on. A combination of traditional paper/foil methods or the use of a multi-line tactile display to show point graphics can be used to present such images.

Analysis of the use of Braille in the educational process

The advantage of traditional methods is undoubtedly the greater availability and lower cost of reading and writing materials. At the same time, they provide the opportunity to work with the publication page by page, with the possibility of subjecting the whole page to a tactile examination, looking for connections between the data on the page and so on. However, writing braille texts using a mechanical machine is quite noisy and, compared to modern technology, editing the text is laborious and time-consuming. Working with braille on paper does not allow simultaneous reading of braille and ink-print text on a computer screen, what modern technology makes possible and easy.

Regarding the skills training for pupils entering primary school, the equipment often ends at the peg and braille typewriter. These and many other aids are, of course, important for the development of the necessary skills for reading and writing. However, education without braille is severely limited because blind pupils are deprived of the unique opportunity to work simultaneously with text in braille and, at the same time, with the text in a digital environment that offers much greater opportunities to access information and a multitude of publications. The unfavourable position of braille in education but also in the lives of blind people is also influenced by the fact that information in braille is woefully scarce even in the everyday life and environment of a blind person (Woodin, 2018).

Braille display shows part or all of a line from the screen to the user at once. Thus, it allows the user to preview a slice of the screen as a whole. With Braille display, navigating through text is significantly faster than using a screen reader with voice output. It is also a very useful aid for foreign language learners. The main reason for this is that speech synthesis (voice output) hides detailed

information about the graphical representation of a word from the blind user (for example, it is in many cases impossible to distinguish an ypsilon from a letter I by ear, even when reading the text fluently). The braille display allows to display the braille text that the educator sees on the screen. In this way, a unique form of literacy development can be achieved because what the pupils read in braille on the braille display can be viewed on the screen by the teachers or parents.

With braille, however, it is also necessary to take into account that the blind pupil must gradually learn computer skills along with braille in order to be able to make full and functional use of the braille display.

Despite the fact that braille displays are one of the most expensive tools, they should be part of the equipment of every single blind pupil in the educational process, practically from its beginning, as recommends European Blind Union (EBU Statement, 2023). Even as a child in the first grade, he or she can use a braille display in collaboration with an assistant, and the teacher, assistant or parent can not only check on the screen what the pupil is reading, but also type simple tasks into a word processor. At the same time, a blind pupil can gradually acquire and develop the computer skills necessary to use a computer and braille from the first year onwards.

The use of a computer with special software and hardware (such as braille displays) is, in our opinion, nowadays essential in school practice. It replaces the typewriter for blind pupils when taking notes, enables them to work effectively with text and to communicate with teachers (doing homework in a form that is easily readable by sighted teachers), as well as with classmates and friends. It gives them access to a source of great variety of information.

The necessity of early preparation of blind pupils for braille reading by tactile training in preschool age is also emphasized by Lopúchová and Schallerová (2022), according to whom it is necessary to develop not only the fine motor skills of children at an early age, but also the tactile-haptic potential of the child.

The rate of use of braille reading skills in Europe is alarming in many countries. In 2018, the European Blind Union (EBU) conducted a survey in nine countries on the use of braille in education, and the results from this survey led the EBU to make recommendations which, among other things, make clear the need to improve braille education, improve the availability of braille materials and the use of braille displays or other assistive technologies in the education process (Woodin, 2018).

From the practice in Slovakia, it can be stated that we, like many other countries in the world, have slipped into the misconception that information received by ear when listening to audio books and listening to a screen reader on a computer or mobile phone can replace the information received by touch in the education of blind pupils.

The prioritization of auditory perception over tactile perception in the last 20-30 years worldwide has resulted in a significant decline in braille text-

processing ability among the blind. Several factors can be taken into account when looking for a reason for the decline in the use of braille in the lives of blind people. The amount of information in braille cannot be compared with the amount of information in print, since the society is used to continuous contact with print in any form. Nevertheless, we are convinced that the unavailability of braille materials cannot be considered as a key factor in the low rate of braille reading skill development. Although we have long observed a problem with accessible textbooks for the blind in our country, existing braille materials alone are still sufficient for training and developing braille reading skills.

Professionals in this field often encounter the situation when blind pupils are not able to work effectively with braille text, do not know the basic grammatical rules and do not master the laws of the graphic structure of the text. Their work with text is often ineffective. It is these aspects of reading that are often neglected or unnoticed in auditory perception of information.

In the education of blind pupils, the question of the priority of auditory or tactile information should not be raised at all. Blind people are totally or significantly deprived of one of the senses they would otherwise use to receive information. It is for this reason that it is of the utmost importance that all other ways of receiving information are trained to their full potential during the educational process. Braille reading training is crucial for the development of reading and writing skills, for developing the literacy. The availability of audiobooks or the reading of publications by means of voice synthesis must not replace the reading of text, especially at school age. The pupil's literacy skills are not sufficiently developed by hearing, and training in reading braille becomes more difficult at a later age. Braille writing also needs to be developed, and training should start with writing on a pegboard, continuing on a mechanical braille typewriter and developing writing skills on electronic devices using modern digital technologies, such as braille display or on-screen braille keyboards on mobile phones.

Teaching and learning braille should include training in at least the following skills:

- Reading and writing using braille.
- Training in effective braille reading, finding the appropriate reading method for each individual, namely the best point of hand/body contact with braille text, moving the hands along the lines of text, using the so called Scissor method of reading braille text, in which both hands start together on one line, move to about the middle of the line, where they separate - the left hand copies the line towards the beginning of the line and moves smoothly to the second line, where it is ready to read, while the right hand finishes the rest of the previous line.
- Working with tactile graphics, methodical preparation for reading tactile graphics with comprehension with the transfer of 3D objects into 2D representation.

- Read books on standalone braille displays or in connection with other devices.
- Read PDF, Word and all other types of documents on braille displays.
- Work with books or educational materials simultaneously using a screen reader along with braille on a braille display.
- Efficient control of computers and mobile devices via braille display and software/hardware braille keyboard.
- Transfer of individual text types to and from separate braille displays and data exchange between a computer or mobile phone and a braille display.

The problem with storing publications in a digital environment and also in well-formatted braille text has so far been that such braille text has been a simple text file without any formatting options, if we do not consider formatting to be text panning with a space or an enter. Such a simple file without any styling, combined with reading only one line at a time and without control over the structure of the document, did not allow the reader to move quickly to different parts of the text, as he or she normally does when reading by sight. This made the publication difficult to work with in digital braille. It was therefore essential to find a way in which such movement around the document could be made possible. Therefore, braille experts are awaiting early coming out of a standard for digital braille files that will allow navigation through a document, as is the case, for example, with web pages. A blind user can browse a page by heading, move to the nearest table, learn the font attributes of the text, and so on. Such possibilities will be opened up by the digital braille format, where the ability to navigate through the various attributes of a publication will enable blind users to work very efficiently with any lengthy and extensive text. At the same time, its encoding will allow easy portability between devices and also the possibility of printing it on paper.

The near future of digital braille display devices promises to make braille more usable in the digital environment. The tactile displays, which are now beginning to be developed and the first commercially marketed versions are already available on the market, offer the possibility of displaying multiple lines of braille text or the possibility of rendering images using dot graphics. These are graphics consisting of dots in a sufficiently dense grid to form patterns. It can be assumed that these devices will have their place in the educational process precisely because they enable texts to be processed quickly and efficiently without having to be printed on paper. They might provide the possibility of previewing a larger part of the text or page, with the possibility of tracing the interrelationships between parts of the text, for example, data in tables. The fact that a simple graphic, such as a chart or a simple image, can also be part of the text greatly expands and enhances the possibilities for efficient work with text and image.

In the case of assistive technologies, the reason for their slow implementation in the educational process is often their cost. This is very high in the case of braille displays and tactile displays in particular. In many developed countries,

however, they are clearly the preferred choice for the provision and delivery of education for blind pupils, whether in a special school or in an inclusive mainstream school environment. Their flexibility and the possibility for pupils to work directly with teachers via computer from the start of school is definitely a significant factor in better learning conditions. Every pupil should be given the opportunity to choose the educational path they are most interested in, the one in which they achieve the best results. If they do not work effectively with braille and assistive technology, they will hardly be able to follow education in the STEM area, even if they show interest or talent in that area.

Conclusion

A comparison of traditional and modern methods of teaching Braille shows us that both approaches have their advantages and disadvantages. Traditional methods provide a foundation for the development of tactile skills, reading and writing, while modern methods and approaches offer flexibility, attractivity, simultaneous access and inclusivity. In our opinion, the ideal approach is a combination of both methods, where traditional methods should be strengthened and complemented by modern digital technologies, whereby we can achieve an optimal level of reading and writing skills and high level of literacy in blind students. Traditional and modern teaching methods complement each other to create a multidimensional approach that will ensure better and more effective learning and easier and faster access to different information, texts and literature.

We consider Braille to be a key tool in the education of blind pupils, enabling access to information, access to education and training for blind people worldwide, promoting skills development, independence, autonomy and enabling blind pupils to be literate. The future of braille teaching should include the integration and implementation of modern digital technologies into the educational process. It is important to raise awareness of the importance and relevance of braille in the educational process of blind pupils, and to invest in the modernisation of schools and its integration into national education systems and policies. We consider the use of modern braille and tactile display technologies across the whole educational process, and from its very beginning, to be a necessity for education in the 21st century.[4]

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