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LEARNING THROUGH PLAY WITH LEGO BRAILLE BRICKS

Abstract. The article substantiates that learning through play builds on how we naturally learn from birth. It can include games to memorize facts, but its real potential is to foster children's understanding of concepts and mastery of a breadth of skills, enabling them to apply what they learn – even in creative ways.

Learning all about LEGO Braille Bricks will consolidate a foundation for teaching students with visual impairment.

The playful activities, holistic skills and tips and tricks covered will allow creation of complete lesson plans using this amazing tool.

We have explored LEGO Braille Bricks and discovered everything about the toolkit, pedagogical concept and website. It is much more than a box full of bricks: it's a whole new pedagogical concept to teach braille through play, in a fun and inclusive way!

LEGO Braille Bricks activities simultaneously develop academic skills, commonly used at school as well as specific visual impairment skills for blind children. Both are essential to deeply understand concepts and nurture a breadth of skills.

LEGO Braille Bricks pedagogical concept contains a selection of 124 skills. These academic and vision-specific skills were selected, divided into the five categories of holistic skills (cognitive, physical, social, emotional, creative).

We completed the following outcomes: discover LEGO Braille Bricks toolkit and pedagogical concept; review the six main activity categories; gain knowledge of how the LEGO Braille Bricks concept can meet students' tactile learning needs; differentiate and understand three types of pre-braille activities: manipulation, orientation, and constellation; engage with LEGO Braille Brick activities based upon the five characteristics of playful experiences (Active engagement, Meaningful, Joyful, Iterative, Social); develop facilitation techniques for brick discovery: how to manipulate, assemble and attach the bricks to the base plate.

Keywords: to play, learning through play, visually impaired children, learning tools, LEGO bricks, LEGO Braille bricks

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НАВЧАННЯ ЧЕРЕЗ ГРУ З КУБИКАМИ LEGO BRAILLE

Анотація. У статті доведено, що навчання через гру базується на тому, як ми вчимося від народження. Воно може містити ігри для запам'ятовування фактів, але його реальний потенціал полягає в тому, щоб сприяти розумінню дітьми понять і оволодінню широким спектром навичок, дозволяючи їм застосовувати те, що вони дізналися, навіть творчо.

На основі знань про інструмент LEGO Braille Bricks можна зміцнити основу для навчання учнів із порушеннями зору.

Розглянуті ігрові дії, цілісні навички та поради та підказки дозволять створити повні плани уроків за допомогою цього дивовижного інструменту.

Ми дослідили LEGO Braille Bricks і дізналися про набір інструментів, педагогічну концепцію та веб-сайт. Це набагато більше, ніж коробка, наповнена кубиками: це абсолютно нова педагогічна концепція навчання шрифту Брайля через гру, весело та інклюзивно!

Вправи LEGO Braille Bricks одночасно розвивають академічні навички, які зазвичай застосовуються в школі, а також спеціальні навички для роботи з порушеннями зору, якими потрібно оволодіти для роботи зі сліпими дітьми. І те, і інше має важливе значення для глибокого розуміння концепцій і набуття широкого спектру навичок.

Педагогічна концепція LEGO Braille Bricks містить вибір із 124 навичок. Ці академічні навички та специфічні для бачення навички були дібрані та розділені на п'ять категорій цілісних навичок (когнітивні, фізичні, соціальні, емоційні, творчі).

Ми представили такі результати: описали набір інструментів і педагогічну концепцію LEGO Braille Bricks; розглянули шість основних категорій діяльності; набули знань про те, як концепція LEGO Braille Bricks може задовольнити потреби учнів у тактильному навчанні; диференціювали та зрозуміли три типи добрайлівської діяльності: маніпуляція, орієнтація та плеяда; як займатися LEGO Braille Brick діяльністю на основі п'яти характеристик ігрового досвіду (активне залучення, змістовне, радісне, ітераційне, соціальне); розробити методи полегшення дослідження кубиків: як маніпулювати, збирати та прикріплювати кубики до основної пластинки.

Ключові слова: грати, навчання через гру, діти з порушеннями зору, засоби навчання, кубики LEGO, кубики LEGO Braille

Statement of the problem. Learning through play builds on how we naturally learn from birth. It can include games to memorize facts, but its real potential is to foster children's understanding of concepts and mastery of a breadth of skills, enabling them to apply what they learn – even in creative ways.

When learning through play, children have experiences that are actively engaging, joyful, meaningful, iterative and socially interactive.

We say that play can lead to deeper learning when the activity is experienced as joyful. Nothing spurs us on more than the feeling of progressing or simply enjoying the task even when it's challenging.

This is easier if what we are doing or learning feels meaningful and builds on what we already know and truly care about. When you really grasp ideas understand how they connect and apply them in new ways, this is learning at its deepest.

It is also much easier to learn something new when we are actively hands-on engaged and get so invested in what we're doing that learning happens naturally.

This happens through a process of experimentation and iterative thinking. As learning is not about being told how to do something correctly, but rather to explore, test and try things out. Sometimes it takes a few mistakes to understand how to reach

a goal, which is why we need to let children keep trying, and help them learn from their mistakes, and try again.

Learning also happens when the activity is socially interactive, like learning from others, allowing us to see something from another perspective, to explain things, negotiate and reach a compromise by sharing our ideas, and understanding a subject.

In practice, these five characteristics will ebb and flow; each characteristic is not necessary all the time, but over time, children should be active and absorbed, feel moments of joy and a meaningful connection, iterate and engage with others.

Analysis of the latest research and publications shows that a lot of researches are devoted to a play definitions, descriptions and proving its importance in children's life (A.Aljarrah [1], L.Barblett [3], J.Christie [4], E.Danniels, A.Pyle, H.Wickstrom [5; 11; 13], K.McAloney, K.Stagnitti [8], D.S.Weisberg, K.Hirsh-Pasek, R.M.Golinkoff [15] and others).

Some submissions describe providing game activity in early and preschool age (E.Miller, J.Almon [9], M.Nilsson, B.Ferholt, R.Lecusay [10], A.Pyle, C.DeLuca, E.Danniels [14], L.Thomas, E.Warren, E. deVries [14] and others), and also in primary school age (K.A.Allee-Herndon, S.K.Roberts [2], K.M.Kemple, J.H.Oh, D.Porter [7], J.A.Jay, M.Knaus [6] and others).

The analysis shows that, unfortunately, in researches there was no description LEGO Braille Bricks and their role in learning through play. But this tool is very effective in working with visually impaired children, and this aspect needs separate discussion.

The purpose of the article is to discover LEGO Braille Bricks toolkit and pedagogical concept.

Presentation of the main research material. Children's development and learning is complex which is why we take a holistic view and highlight the importance of their physical, social, cognitive, creative and emotional skills and how this complement and interact with one another:

Physical skills: being physically active, understanding movement and space through practicing sensory-motor skills. Spatial understanding and nurturing an active and healthy body.

Social skills: collaborate, communicate and understand other people's perspectives through sharing ideas, negotiating rules and building empathy.

Cognitive skills: concentration, problem solving and flexible thinking by learning to tackle complex tasks and building effective strategies to identify solutions.

Creative skills: coming up with ideas, expressing them and transforming them into reality by creating associations, symbolizing and representing ideas and providing meaningful experiences for others.

Emotional skills: understand, manage and express emotions by building self-awareness and handling impulses. Staying motivated and confident in the face of difficulties.

Young blind children have the same dreams and aspirations for their future as sighted children. But as they grow older, they risk involuntary isolation as a consequence of exclusion from social and sporting activities as well as taking the same educational and career paths as sighted children. Today, the number of blind people receiving an education is drastically declining leading to greater unemployment. Research shows that learning braille can widen opportunities for blind and visually impaired children, enabling them to experience intellectual freedom, independence and equal access to study and work. Braille opens doors for blind people to further develop a wide breadth of skills – all helping to build the confidence needed to pursue their dreams and aspirations in life. According to the European Blind Union (EBU), Braille knowledge leads to better literacy – correct spelling, reading and writing – and greater understanding of text structure. Braille users often have a higher level of education and have better employment opportunities. So, despite technical advancement, it is still highly important for children to learn braille and LEGO Braille Bricks provide a revolutionary platform to teach braille in a very playful and therefore child appropriate manner.

LEGO Braille Bricks are offered to professionals working in different settings or in select institutions, school services catering to the education of children with visual impairment aged four and up. This tool is much more than bricks. It's a whole new pedagogical concept.

LEGO Braille Bricks are to help blind and visually impaired children to learn Braille and benefit from this playful learning tool. Although the toolkit is intended as a playful introduction to braille for younger children four and up, it has also proven to have learning opportunities and benefits for children in secondary school. Because the bricks also feature letters, numbers and symbols they can be used simultaneously with sighted peers and classmates.

Each LEGO brick also has a printed letter or character to ensure the tool is inclusive allowing sighted teachers, students and family members to play on equal terms with a child with vision impairment.

A selection of signature LEGO brick colours has been chosen specifically to ensure colour contrast and allow for a playful learning experience in an inclusive setting.

Each LEGO Braille Brick kit contains braille bricks with letters, basic punctuation symbols, number signs for creating numbers, and signs of operation math symbols so these LEGOS can be used across a variety of subject areas.

What makes these LEGO Braille Bricks so exciting is that they are designed to support tactile learning skills while being fun, interesting, motivating, engaging, and meaningful materials students can use to build and play. When learning visually, we receive whole-picture information instantaneously; learning tactually initially takes more time to explore/figure out individual pieces of information and then putting all those pieces together to form the whole-picture concept. Braille is an amazing literacy code based on a set of six dots presented in individual braille cells

or in combination with two or more braille cells but learning it can be tricky. What makes learning braille tricky is figuring out which dots of each braille cell are there, which dots are not there, and where each dot is located within each braille cell and in relation to the adjoining braille cells. Developing the tactile perception skills to figure this all out is often challenging and time-consuming. These braille LEGOS have very enlarged braille dots that provide more tactually distinct patterns, which in turn provide more tactual information for figuring out each braille symbol.

The aim is for children to firstly start to use touch to identify different dot combinations and then to start to learn braille in a fun way and the bricks have printed letters on them enabling children with and without vision impairment to play together.

A toolkit contains all the characters you need to write words, short sentences and do simple math. Some additional characters may be useful to write advanced math, words in a foreign language or in contracted braille. Make additional LEGO Braille Bricks by using 2x4 plates and adding 1x1 flat tiles and 1x1 plates. Let's build a 6-dot cell needed for some activities, placing six 1x1 plates on dots, 1 to 6 and two flat tiles on dots, 7 and 8. Remember, using a one colour brick is a good option if you don't want low vision students to identify the bricks too easily. These new bricks are useful when learning foreign languages. Every language has its own special characters. Children will need them to correctly spell and write certain words. Blind children learn contracted braille at an early stage so if you need to make contracted braille bricks, you can make your own. Finally, these bricks can be used to make other special characters: math signs, punctuation marks and even music notations!

The LEGO Braille Bricks are offered to schools and services catering to the education of blind and visually impaired children with distribution handled through participating partner networks.

Louis Braille, a French young blind student, invented braille code in the early 19th century.

The Braille alphabet largely follows the French alphabetical order. It is based on a logical construction by series of ten characters.

First series: the first ten letters (A to J) are made up only of combinations using the four dots at the top of the cell.

Second series: the next ten letters (K to T) are composed of the same combinations as the first series, to which dot 3 has been added. Thus, to write letter L (dots 1, 2, 3), the two dots used in the cell for letter B (points 1, 2) have been retained, with the addition of dot 3.

Third series: the next five letters (U to Z) are composed of the same combinations as the second series, to which dot 6 has been added. Thus, letter V has the dots 1, 2, 3 of letter L, and dot 6.

Only W (dots 2, 4, 5, 6) escapes this rule. Indeed, at the time of the invention of the braille code, this letter was not useful to write French words.

Working with experts within the field has been an instrumental part of developing and testing the LEGO Braille Brick concept. The initial test partners have included the “Danish Association of the Blind”, Brazilian based “Dorina Nowill Foundation for the Blind”, UK based organizations “Royal National Institute of Blind People” and “Leonard Cheshire” as well as Norwegian “Blindeforbundet Norge”. A second round of testing in 2019 was conducted in partnership with organizations in Germany, France, Mexico and United States of America. We are now working with official partners from the blind community in each country where we launch. Their tasks are to distribute the toolkits and disseminate the teaching concept to the teachers and support staff educating blind and visually impaired children.

LEGO Braille Bricks are much more than just braille bricks! It is a whole pedagogical concept allowing children to learn braille and acquire essential skills in a playful way.

The teaching materials are intended to serve as suggestions to help you get started with LEGO Braille Bricks. Each activity can be varied in the level of difficulty, according to the child’s motivation and prior level of braille knowledge. Each child is different, and it is important to work and play with the bricks relative to the child’s development stage.

The activities are divided into six categories: three in pre-braille and three in braille:

Pre-Braille Manipulation: Discover and get used to the bricks, learn how to handle, assemble and put them on the base plate. All activities across this section can be completed with classic LEGO bricks.

Pre-Braille Orientation: Learn how to position the bricks on the base plate and be aware that their orientation is important.

Pre-Braille Constellation: Discover the braille cell and how studs are arranged in two columns. Learn how to differentiate the studs.

Braille Characters: Learn braille letters, numbers, mathematic symbols and punctuation signs and know how to read and write them.

Braille Literacy: Assemble characters brick by brick and play with words in order to develop the ability to read and write.

Braille Numeracy: Assemble characters, play with numbers and develop the ability to do basic mathematics and geometry.

Each category proposes an equal number of activities.

Young children can start learning through play using LEGO Braille Bricks with pre-braille manipulative activities. They progress at their own pace through to the last two braille categories: literacy and numeracy.

We have chosen not to give any age indication, for any of the activities. A child who knows braille or a child who has additional issues may need to do some pre-braille activities to improve manual dexterity or tactile recognition. Children appreciate and benefit from simple warm-up activities or playing a familiar game.

Practitioners are invited to set up lesson plans by mixing activities from various categories.

Each activity sheet has the same template, which includes eight different sections:

1. At the top of the page, you will see the *title*, an average *time* to do the activity and the *number of participants* required. *Photos* are provided and show implementation examples, for those who like to quickly visualize the activity.

2. *Let's play* is the only section directly addressed to the students. For those with little experience teaching or caring for children with visual impairment, written adaptive directions are provided. Of course, you are free to adapt and modify the text as you wish.

3. *How to prepare* is basically the list of « ingredients » needed for the activity. A proposed brick selection is for easy/medium difficulty.

4. *Facilitation tips* allows to support children with visual impairment, encourage their engagement, creativity and adapt the activity to their needs and skills.

5. The next section contains *Possible variations*, making the activity easier, or open to more complex ideas.

6. *Children will develop these holistic skills* is a list of skills specifically targeted in this activity. Usually, there is one skill in each of the 5 domains. Clicking on one of the icons directs you to the complete list of the corresponding domain.

7. *Did you know* contains key messages about learning through play and teaching braille.

8. Finally, you will find options for *Download and print*. You can download the activities in .docx and modify freely to fit your practice and your students.

The teaching materials are meant as suggestions for getting started with LEGO Braille Bricks.

Each activity can be varied in the level of difficulty according to the child's motivation and level of knowledge about braille.

Each child is different and it is important to work and play with the bricks with respect to the child's development stage.

The activities are divided into:

- Pre-braille activities
- Braille activities

With pre-braille and braille activities it is possible to work with multiple academic and visual impairment skills.

Let's have a look at the three pre-braille categories

- “*Manipulation*”. Discover and get used to the bricks, learn how to handle, assemble and put them on the base plate. You will identify tactile characteristics of bricks and control motor skills. Students will develop fine motor skills and recognize spatial relationships through imagination and storytelling.

The examples of the games are: “Save the Turtles”, “Caterpillar to Butterfly” and others.

- “*Orientation*”. Learn how to position the bricks on the base plate and be aware that their orientation is important. Your students will develop hand and finger strength and recognize spatial relationships. Students will compare different orientations of LEGO Braille Bricks on a base plate.

The examples of the games are: “Apple trees”, “Find the Crazy Duck?” and others.

- “*Constellation*”. Discover the braille cell and how studs are arranged in two columns. Learn how to differentiate the studs. Children develop spatial and motor skills while recognizing spatial organization of the braille cell.

The examples of the games are: “6-Car Parking Lot”, “Body Braille Twister” and others.

As a practitioner, in many pre-braille and braille activities, you will have to build a frame: it can be a simple line, the outline of the plate, columns or separation walls.

Don’t forget that, at the beginning of the activity, it will take time for the child to discover this existing frame, time to explore the base plate, to take information from what is under their finger.

That’s why, we often suggest to build this frame with the child. There are several options:

- Work together on the same plate
- Give the instructions verbally
- Make a sample plate to be reproduced on another one

This could be the first part of the students’ activity! Even with an older student they will have to practice manipulative activities, to gain more abilities using the bricks.

We should never underestimate this construction. It is not so easy to make a straight row without the help of the sight. Building this framework calls upon notions of geometry, symmetry!

Here is a selection of pre-braille activities to help children improve skills and acquire sufficient knowledge before playing “6-car parking lot”:

1- Free-play: In this activity, students will discover the toolkit at their own pace. This important step is sometimes omitted or forgotten. Visually impaired students need time to touch the bricks, try to position them and invent their own activities. You can leave five or 10 minutes at the end of the lesson for free play, or you can start with it. Even with a free play activity children will develop amazing skills.

2- Cake decorating: If you want children to be confident while placing bricks on the baseplate, this activity is a good one, aiming to develop fine motor skills, explore the base plate and work on pattern identification while decorating a cake. This can be also a warm-up activity.

3 - *Place in Squares*: Other activities help children to learn how to attach bricks on the base plate. In this one, children look for squares on the base plate, and place one brick inside each. That's exactly what we want them to do in "6 car parking lot": take a brick and place it at the right spot!

4 - *Apple Trees*: Discover orientation of the bricks and how to explore the baseplate while planting apple trees.

These preliminary activities can help children build the skills they need to meet the prerequisites and succeed in *6-car parking lot*.

Help students acquire prerequisite skills for performance of complex multiple steps, by choosing appropriate activities, medium and support.

Clicking on a category card, for example, "Manipulation", brings up numerous specific activities for this category. Each activity card includes an activity phase drawing with a brief explanation. Clicking the card leads to the activity sheet.

We see pre-braille as the phase of learning when children develop prerequisites and fundamental skills to read and write in braille.

Some of the fundamentals are:

- Tactual skills: exploration and discrimination
- Auditory skills
- Fine motor skills and manual coordination
- Finger isolation and independence
- Spatial skills (right / left, front / back, up / down)
- Rhythm and pattern recognition
- Spatial organization of a braille cell
- Body awareness
- Objects identification: concepts such as same / different, big / little, tall /small
- Time awareness: yesterday, today, tomorrow, earlier / later

A multi-sensory approach to pre-braille promotes development of motor, auditory and tactual skills as well as concepts. Most importantly, all the activities have been created to encourage, support and develop a love for reading.

In the website LEGObraillebricks.com you will find all the inspiration you need to teach braille through play.

There are more than 100 activities and five lists of holistic skills. Feel free to explore, use and download any content you like.

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The site is fully accessible and easy to navigate.

Let's explore the menu bar and its six items.

First one on the left is the *LEGO Braille Bricks logo*, which is the Home page. Click here for more information about "LEGO Braille Bricks" and "Learning through play". Using the "Quick activity finder", you can see all activities, search by category or keyword.

Second item in the menu bar is *Activities* leading to more than 100 activities, divided into six categories: manipulation, orientation, constellation, characters,

literacy and numeracy. Each category card opens all activities cards of this specific group. Each activity card includes a drawing and a brief overview of the activity. Click on the cards to open specific activity sheets.

Third item is *Facilitation* including the basics of facilitating learning through play, the importance of the mindset and the five characteristics of playful experiences. There are also links to “Facilitating activities for visually impaired children”, “Preparation Tips”, “Material Tricks”, and others.

Fourth item *Learning through Play* presents the five holistic skills: creative, physical, social, cognitive and emotional. Click on each card to access to each specific list.

Fifth section *About* provides LEGO Braille Bricks, LEGO Foundation and LEGO Group information.

Last section *Get bricks* includes the list of official partners in various countries, who are distributing and implementing LEGO Braille Bricks.

<https://LEGOBrailleBricks.com> offers cards with enticing titles for each activity and a global vision of ideas that facilitators can practice with their students.

Activity overview enables a selection of the ones best suited to meet our goal: they are great suggestions.

For writing one's name, activity choice is numerous.

Braille Characters category includes:

- Identical Letter Towers
- Identify Individual Letters
- Listen and Pick a Letter

Braille Literacy includes:

- Find your Letter
- What Letter is Missing
- Word Scramble
- Hidden Word
- Upper Case

The idea is not to offer them all, but to create a cocktail of fun activities, promoting learning through play. The child learns to write their name without being bored by the same activity!

Let's combine four activities and imagine a fun 45-minute session for a young student!

1. *Identical Letter Towers:* In a bowl, place all the letters needed to spell the student's name 3 times. First, ask the player to build a tower for each letter in their name. Second, pick all the bricks which spell their name one time.

2. *Find your Letter:* Randomly place all the letter bricks on the baseplate. Instructions are to find the first letter of their name and continue until the spelling is complete.

3. *What Letter is Missing?* Remove a letter from the name and ask which letter is missing.

4. *Hidden Word*: Hide the name in a sculpture made of classic LEGO and braille bricks. Ask the student to look for the braille bricks and write their name on the baseplate.

Useful “Tips and Tricks” such as how to build your own braille labels can also be added!

LEGO Braille Bricks provides creation of multiple playful lesson plans, offering the best opportunities to learn braille through play.

Conclusions. So said above let us come to conclusion that learning through play builds on how we naturally learn from birth. It can include games to memorize facts, but its real potential is to foster children’s understanding of concepts and mastery of a breadth of skills, enabling them to apply what they learn – even in creative ways.

Learning all about LEGO Braille Bricks will consolidate a foundation for teaching students with visual impairment.

The playful activities, holistic skills and tips and tricks covered will allow creation of complete lesson plans using this amazing tool.

We have explored LEGO Braille Bricks and discovered everything about the toolkit, pedagogical concept and website. It is much more than a box full of bricks: it’s a whole new pedagogical concept to teach braille through play, in a fun and inclusive way!

LEGO Braille Bricks activities simultaneously develop academic skills, commonly used at school as well as specific visual impairment skills for blind children. Both are essential to deeply understand concepts and nurture a breadth of skills.

LEGO Braille Bricks pedagogical concept contains a selection of 124 skills. These academic and vision-specific skills were selected, divided into the five categories of holistic skills (cognitive, physical, social, emotional, creative).

We completed the following outcomes: discover LEGO Braille Bricks toolkit and pedagogical concept; review the six main activity categories; gain knowledge of how the LEGO Braille Bricks concept can meet students’ tactile learning needs; differentiate and understand three types of pre-braille activities: manipulation, orientation, and constellation; engage with LEGO Braille Brick activities based upon the five characteristics of playful experiences (Active engagement, Meaningful, Joyful, Iterative, Social); develop facilitation techniques for brick discovery: how to manipulate, assemble and attach the bricks to the base plate.

However, the conducted research does not cover all aspects of the declared issue. In our opinion, the development of clear and practically oriented methodical recommendations for planning and conducting lessons using LEGO Braille Bricks. This can be useful for professionals who work with children with visual impairments.

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