

Why do children with special needs thrive in Montessori schools?

Continuing our series of articles which focus on learning materials in a Montessori classroom, **Wendy Fidler** explores the Roman Arch* and other architectural structures which help children develop visual and spatial literacy and problem-solving skills.

There is nothing quite like wooden blocks to get children engaged in building. For work that absorbs children in creative activity for extended periods of time, building blocks win every time!

Dr. Maria Montessori designed a variety of sensorial activities using wooden blocks, including the well-known Pink Tower, Long Rods and Broad Stair; these are specific pieces of didactic (instructional) apparatus which promote children's sensory discrimination, coordination and spatial awareness, as described in Parts 1 and 2 of this series. These materials were also expressly designed to promote children's understanding of mathematical concepts.

In Montessori settings there are also applications for construction which promote children's language development and which provide foundations for learning in history, geography, design, technology and physics. – Construction activities begin with sand and water, smooth stones, clay bricks, twigs and wood blocks and progress to kits of blocks which teach classical and modern architectural techniques.

Building a Table-Top Sandcastle

All children can access this lovely activity – make picture or photo cards to help younger and/or deaf children and those with little or no language/reading skills to sequence events. Working with a low heat offers a good opportunity to reinforce the safe-child aspect of Every Child Matters. Children love to examine cause and effect

Part three

LEARNING ACTIVITY

Ingredients: 3 cups sand, 1.5 cups cornflour, 1.5 cups water, food colouring (optional)

Method: Mix the ingredients together and stir over a low heat. Allow the mixture to cool before building your sandcastle. Air dry – the sandcastle will last for a while.



– it leads to a spirit of enquiry. Is the 'cooked' sandcastle stronger than one made from sand and water only? Other tests for construction materials include watching soft wood expand in water, making cement, mud bricks and plaster and comparing similarities and differences.

Linking Sandcastle Construction to Language Development

In the BBC interactive computer game, Sandcastle Quiz (See Resources section) children start by choosing a phoneme. A word containing a gap will appear in the sand and Colin the Clam says the complete word out loud. The idea is to click on the sandcastle with the correct spelling for the missing phoneme. Each word the child gets right will add a sandcastle to the sandcastle they are building.

At the end of the game, a print out shows the sandcastle with all the words spelt correctly! Interactive games such as this work really well for children with short attention spans, dyslexia (no writing necessary) and dyspraxia (no struggling to hold a pencil).

Using Construction to Promote Cultural Studies

There are lots of correlations between young children's emergent building styles and those of ancient history. We can look back thousands of years to find examples of such architecture.

Figure1. shows a post and lintel construction; these structures are called Dolmen. Hundreds of dolmen still exist throughout Europe – they were built to cover graves in the days when people still lived in caves and are made of huge boulders with two vertical stones and one horizontal stone that spans across the top.

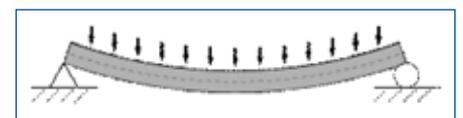


Fig.2 Side view of a simply supported beam (top) bending under an evenly distributed load (bottom)

Span is a section between two intermediate supports, e.g. of a beam or a bridge. The span is a significant factor in finding the strength and size of a beam as it determines the maximum bending moment and deflection. A span can be made of a solid beam for bridges, or from a flexible rope-like material for power lines, overhead telecommunication lines, some type of antennas for aerial tramways.

How do Construction activities help Children with Special Needs?

Children love to use long and unusual words, such as the names of dinosaurs and the historical eras of the Montessori time lines. By using correct terminology, such as 'span', 'arch' or 'cantilever' to describe what they are building, we are giving all children the means of communicating through words and constructions their growing understanding of concepts of weight, forces and balance.

LEARNING ACTIVITY

Can you make a post and lintel construction with only your hands and a pencil or straw?

Can you spot post and lintel constructions in modern buildings?

In true Montessori multi-sensory fashion children are hearing, saying and working on practical activities for each concept. This inclusive method promotes learning for all children, whatever their preferred learning styles.

Imagination, as Montessori taught us, is a wonderful tool but cannot be created out of nothing. Children with learning difficulties often have problems with imagination and perception – whereas, often as not, they are skilled in lateral and philosophical thinking, reasoning and creativity. A teenager recently asked me, 'How do I know that what you see as blue is the same as what I see as blue?' Children with Learning Differences and Difficulties – (LDD is now the designation for children with special needs but without a Statement of Special Educational Needs) - often run rings around other children when it comes to 'thinking out of the box', artwork, poetry or using materials in innovative ways. This is why reasoning games such as 'Sudoku' are so popular with people who do not succeed with traditional IQ type tests and crosswords – because Sudokus do not depend on reading, spelling or mathematics skills to solve them.

Creative imagination is directly related to the quality of sensorial experience in the

LEARNING ACTIVITY

Can you make a span using two chairs and a piece of string? What else could you use?

Did you know that the longest span in the world stretches for 2303 metres? See the Resources section to find out where it is!

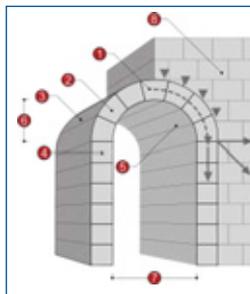
real world. As children progress through Montessori Sensorial and construction activities they develop a rich imagination which helps them 'imagine' or picture a solution to problem/puzzle solving.

Greater and varied experiences of purposeful activity and problem solving lead to more useful, creative and effective imaginations – thus we see all the time that children who are good with their hands are effective problem solvers.

The Roman Arch

Background: An arch is a curved structure capable of spanning a space while supporting significant weight (e.g. a doorway in a stone wall). The arch appeared in Mesopotamia, Indus Valley civilization, Egypt, Assyria, Etruria, and later refined in Ancient Rome. The arch became an important technique in cathedral building and is still used today in some modern structures such as bridges.

Fig. 3
The Roman Arch is semicircular, and built from an odd number of wedge-shaped arch bricks called voussoirs. The capstone or keystone is the topmost stone in the arch; this locks the other stones into position.



Key to bricks in a masonry arch:

1. Keystone
2. Voussoir
3. Extrados
4. Impost
5. Intrados
6. Rise
7. Clear span
8. Abutment

The Roman Arch is based on a traditional semi-circular arch. It is built from wedge-shaped 'arch bricks' which are supported during construction by a framework 'form' until the uppermost arch brick is fitted in place.

Many Montessori schools limit their use of architectural construction kits to the Roman Arch, but there are other applications including domes and cupolas and even a Coliseum and Mayan and Egyptian Pyramids. (See Resources Section)

How does the Roman Arch help children with special needs?

Building in three dimensions opens children's eyes and minds to the styles of buildings we see in magazines, books, and in real life; and it helps bring history to life. Without this hands-on experience children who struggle to 'imagine' concepts would have difficulty grasping these concepts. After building the arch and removing the framework 'form' children can take turns pressing straight down on the keystone with their full



PHOTO: MARU MONTESSORI/AUCKLAND, NEW ZEALAND
Hand and eye coordination and problem solving using the Roman Arch.

force. It's amazing how much weight a small block structure can stand. The arch does not collapse but instead 'gives' just enough so the children can see how the force is distributed out and down.

Children can be challenged to build an opening with the same span using the same blocks without making the arch. They will not succeed – this consolidates their understanding of the importance of the arch in Roman architecture and in buildings today. Armed with this understanding they are better able to 'imagine' the uses the Romans applied to the arch including the barrel vault, groin arch, and the dome.

Teaching Note:

If getting the angled blocks in the right order is a little tricky for younger children pencilling numbers that match the diagram should solve that problem.

Summary

Working with open-ended natural construction materials such as sand and water helps children develop visual discrimination, hand and eye control, vocabulary extension and concepts which underpin later learning.

The Roman Arch and other architectural kits build on children's early learning and give practice in the beginning, reasoning and ending of an activity. In the same way that children learn the exact techniques for practical life skills of woodworking, gardening or playing a musical instrument, they learn the techniques for construction; this facilitates creativity, independence and innovation. Through the repeated use and experimentation with these materials children learn to follow through an idea, a cycle of activity, solve problems and bring their bodies (especially their hands) under control. This is the foundation for the creativity of a professional – be it an artist, composer or architect. ■

See Resources on following page

Special Needs

Continued from previous page

* Even though the Roman Arch is used alongside the sensorial materials in many Montessori classrooms, it was not part of the original materials which Dr Montessori designed.

Resources

The Coliseum Set Architectural Blocks (C5744)
110 pieces in 7 shapes -
this set re-creates the
grand style of ancient
Rome.



<http://www.montessori-n-such.com/detail.aspx?ID=129>

Architectural History Blocks

These sets contain maple (hardwood) blocks which recreate architectural wonders of the world:

- The Mayan Pyramid Set exemplifies the civilization of Mexico, Guatemala and Belize 1500 years ago. 80 pieces in 14 shapes
- The Egyptian Pyramid Set is built in layers so one can see the chambers inside. 67 pieces in 18 shapes.



- The Middle Eastern Set contains the onion domes which give the special look of the 7th-16th centuries in Persia, Syria and elsewhere in the Middle East. 50 pieces in 13 shapes.
- USA Capitol Set recreates the style and grandeur of the state capitols and municipal buildings. 70 pieces in 25 shapes.

www.michaelolaf.com

ArchKIDecture - established in 1996 to encourage visual literacy and explain math, science and visual arts concepts through the medium of architecture.

<http://www.archkidecture.org/learn.html>

For the BBC Sand Castle interactive Phonics game, visit:

<http://www.bbc.co.uk/schools/wordsandpictures/phonics/sandcastle/flash/game.shtml>

For Topic/Project Material on Arches used by the Persian, Harappan, Egyptian, Babylonian, Greek and Assyrian civilizations for underground structures such as drains and vaults, and the ancient Romans who were the first to use them widely above ground, (although it is thought that Romans learned it from the Etruscans) and facts about arches used in some bridges in China since the Song dynasty, visit:

<http://en.wikipedia.org/wiki/Arch>

For a list of remarkable Spans, either used for power line crossings of rivers, sea straits or valleys, as antenna or for aerial tramways visit:

http://en.wikipedia.org/wiki/List_of_spans

On July 7, 2007 (that was 07/07/07) the NEW Seven Wonders of the World were announced. Find out more at

<http://www.new7wonders.com/>

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