Block Play

Making Maths Matter
East Lothian Conference
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Workshop Outline

- A brief history of block play
- Unit blocks
- Block Play and Curriculum for Excellence
- How does block play support development?
- How does block play support mathematical development?
- Stages of block play and their inherent mathematical concepts
- Schemas
- Role of the adult
- Professional enquiry – our experience

Friedrich Froebel

- Developed the Kindergarten System.
- Pioneered the idea of women as teachers.
- Believed that self activity and play are essential factors in child education.

The first Kindergarten opened in 1840 in Blankenberg, Bavaria.

The Curriculum was

- Based on play
- Wooden blocks - Froebel's Gifts
- Workshop experiences - Occupations
- Mother songs – finger rhymes and action songs
- Circle games and dancing – for healthy activity
- Growing and observing plants to stimulate awareness of the natural world

Froebel insisted that learning must start with the concrete and move to the more abstract, and that perceptual development preceded abstract thinking skills.

He also developed the concept of unity and the interconnectedness of things

Froebel's Gifts

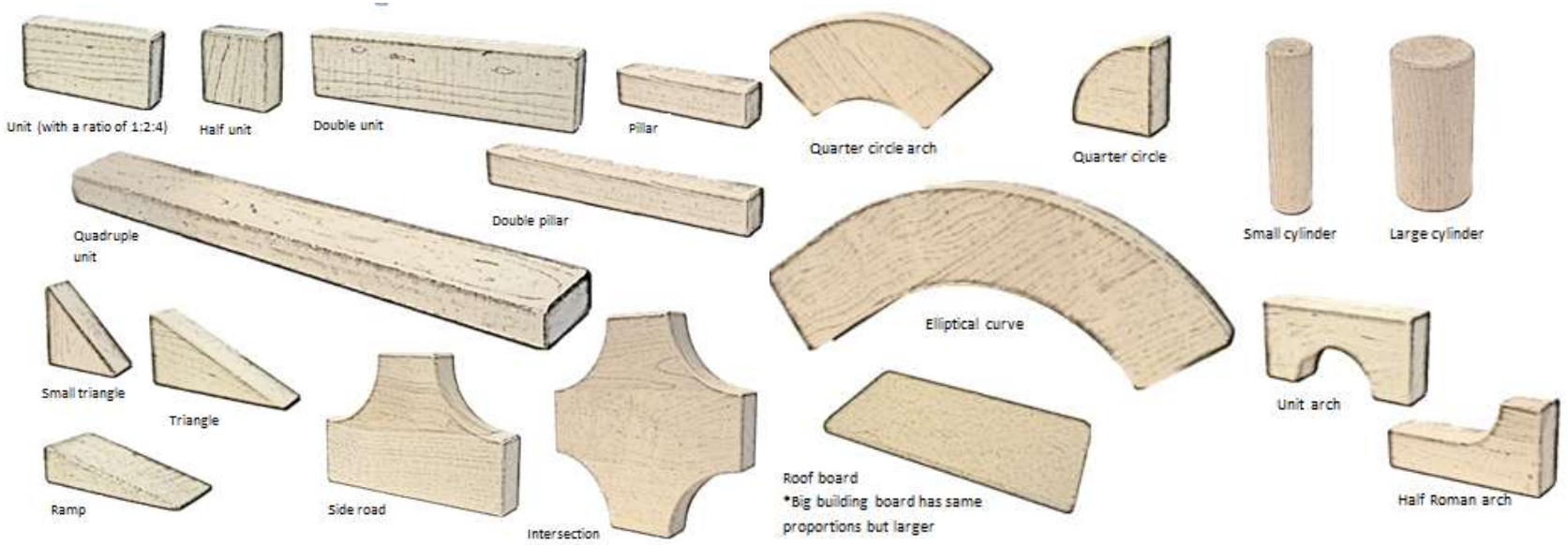
Solids – colour, shape, number, extent, symmetry, proportion

Caroline Pratt

- Invented the Unit Block
- Founded the City & Country School in New York
- Focused on first hand experiences and open ended materials

Unit Blocks

Unit Blocks


Unit (with a ratio of 1:2:4)
Half unit
Double unit
Pillar
Quarter circle arch
Quarter circle
Small cylinder
Large cylinder
Quadruple unit
Double pillar
Elliptical curve
Small triangle
Triangle
Unit arch
Ramp
Side road
Intersection
Roof board
*Big building board has same proportions but larger
Half Roman arch

Areas of the curriculum

Which areas of the Curriculum for Excellence do you think are met by block play?

- Numeracy and Mathematics
- Literacy and English
- Health & Wellbeing
- Sciences
- Technologies
- Social Studies
- Religious and Moral Education
- Expressive Arts

Numeracy and mathematics

I am developing a sense of size and amount by observing, exploring, using and communicating with others about things in the world around me. MNU 0-01a
I have explored numbers, understanding that they represent quantities, and I can use them to count, create sequences and describe order. MNU 0-02a
I use practical materials and can 'count on and back' to help me to understand addition and subtraction, recording my ideas and solutions in different ways. MNU 0-03a
I can share out a group of items by making smaller groups and can split a whole object into smaller parts. MNU 0-07a
I have experimented with everyday items as units of measure to investigate and compare sizes and amounts in my environment, sharing my findings with others. MNU 0-11a
I have spotted and explored patterns in my own and the wider environment and can copy and continue these and create my own patterns. MTH 0-13
I enjoy investigating objects and shapes and can sort, describe and be creative with them. MTH 0-16a
In movement, games, and using technology I can use simple directions and describe positions. MTH 0-17a
I have had fun creating a range of symmetrical pictures and patterns using a range of media. MTH 0-19a
I can match objects, and sort using my own and others' criteria, sharing my ideas with others. MNU 0-20b
I can use the signs and charts around me for information, helping me plan and make choices and decisions in my daily life. MNU 0-20c

Literacy and English

I enjoy exploring events and characters in stories and other texts, sharing my thoughts in different ways. **LIT 0-01c**
As I listen and talk in different situations, I am learning to take turns and am developing my awareness of when to talk and when to listen. **LIT 0-02a / ENG 0-03a**
I listen or watch for useful or interesting information and I use this to make choices or learn new things**. LIT 0-04a**
Within real and imaginary situations, I share experiences and feelings, ideas and information in a way that communicates my message. **LIT 0-09a/ LIT 0-26a**
I enjoy exploring events and characters in stories and other texts and I use what I learn to invent my own, sharing these with others in imaginative ways. **LIT 0-09b / LIT 0-31a**
As I listen and take part in conversations and discussions, I discover new words and phrases which I use to help me express my ideas, thoughts and feelings. **LIT 0-10a**
I use signs, books or other texts to find useful or interesting information and I use this to plan, make choices or learn new things. **LIT 0-14a**
I explore sounds, letters and words, discovering how they work together, and I can use what I learn to help me as I read and write **ENG 0-12a / LIT 0-13a / LIT 0-21a**
As I play and learn, I enjoy exploring interesting materials for writing and different ways of recording my experiences and feelings, ideas and information. **LIT 0-21b**

Health and wellbeing

I am learning to assess and manage risk, to protect myself and others, and to reduce the potential for harm when possible. **HWB 0-16a**
In everyday activity and play, I explore and make choices to develop my learning and interests. I am encouraged to use and share my experiences. **HWB 0-19a**
I am aware of my own and others' needs and feelings especially when taking turns and sharing resources. I recognise the need to follow rules. **HWB 0-23a**
I can show ways of getting help in unsafe situations and emergencies. **HWB 0-42a**
I understand positive things about friendships and relationships but when something worries or upsets me I know who I should talk to. **HWB 0-44b**
I am aware of the need to respect personal space and boundaries and can recognise and respond appropriately to verbal and non-verbal communication. **HWB 0-45**

Sciences

Through play, I have explored a variety of ways of making sounds. **SCN 0-11a**
Through everyday experiences and play with a variety of toys and other objects, I can recognise simple types of forces and describe their effects. SCN 0-07a
Through creative play, I explore different materials and can share my reasoning for selecting materials for different purposes. SCN 0-15a

Technologies

Within and beyond my place of learning, I can reduce, re-use and recycle resources I use, to help care for the environment. **TCH 0-02a**
Throughout my learning, I share my thoughts with others to help further develop ideas and solve problems. **TCH 0-11a**
Within real and imaginary settings, I am developing my practical skills as I select and work with a range of materials, tools and software. **TCH 0-12a**
Through discovery, natural curiosity and imagination, I explore ways to construct models or solve problems. **TCH 0-14a**
Throughout my learning, I explore and discover different ways of representing my ideas in imaginative ways. **TCH 0-15a**
I enjoy taking photographs or recording sound and images to represent my experiences and the world around me. **TCH 0-04b**

Social studies

I have experimented with imaginative ways such as modelling and drawing, to represent the world around me, the journeys I make and the different ways I can travel. **SOC 0-09a**
I make decisions and take responsibility in my everyday experiences and play, showing consideration for others. **SOC 0-17a**
Within my everyday experiences and play, I make choices about where I work, how I work and who I work with. **SOC 0-18a**

Religious and Moral Education

As I play and learn, I am developing my understanding of what is fair and unfair and the importance of caring for, sharing and cooperating with others**. RME 0-02a/ RME 0-05a**
Within my everyday experiences and play, I make choices about where I work, now I work and who I work with.
I am developing respect for others and my understanding of their beliefs and values. **RME 0-07a**
As I play and learn, I am developing my understanding of what is fair and unfair and why caring and sharing are important**. RME 0-09a**

Expressive Arts

I have the freedom to discover and choose ways to create images and objects using a variety of materials. **EXA 0-02a**
I can create a range of visual information through observing and recording from my experiences across the curriculum. **EXA 0-04a**
Inspired by a range of stimuli, I can express and communicate my ideas, thoughts and feelings through activities within art and design. **EXA 0-05a**
Working on my own and with others, I use my curiosity and imagination to solve design problems. **EXA 0-06a**
I can respond to the work of artists and designers by discussing my thoughts and feelings. I can give and accept constructive comment on my own and others' work. **EXA 0-07a**
I have the freedom to choose and explore how I can use my voice, movement, and expression in role play and drama. **EXA 0-12a**
Inspired by a range of stimuli, I can express and communicate my ideas, thoughts and feelings through drama. **EXA 0-13a**
I use drama to explore real and imaginary situations, helping me to understand my world. **EXA 0-14a**
I can respond to the experience of drama by discussing my thoughts and feelings. I can give and accept constructive comment on my own and others' work. **EXA 0-15a**

How does block play promote development?

How does block play promote development?

Social/Emotional Development

- Communication
- Collaboration
- Negotiation
- Understanding of rules and considerate behaviour
- Risk-taking
- Confidence
- Making choices and decisions
- Concentration
- Leadership
- Anticipation
- Problem solving

How does block play promote development?

Physical Development

- Motor skills, fine and gross
- Control
- Use of space
- Judgement
- Collaboration
- Understanding that equipment has to be used and stored safely
- Strength (hollow blocks)

How does block play promote development?

Cognitive Development

- Sorting, matching, order, sequence, counting, comparison
- Measurement – space, size, length, mass
- Shape – form, angles, symmetry
- Fractions – units, halves, quarters
- Position
- Patterns and relationships
- Mapping, representation and recording
- Estimating
- Properties – balance, weight, fit, support, stability, structures, design, problem solving, testing
- Structures
- Human interaction with the environment

How does block play promote development?

Language and Creative Development

- Expression and communication of ideas, thoughts and feelings
- Relevant vocabulary
- Imagination
- Drama
- Story making
- Representation of own ideas and symbols
- Mark making
- Exploration
- Imaginative and creative ideas
- Aesthetic awareness
- Development of 3D structures

How does Block Play support mathematical development?

What does the research say?

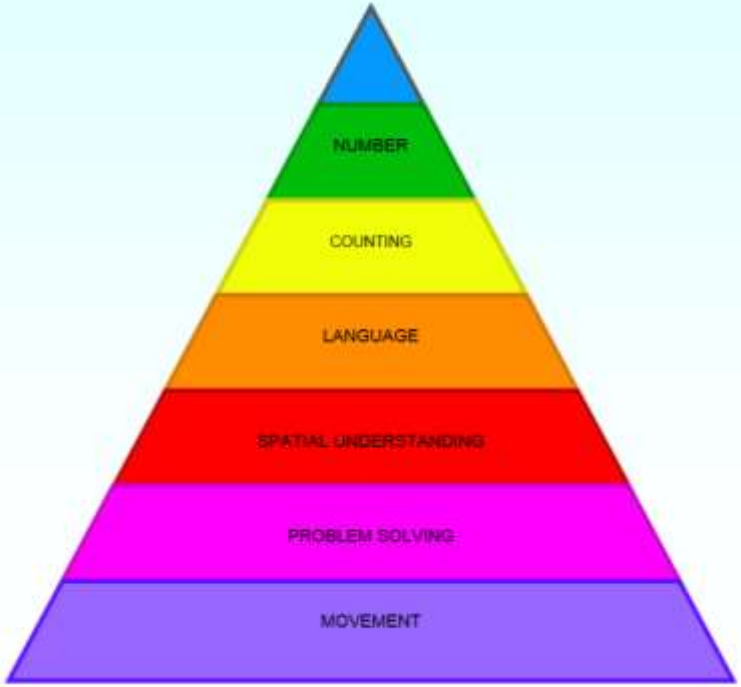
Block building can improve children's spatial skills that in turn support complex mathematical problem solving in middle and high school.

Brian N. Verdine, Roberta M. Golinkoff, Kathryn Hirsh-Pasek, Nora S. Newcombe, Andrew T. Filipowicz and Alicia Chang. **Deconstructing Building Blocks: Preschoolers' Spatial Assembly Performance Relates to Early Mathematical Skills**. *Child Development*, September 2013

Sophisticated pre-school block play predicts mathematical achievement at 7th (S1) and High School Grades

Charles H.Wolfgang, Laura L. Stannard, Ithel Jones. **Block Play Performance Among Preschoolers As a Predictor of Later School Achievement in Mathematics.** *Journal of Research in Childhood Education;* Spring – Summer 2001

Maths Pyramid for Babies and Young Children



Stages of Block Play

Stage 1

- Blocks are carried around but not used for construction.
- *Mathematical concepts - Attributes (colour, size, shape, orientation, texture); measurement/comparison.*

Stage 2

- Blocks are placed in rows on the floor horizontally or vertically (stacking)
- *Mathematical concepts - ordering/seriation, equivalent length, ratio of length, sorting, weight, corners/edges/surfaces, one-to-one correspondence.*

Stage 3

- Blocks are used to bridge the space between other blocks
- Mathematical concepts - *Spatial* e.g. positional words, relationships, maps/directions; *Geometrical* e.g. recognizing and naming shapes, transformation.

Stage 4

- Blocks are used to enclose a space
- Mathematical concepts - *perimeter, measurement, number of openings, numeral awareness/recognition, number relationships, problem solving/computation, Parts-to-whole relationships)*

Stage 5

- Complex Structures: Blocks are placed in patterns or symmetrically when building. Block accessories may be incorporated. Buildings are not generally named.
- Mathematical concepts - *Patterns, symmetry, equality, classification.*

Stage 6

- Block building often reproduces actual structures known by children. There is a strong impulse for dramatic play around the structure.
- Mathematical concepts – *A combination of the previous concepts.*

So what might we see when children build with blocks?

- Building towers upwards (verticals)
- Building along in rows (horizontals)
- Making slopes
- Making enclosures – circular, square or linear (regular or irregular
- Edge bordering
- Filling in
- Making a central core with radials, or zigzag lines, or intersections or grids
- Making symmetrical or asymmetrical forms
- Putting blocks inside, outside, over, under, on, through, rotating
- Transporting blocks from here to there and back again

Schemas

- *TRAJECTORY* – Children are learning about height, speed, distance and how things move.
- *ROTATION* –Through their explorations children develop an understanding of how objects and themselves turn.
- *TRANSPORTING* – Through exploration children will be learning about distance, journeys and places, as well as mapping where things are.
- *ENVELOPING* – Children are exploring with the idea of completely covering objects, spaces and themselves.
- *ENCLOSURE* – Children are finding out about size, shape, measurement and volume of spaces.
- *POSITIONING* – Children are learning about order, sequencing, classification, shape, symmetry and mapping.
- *ORIENTATION* –Children are learning out how things look from different angles.
- *CONNECTION* – Children are finding out about how to join and fasten things together in different ways.
- *CORE AND RADIAL* – Children are finding out about how to extend themselves.

The Role of the Adult

"Rich block play does not just occur. It develops when the adult acts as a powerful catalyst working hard to enable it." Tina Bruce

Setting up the block area

Pedagogical Knowledge

'Play creates a zone of proximal development of the child. In play a child always behaves beyond his average age… as though he were a head taller than himself… play contains all developmental tendencies in a condensed form and is itself a major source of development.'

Scaffolding Block Play

- To unlock the benefits of block play, the children need social interaction from adults as well as other children.
- Through effective comments and questions adults can encourage children to think deeply about their experiences with blocks and materials.
- The way an adult responds can help children make connections and create meaning during their block play.

Observations

The first step is to observe children with intent. Through focused observations of children in the block area:

- we are offered openings into the children's worlds
- we can observe many rich applications of academic skills
- provides us with opportunities to see the meanings the child's have created and the questions with which they are struggling
- These observations provide next steps in planning by revealing to us an insight of how to expand the children's learning and how to nudge them forward through the asking of open-ended questions and /or the arrangement of materials.

Talking with children about their structures

"That's a nice model." "Well done." "What have you built?" are not useful responses to this model.

"I see you used one block that is longer than the others."

"Look, your blocks make a space in the middle."

"All of your blocks except one are touching."

"You used four blocks. You made the whole building with just four blocks."

"All your blocks are rectangles, but they're not all the same size."

For an inexperienced builder, statements can be more helpful than questions.

- Choice of blocks: “You used a curved block.”
- The arrangement: “The blocks are on top of each other.”
- The number used: “You balanced three blocks.”
- The similarity: “The rectangular blocks are the same length.”

Open ended questions

- **Examples of open-ended questions to ask during block play:**
- What would happen if …?
- What else could you try…?
- What else is another way to…?
- How could you change…?
- What might explain…?
- I noticed…
- Tell me about…
- How would you…?
- How is _____ and _____ the same? Different?
- How can you use _____ differently?
- How did you…?

Measurement Questions

- If both buildings have the same number of blocks, why is this one taller?
- How can we work out whose building has more blocks?
- How can we make sure that _____ is taller/shorter/same as _____? (keep asking questions to guide toward measuring with standard or non-standard unit)

Concepts of Structure

- How can you make sure _____ (animal etc.) doesn't escape?
- What will the people do in your building?
- What happens when it rains on your house/castle/hotel etc.? What can you do to help the people inside stay dry?
- What do the people need inside of the _____, outside of the _____?
- How can you build those items?

Concept of Balance

- Why doesn't your tower fall down?
- How can we use these blocks to make something really tall that doesn't fall down?
- How can we use these blocks to make something that is really long?
- How can you make a bridge that goes over part of the structure?

Shape/Pattern Questions

- Can you continue this pattern?
- Describe the shape.
- How do we know it is a … (circle, square, etc.)?
- If we turn the shape upside down/sideways etc., how do we describe the shape now? How do we know it is still a … (circle, square, etc.)?
- How can we estimate/guess the number of blocks used?
- How is _____ the same or different?
- What do you think is similar to this structure (or shape)?
- How can you use the blocks to make one big _____ (shape)?

Concept of Ramps

- Which container moves down the ramp fastest/slowest?
- What is same/different?
- What doesn't move and why?
- What can you change to make it move faster?
- What can you add to the ramp to slow down the movement?
- What angle of the ramp makes it go faster/slower?
- How can you compare…?
- How is this ramp the same/different as…?

Adding in Literacy

- How will people know that this is a _____? (Guide toward adding of materials that symbolize that type of building or using paper and markers to make a sign for the building/structure.)
- How can we use the blocks to retell the story that we read at story-time? What do we need to build? What else is needed?