SUPPORTING NUMERACY AND LITERACY IN PLAY-BASED EARLY LEARNING PROGRAMS

REPORT

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LAND ACKNOWLEDGEMENT

MSVU is located in Kjipuktuk (Halifax), part of Mi'kma'ki, the unceded ancestral territory which remains the homeland of the Mi'kmaq Nation. This territory is covered by the Covenant Chain of Treaties of Peace and Friendship signed between 1725 and 1779. These treaties are affirmed by the Supreme Court of Canada and recognize Aboriginal Title (which is embedded in both the 1763 Royal Proclamation and in section 35(1) of the 1982 Constitution Act). The treaties are living agreements that establish the rules for an ongoing Treaty relationship between nations.
We pay respect to the knowledge embedded in the Mi'kmaw custodians of the lands and waters and to the Elders, past, present, and future.

RECOGNITION STATEMENT

We also pay respect to the histories, contributions, and legacies of African Nova Scotian communities that have been here for over 400 years and the 52 African Nova Scotian communities throughout the region today.

WHAT & WHY?

CONTEXT

Numeracy and literacy are both enhanced through young children's play, exploration, and learning. There are many ways for children to communicate ('literacies') and apply mathematical knowledge ('numeracy'). Understanding and acknowledging this supports a sociocultural perspective of early childhood curriculum. This perspective is what guides the Nova Scotia Early Learning Curriculum Framework. This approach recognizes the important role of children, families, educators, and communities in the development of literacy and communication.

Play is a valuable resource in the early learning environment. It is through play that a child has the freedom to learn and explore on their own terms. Early childhood educators are able to support and encourage children's emerging numeracy and literacy through the intentional design of the learning environment, programming and interactions.

This research study looked at how providing a meaningful and functional numeracy and literacy-rich play-based environment helps to build positive attitudes and competencies for children in publicly funded early learning programs.

PROJECT AIMS:

1. To capture and reflect on how numeracy and literacy are supported within the Pre-primary Program through pedagogical documentation.
2. To use documentation as a tool to discuss and critically think about numeracy and literacy within the Pre-primary Program. Also, to use documentation as a way of sharing experiences and building skills.
3. To collaborate on ideas of how to enhance play-based programming to support children's numeracy and literacy development in Pre-primary Programs in Nova Scotia.

WHO?

Three groups of Pre-primary educators were recruited into this study and were selected based on the unique community perspectives and opportunity gaps in professional development and expectations for numeracy and literacy.

Rural Communities

5 Pre-primary educators from 3 Regional Centres for Education (RCE) across Nova Scotia participated

Years of experience ranged from 15 to 22 years

Black and ANS Communities

7 Pre-primary educators from 2 RCE participated. Four participants identified as Black or African Nova Scotian (ANS) and four participants identified that they worked in a community with a population of ANS students and families

Years of experience ranged from 4 months to 30 years

Francophone Communities

5 Pre-primary educators working in the Conseil Scolaire Acadien Provincial participated

Years of experience ranged from 9 to 22 years

METHODS

FORMAT

This research study included a series of six workshops. The workshops consisted of three information-sharing sessions, followed by two photo-sharing sessions and one final group brainstorming session. Recognizing the vast knowledge early childhood educators carry, all sessions were collaborative. Each group shared their personal experiences as an early childhood educator (ECE) in a Pre-primary classroom and examples of numeracy and literacy in their play-based classrooms through photos. Each group collaborated on and approved a final visual representing the themes discussed throughout the workshops.

GROUPING IDEAS

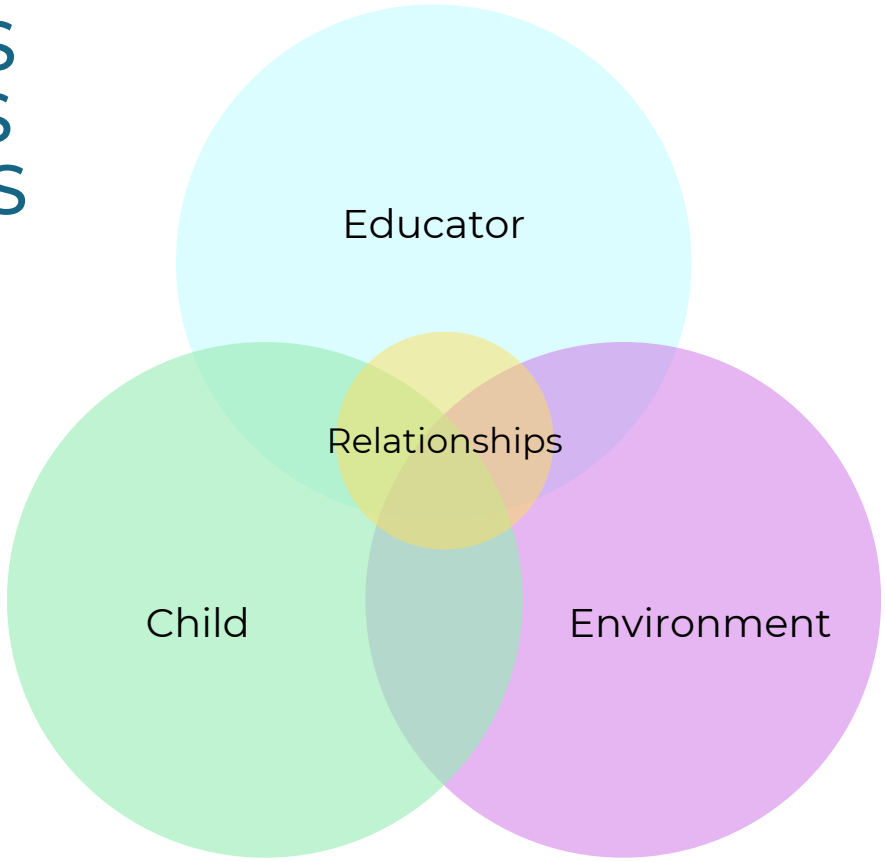
Following each photo-sharing workshop, participants engaged in a brainstorming session to compile and group ideas across photos, within their cohorts. These ideas informed the development of a visual by researchers, which was brought back to the group for further revision. This collaborative process gave participants a voice in finalizing the main concepts that arose from the six weeks of discussion.

THEMES ACROSS GROUPS

While each group had its own perspectives on how numeracy and literacy were exhibited in their photos, there were common ideas across all groups that reflect our themes from this research.

Through their reflections, participants spoke about the role of the educator, the child, the environment, and relationships in a play-based early learning program, and emphasized the interconnectedness of these themes. A visual (see page four) was co-created by the research team and highlights how these common ideas work together to support numeracy and literacy in a play-based early learning program. We chose three photos from each group that exemplify how all themes work to support numeracy and literacy learning.

THEMES ACROSS GROUPS



A numeracy and literacy lens:

Relationships are the connection between the child, the educator, and the environment. They act as the foundation for all learning, working together and separately to inform play-based approaches and responsive interactions.

Educators support the numeracy and literacy environment by being thoughtful and intentional in their planning of the play environment, and by drawing on their knowledge of the children to model and scaffold opportunities for learning and growth.

By creating an **environment** that fosters exploration through accessible and flexible materials, opportunities for play-based learning emerges through invitations, unplanned/spontaneous learning opportunities and extensions of past activities.

Each **child** comes to a program with abilities, background experiences, curiosity, and an eagerness to explore and engage with other children, adults, and the environment. Each child is part of a family, a community, and a culture with experiences that influence their interactions and enrich the learning environment.

Due to the interactive nature of the ECE classroom, all themes can be found within each photo. Please note, any names used in quotes are pseudonyms.

COMMUNITY CONNECTIONS

Educator Voice

"I reminded them about our I spy game and I said, 'I have notebooks and markers. If anybody wants to write numbers,' and everybody wanted one. So, as we walked, I said 'OK, let's go on a number hunt.' We started singing, I changed the Bear Hunt song to the Number Hunt song..."

"This activity included numeracy, and it also extended their literacy knowledge with some new vocabulary such as "apartment, university, pharmacy and transit. We found numbers everywhere - the school, the pharmacy, on cement trucks, transit buses, street signs, apartment buildings, and a variety of street signs. "

Researchers' Interpretation

As an educator in a play-based early learning program, close observation of the children and their interests is an invaluable tool. In this example, the educator noticed the enjoyment and interest that the children had in an impromptu game of 'I spy' and 'number hunt'.

Observation also informs the selection of materials. Noticing the children's interest, the educator offered notepads and markers. This provided children with the opportunity to take note of the world around them.

The number hunt and notepads encouraged children to think about the symbolic representation of numbers and how they are used to communicate meaning. Their conversations about the use of numbers provided new vocabulary supporting both early literacy and numeracy.

Child	Inspired by a previous activity the children liked, the children were free to engage in the activity in their own way.
Educator	The educator was prepared to support children's play with readily available literacy materials, and provided games to engage children in the exploration of numbers, symbols, and signs.
Environment	The environment provided traditional numeracy materials in a non-traditional setting.
Relationship	The educator was aware of the children's interests and capabilities. Showing them a familiar environment in a new context.

LABELLING NATURE

Educator Voice

We talk a lot about plants and gardens and the students were super interested, so we decided to go and look, to see what was growing in our garden. We had taken out the clipboards with markers, pencils, and paper.

I explained to the students, 'You know, sometimes, when we see things and we want to remember it, we can document it.'

*...it's not important what she wrote, the words, the specific letters, or even the images that she drew, it's not that at all. It's the idea that what they put on paper is their way of sharing their knowledge with other people, even if sometimes for some students, they don't understand that is what they are doing. But that, that's power.**

*Please note these quotes have been translated from French and are therefore not exact quotations.

Researchers' Interpretation

Presenting materials and modeling their use is an intentional way of fostering numeracy- and literacy-rich play opportunities.

In this example, the educator observed the child's interest in the garden and, through a well-timed invitation, encouraged the child to document what she saw, supporting the child's confidence and sense of agency as a writer and a careful observer.

The educator noted that what words the child wrote or how she wrote the words didn't matter as much as what the child was learning from the act of writing what she saw. The educator recognized the importance of giving the children both the opportunity to learn that words have meaning and the power that comes from being able to convey that meaning to others.

Child	The child chose what she saw as important and documented what was interesting to her.
Educator	The educator understood how to best support the child's interest in writing by helping the children spell words when asked and by supplying easily accessible writing materials.
Environment	Numeracy and literacy were intentionally brought outdoors by providing clipboards and writing materials.
Relationship	The connection between the child, educator and materials allowed the child to be confident in documenting what she saw.

THE EXCHANGE

Educator Voice

"After finishing her lunch one day, Zoe began to set up shop to sell some lemonade. She found a shelf and placed a wooden cash register, a collection of wooden cylinder logs, and an orange plastic frying pan down on it, she boldly announced 'lemonade for sale!'

A classmate named Ben walked in her direction. He stopped in front of Zoe as she passed two of the wooden log objects to him. 'Thank you, $2.00,' she told him. Ben took the wooden logs and placed them in a bowl he was holding in his hands. 'Thank you,' Ben replied with a look of amazement in his eyes. Then Zoe handed three wooden logs to Ben. He gladly accepted them and placed them in a bowl next to the other two. 'That's all the money I can give you,' Zoe exclaimed as she added more wooden logs in the plastic frying pan and then covered it with her hands."

Researcher Interpretation

While observing day-to-day activities in her classroom, this educator noticed that outside, the children seemed to be interested in using things like grass and sticks as 'money'. This observation inspired this educator to place small wooden logs for use in dramatic play.

The logs allowed for many numeracy-related opportunities, from classifying certain logs as money and others as lemonade based on their size to counting and exchanging the money.

This example also speaks to the importance of conversation and communication which is so prominent in children's imaginative play. Zoe and Ben agreed that the logs represent currency and understood that currency is exchanged for product, reflecting real life experiences.

Child	The child was autonomous in setting up their lemonade stand and announcing it to their classmates.
Educator	The educator observed the children's interest in playing store and provided materials to extend the play.
Environment	Other children visited the lemonade stand and engaged in conversations about the required payment.
Relationship	Elements of both numeracy and literacy were present as children negotiated value with logs and calculated amounts for each purchase.

PARADE OF PATTERNS

Educator Voice

"So one of my support staff made these [number cards], and we keep them on our shelf with our loose parts and our play dough so they can dig them out, they can trace them, they can write on them- they're all sealed in plastic.

This day, the child got our loose parts off the shelf and she was lining them up [on the number card]. She was making a pattern as well with them so she was alternating the colours.

And as she was doing it, the other kids were watching her and she was counting them to see if it worked out to be 5 to fill it in. They were trying to figure out their own patterns on different numbers cards and were following alongside her. They were helping each other figure out what number they had. They said, 'Count them again and we'll count slower,' and they helped each other figure out the numbers."

Researcher Interpretation

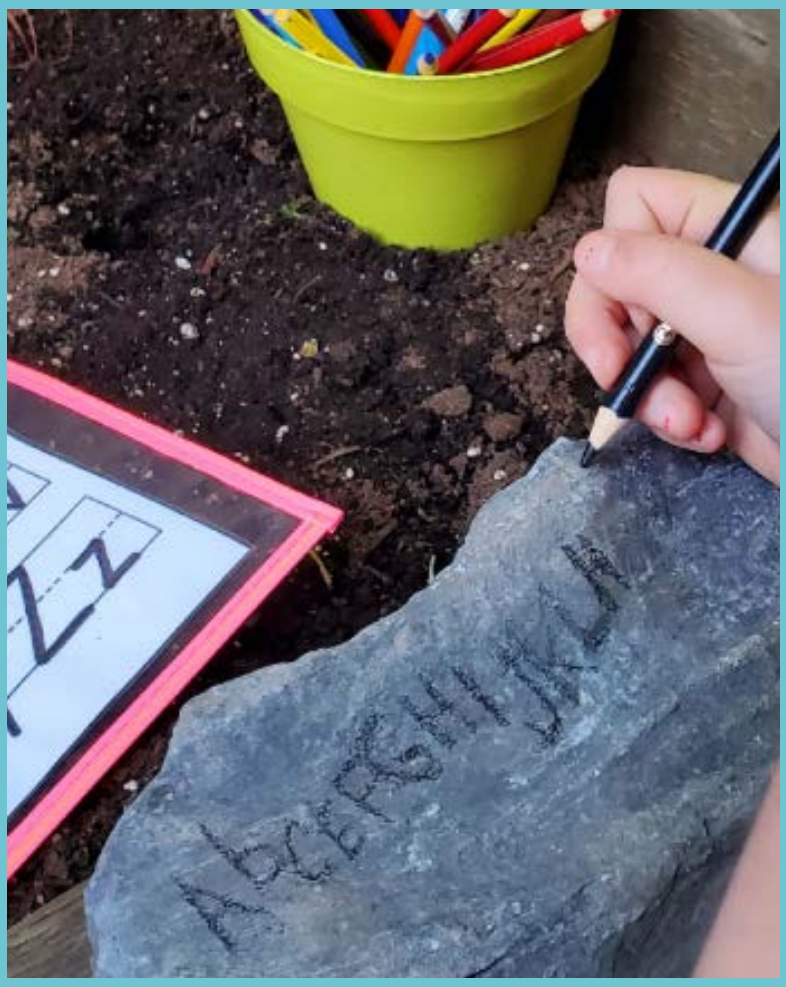
Worksheets have traditionally been used in educational contexts in very teacher-directed ways to familiarize children with number and letter symbols, placing an overemphasis on only one component of literacy and numeracy. Even when worksheets are presented as playful learning opportunities, they can limit learning opportunities by restricting children's options and focusing on an outcome rather than the process of discovery.

In this example, however, the laminated worksheets, supplied by a support staff, were instead used as a provocation with loose parts. No instructions were provided. Children were free to use the material in their own way. During their play, the educator was able to see examples of problem-solving, number recognition, counting, and sequencing in patterns.

Child	Problem-solving skills were evident as the child predicted and then demonstrated how many jewels were needed to fill a space.
Educator	The educator saw the children's interest in the material and found a way to give the children the freedom to interact as wanted.
Environment	The materials were flexible and accessible, with the sheets stored in the loose parts area.
Relationship	The children were forming relationships with each other through their shared interests in counting and problem-solving.

ACCESSIBLE MATERIALS

Educator Voice



Lyette found a lead pencil on the ground, it was broken. She started to write on a rock, she then brought it over to me and said, 'Look when I move like this, you can see the letters,' because it was just a lead pencil. Then she said, 'Look, I made an A.' She pointed out that when she put the letter A in the ray of the sun, the lead shone a little bit.

*I suggested that she try another type of pencil, a coloured pencil. Lyette began to write the alphabet, and she said, 'I want to make it in small letters.' She went to look for a reference because she didn't remember how to write the lower case letters herself, then she continued to write on the rock. She wrote the whole alphabet on her big rock. There were lots of other children who started to write on rocks, some were writing the letters of their names, others just drew pictures.**

*Please note these quotes have been translated from French and are therefore not exact quotations.

Researcher Interpretation

A broken pencil and a flat rock on the playground acted as a provocation for this literacy-rich play. The activity started spontaneously by exploring the unusual materials and their relationship to the sunlight.

The easy accessibility of the pencil crayons and alphabet sheet encouraged Lyette to expand on her initial discovery of how the pencil marks became visible in the sunlight, to exploring the letters of the alphabet. She has a real interest in creating both upper case and lower case letters and this plays out in her interactions with the rock and the writing tools.

Child	This activity was spontaneously initiated by the child finding a broken pencil on the ground and trying to write on a rock.
Educator	The educator supported the child's learning by reminding her of a previous activity where different colours showed up better on dark backgrounds.
Environment	The letter sheet and coloured pencils were easily accessible for the child to bring outside to extend the play.
Relationship	The child was eager to share what she had done with the educator, and was aware of what materials the environment had to offer.

BEST OF FRIENDS

Educator Voice

"As part of our garden project, the children have been collecting worms to put in our composter. The child in this photo came over and she started squealing with excitement because she found this worm and it's shaped itself into the letter 'L' and her name starts with 'L'. She was just beside herself with excitement and she started petting the worm.

She came over and she said, 'Look, look, the worm. It loves me because it made the first letter in my name!' and she was very, very excited. She was convinced that this worm was now her very best friend because, of course, it made the first letter of her name."

"It's such an unlikely literacy opportunity."

Researcher Interpretation

The natural flexibility of the outdoors gives children the freedom to explore. Natural loose parts like sticks, rocks, and grass are invitations for the imagination and children's natural curiosity provides many opportunities for interactions with nature.

A wiggling worm led to a moment of early literacy magic. In this moment, the worm wiggles its way into the shape of the first letter of this child's name. Not only did the child recognize the letter 'L' visually, but she also recognized its significance as representing her identity. The child also considered the letter 'L' as a form of communication from the worm to her. A delightful encounter involving nature, relationships, and literacy.

Child	The child was open to communicating with non-human creatures in nature, paying careful attention to the 'L' shape created by the worm.
Educator	Through her observations, the educator is taking note of the child's interest and documenting it for further discussion and reflection.
Environment	This moment spontaneously developed as the child was outside collecting worms, without the educator setting up the environment.
Relationship	The child's relationship with the natural world supported her exploration of the worm's body and movements.

CONSTRUCTION AND CONFIDENCE

Educator Voice

"So, the child grabbed the Lego box, put it on the floor and he started arranging all the Legos. I saw that he had a plan, like a concept and he set up those designs.

Later I went to him, I said, 'What are you doing?' He looked at me, thought for a while, looked at what he did, and said, 'Construction sites'. I asked him where he got that idea from and he said, 'My book at home.' He could bring the idea he saw in his book at home and made it a reality by translating it with construction blocks..

I asked the question, 'The construction site, did they have all these colours?' he said, 'No, no, no, no. But they have building blocks, and they have a truck, the one that carries the stone'. The child was excited to call his friends over to see his project. He was proud and confident to explain his work to his friends.

In this picture and scenario, I see cognitive skills applied by the boy. He also used his imaginative skills by picturing the image he saw in his book at home and applying it to his learning materials in the classroom. When children are supported to bring out their skills through play and learning materials, it helps build their confidence and capabilities."

Researcher Interpretation

The Nova Scotia Early Learning Curriculum Framework views children as capable, confident and curious. These elements are often most observable in children when they are engaged in free play.

This child, who was new to the program, had been working on his confidence and on finding opportunities to connect with the other children. Building this construction site, based on his knowledge from a book he and his parent had read at home, allowed him to demonstrate his expertise on this topic which provided him with a way to connect with some of the other children.

Concepts of early literacy are evident through the connections made from his knowledge of construction sites from books and from real life experiences to his imaginary play and his eagerness to communicate what he knows to others. Early numeracy is also present through his spatial awareness skills and his ability to recreate 3D structures from his memory book illustrations.

Child	The child independently selected Lego to play with as he had the idea to make a construction site based on a book he read at home.
Educator	The educator recognized the child's confidence in his play and asked him questions to learn more about his process.
Environment	The accessibility to materials of choice allowed the child to engage in play that interested him.
Relationship	By engaging in an activity the child had confidence in, he was able to connect and communicate with other children.

EQUAL MEASUREMENT

Educator Voice

He was explaining that each small ballB was like when the bees put their nectar inB the little boxes to make honey afterward.B So that's what the bees are depositing,B it's all little balls of nectar and there areB three of them in each of the little tins.

...and then he explained the process ofB making honey, it was really cool. But heB was particular about how many of theB little balls go into each tin and how heB had to fill in all the tins so that it lookedB like it filled well. Because he tried four, butB they didn't fit so well. Then he tried twoB but it was too empty.

*I helped because he went as far as heB could to count them. And then he looksB at me, 'I can't count no more.' So weB counted together as far as we couldB count. **

*Please note these quotes have been translated from French and are therefore not exact quotations.

Researcher Interpretation

Spontaneous learning opportunities may seem to be unplanned but are supported by the teacher's intentional decisions about the selection of materials and the design of the learning environment, based on observations of children's explorations and an understanding of what types of opportunities might engage, challenge, and interest children.

Several children in this educator's classroom were very interested in bees so she supported their interest by reading books about bees and providing open-ended materials like play dough and loose parts which some of the children used to make bumblebees.

Based on his own interests and previous knowledge, this child associates the play dough balls and the muffin tin with his understanding of nectar and honeycombs. By assessing what amount of nectar best fills the tins, the child is also building his problem-solving and measurement skills.

Child	The child used the materials around him to align with his previous learning about bees and nectar.
Educator	The educator provided the time, space, materials, and opportunity for exploration and supported him by helping him count when he asked for help.
Environment	The availability of materials prompted the child to extend his previous learnings and share his knowledge with the educator.
Relationship	Previous activities planned by the educator helped the child use the materials around him to in a new, but related way.

X MEANS NO

Educator Voice

"We had water and paintbrushes and buckets, it was a hot day and I just let them go and to see what they would do with them. First, Elliot was washing his truck and then he was pushing it around, making engine noises and sounding out sirens.

He then stopped and started making Xs in a box surrounding him. I was just watching him and seeing what he was going to do. Then, another child walked over and tried to walk into the box of Xs. And Elliot says, 'No, you can't come past the X. X means stop. This is my fire station and I'm the fireman. So you have to make your own fire station.'

So I thought it was pretty neat that he used Xs as a symbol like 'No, you cannot come by.'

So then the other little boy says well, 'How come I can't come in?'. Elliot said, 'Because I have...' and he started counting, he said, 'I have 4, 5, 6, 7' and he counted them all around him '...12, he said, 'I have 12 Xs around here and that means you can't enter', you have to make 12 Xs yourself'."

Researcher Interpretation

When educators plan invitations they may have certain ideas of how the play will look. This educator shared with us that she brought out buckets, water, and paintbrushes with the idea that the children would wash their toy cars as they had typically done. What caught the educator's interest is when the child began to use the materials in a different way than she expected.

The flexibility and accessibility of these materials allowed the child to engage in imaginative play which is a key component of early literacy and numeracy. In this example, the child is able to quantify the number of Xs and is also able to demonstrate his understanding that symbols such as 'X' can be used to communicate messages such as 'no' or 'stop'.

Child	The child led the play by interacting with the materials as they wanted, and by setting rules for the markings and how other children could join their play.
Educator	The educator provided the materials and allowed the children to interact with them as they wanted, making notes of what she observed.
Environment	The materials set up outside by the educator were accessible to the children for use to suit their play.
Relationship	The children worked together to negotiate the steps they each had to take to make their own fire stations.

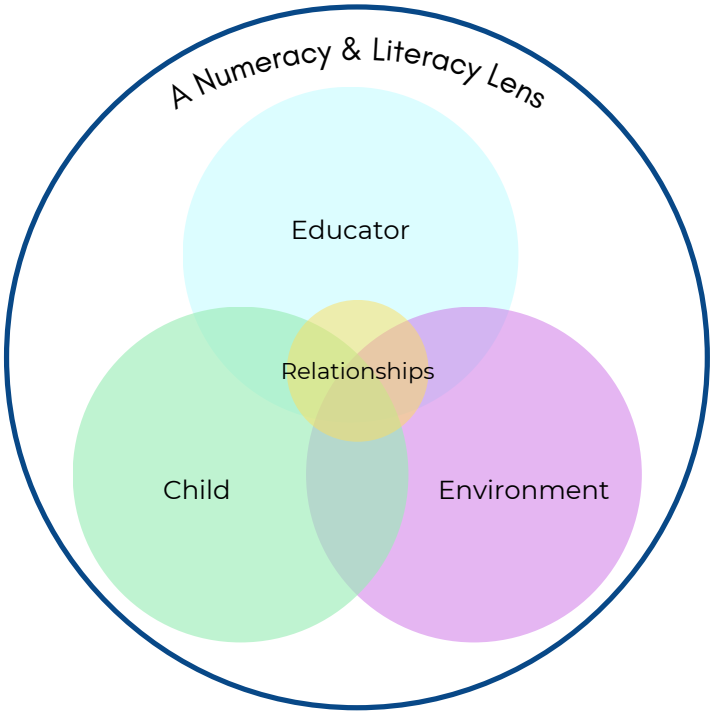
CONNECTIONS WITHIN THE PLAY-BASED CLASSROOMS

RELATIONSHIPS

Relationships were discussed across all groups through its importance in fostering play-based learning and was a central theme that connected educators, children, and their environment.

A closer look at the photos and their accompanying stories shows that relationships play a role in multiple elements of the classroom. The relationship between the child and the educator is commonly known as the foundation for all learning, as trust and understanding are the building blocks for the creation of playful learning environments that intentionally meet children's interests. Beyond the child-educator relationship, we must consider the other interactions that occur in the early childhood education environment. Both the educator and the child have relationships with the environment through their levels of trust and comfort in the space. Child-to-child and educator-to-educator relationships are also crucial elements of play-based learning as they influence the quality of interactions.

Elements of all relationships can be seen within each photo, showcasing the significance that they hold within the early childhood education environment.



NUMERACY & LITERACY LENS

Participants spoke of the ‘numeracy and literacy lens’ they applied in viewing children’s play. This lens was considered to help uncover the fundamental early learning concepts that emerge in everyday interactions and play. Whether it be seeing letters in wiggling worms, pointing out numbers in the community, or putting three balls of nectar in each space- when a numeracy and literacy lens is applied the abundant opportunities for learning through play becomes evident.

Putting it into practice

Based on the findings from this study, below are some practical examples of how numeracy and literacy can be supported in your every day interactions with children.

- Accessible and Flexible Materials
  - Materials that are easy to access allow play to happen alongside of inspiration. Take a moment to reflect on where in your classroom you could place writing materials and how it would extend the play in that area. How could these materials be used in your outdoor play environment?
  - Non-traditional materials also bring a lot of value to the learning environment. Materials that are open to interpretation invite interest and from there using a numeracy and literacy lens, you will be able to extend the skills that children are exhibiting.
- Make use of the natural environment
  - Our world is full of numeracy and literacy opportunities! When you point out patterns in natural and the outside world these help children make sense of the practical application of these skills. How and why they're used in the real world.
- Role Modeling
  - Have you noticed the children modeling you during free play? Reading books or writing list? Modeling an interest in numeracy and literacy is an important way to instill these skills in the children you work with. Continuing to read books, write notes, and to notice patterns out loud will help children see the value in these activities.
- Encouragement
  - Children naturally engage in numeracy and literacy activities. Noticing when this happens and giving children the language for what they are doing solidifies these skills.

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GLOSSARY

LITERACY: The many modes of communication (i.e., movement, dance, crying, laughing, painting, gesturing, scribbling, building, reading).

EARLY WRITING AND INVENTIVE SPELLING: Meaningful, purposeful experiences throughout the day for children to write. This can include anything from children drawing marks and symbols to represent words, to drawing letters, to writing words.

ALPHABET AWARENESS: Learning about the purpose of letters and the role they play in communicating with others

MOVEMENT: A type of communication, children can express themselves through music/movement/dance

CONCEPTS OF PRINT: Children begin to understand print and writing when they see the purpose and function of print and writing. Examples of meaningful print: name tags, attendance, books. Examples of meaningful writing: notes, signs, reminders, writing stories, captions on photos.

IMAGINATIVE PLAY: This will often appear as children playing 'pretend' (ex. play that involves pretending to work at a lemonade stand), and/or using one thing to represent another (ex. using toy logs to represent money; OR using small wooden blocks to represent people).

SYMBOLS: Use of marks or markings to represent or communicate something.

INTERPRETING IMAGES: When children use images (often in books or signs) to interpret the story or to infer meaning.

COMMUNICATION: When participants describe the children communicating during play. This could be communicating with the teacher or their peers.

NUMERACY: The ability to work with mathematical concepts and reason with numbers (Red River College, 2018).

CLASSIFYING/COMPARING: Organizing materials by attribute.
Classifying= placing objects into sets based on similarities.
Comparing= looking at differences, e.g. opposite, more than, less than.

MEASUREMENT: Measurement is determining the size or amount of something. Includes measurements of weight. May include matching the same size of one item to another.

SPATIAL RELATIONS: Require an understanding of where objects are in relation to something else. (ex., position words like under, over, in, behind; understanding where something is located in relation to something else)

SEQUENCING/PATTERNS/SORTING: Patterns are sequences that repeat.

COUNTING/ENUMERATION/ADDITION: Saying number words, counting, instantly recognizing a number of objects, reading or writing numbers.

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