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Mathematics At Kindergarten Level: Preparing Early Childhood Trainee-Educators

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The new B.A.(ECEC)(Hons.) degree

The B.A. (ECEC) (Hons)

- Traditional programmes for teacher training being phased out:
  - B.Ed. (Hons) Primary - recently, main focus Years 3 to 6
  - B.Ed. (Hons) ECEC – focus KG + Years 1, 2

- New programmes first offered in October 2017:
  - Professional Masters “Master in Teaching and Learning” (MTL) Primary (Years 1 – 6)
  - BA (Hons.) (ECEC) (Kindergarten)

- BA is 3-Year programme; MCAST Level 5 diploma students can join for the final year and obtain the degree.

- The BA programme Includes a Study Unit on Mathematics Education in 2nd year
  - Study unit entitled “Children’s Early Experiences with Mathematics”
  - 28 hours of contact with students (interactive lectures) + readings + assignment

Early Childhood Pedagogy

“Learning through Play”

- For children to engage in learning through high-quality play, they require 3 main elements:
  - Sustained time to play without interruptions
  - High-quality provision and resources
  - Sensitive interactions with adults
- Therefore, the KGE has an important role to play in a child’s learning by intervening gently as children engage in free play

Montague-Smith, A., Cotton, T., Hansen, A., & Price, A.J. (2018). *Mathematics in Early Years Education.* London: Routledge.

Intervening at “teachable moments”

- While children play, the educator observes them and identifies elements in the spontaneous situations that can be used to promote learning of mathematics.

- Example. Suppose a child is building towers with blocks, describing them as ‘big’ (kbir) and ‘small’ (żgħir).
  - The educator can talk to the child about what they are doing, focus on which towers has more/less blocks (focus quantity).
  - S/he can also introduce new vocabulary ‘tall’ (twil/għoli) and ‘short’ (qasir/baxx) which can support the child to be more specific about what ‘kind’ of ‘big’ it is.

- Limitations of depending solely on this approach:
  - It may be difficult to spend the necessary time on observation to find these ‘moments’ as children play freely
  - Teacher needs to be ‘alert’ to what mathematical idea can be addressed at that moment
  - Possibly, not enough mathematics will be addressed, OR concepts might not build on each other

Clements, D.H. & Sarama, J. (2018). Myths of Early Math, *Education Sciences, 8,* 71

Teacher-initiated activities

- The KGE can plan activities with a specific focus in mind (teacher-initiated).

- Example 1. An activity prompted by the children themselves, therefore carried out in response to children's ideas). During a Circle Time conversation related to the theme/project 'Transport' , two children talk about the buses they have caught with their parent/grandparent. They comment that there were numbers on the front of the buses. This gives the educator the idea of bringing along a large picture of a bus the following day and some number cards. Working with groups of four children, the KGE supports the children to attach bus numbers thus focusing on the 'nominal' use of number.

- Example 2. A 'stand-alone' activity devised by the teacher. The teachrr might wish to focus on the quantity 5. The teacher provides various sets of items and asks the children to make up different groups of 5 on coloured plates (five big buttons, five Playmobil dolls, five small dinosaurs, etc.). The children are then to choose the number from a set of cards.

Trainees' Knowledge of Mathematics

The strands of mathematics

- There is much more to EC mathematics than just counting! I strongly believe that an educator needs to have ‘subject knowledge’ to be prepared to respond to ‘teachable moments’ and to plan activities.

- Five ‘content’ strands of mathematics:
  - Number (sets, number sense, counting, number operations)
  - Pattern (Algebra)
  - Measurement
  - Handling Data
  - Space and Shape

- In the study unit, we also discuss processes:
  - Representation (modelling mathematics through manipulatives, symbols and drawings)
  - Communication (conveying mathematical ideas through speaking, writing, drawing)
  - Connection (linking mathematics with other areas of knowledge and life experiences)
  - Problem solving (simple situations e.g. How shall we place the toys on the shelves so that they all fit neatly?)
  - Reasoning (occurs through talking situations through).

“Big Ideas” – (1)

- Kindergarten experiences involves the ‘Big Ideas’ of mathematics.
- Example 1.

Big Ideas of Sets

Topic	Big Ideas	Examples
Sets and Sorting 	• Attributes can be used to sort collections into sets. • The same collection can be sorted in different ways. • Sets can be compared and ordered.	• Color, size, shape, type of object, etc. • Red bears vs. blue bears; big bears vs. little bears • *There are more red bears than blue bears.* (compare); *small bears, medium bears, large bears* (order)

“Big Ideas” – (2)

Example 2.

Big Ideas of Pattern

Topic	Big Ideas	Examples
Pattern and Regularity 	• Patterns are sequences (repeating or growing) governed by a rule; they exist both in the world and in mathematics. • Identifying the rule of a pattern brings predictability and allows us to make generalizations. • The same pattern can be found in many different forms.	• Dots on a ladybug; posts of a fence; adding 1 to any number gives you the next number. • *After lunch comes recess; If we keep counting people's feet, it will always be 2 more.* • Big block, little block; big block little block; big block, little block . . . OR snap, clap; snap, clap; snap, clap . . .

Study-Unit Assignment Tasks

Examples of BA study-unit assignment questions – (1)

Informal teacher interventions during play (hypothetical case studies)

- Example 1. Patrick (KG1) is playing with blocks at a table. He first empties the blocks onto the table, then starts putting them back into the bucket. As he drops one block at a time into the bucket, he says: “One, three, FIVE!” Then he puts another three into the bucket, saying “One, four, THREE!” For another three blocks, he says, “One, five, TWO!” Explain how you could use this play situation to help Patrick focus on the counting principle of ‘stable order’ (for numbers up to 5).

- Example 2. Mohammed (KG2) has taken the balance scales to play with; he starts randomly placing a mixture of items in the pans: blocks, small plastic dinosaurs, wooden puzzle pieces. His friend Zak intervenes, placing his lunch fruit box on one pan. This results in items falling out onto the table. Mohammed is annoyed and a quarrel ensues about how to play. Explain how you could use this situation to draw the boys’ attention to the use, including the purpose, of a balance scale. (You may bring other items to the table).

Examples of BA study-unit assignment questions – (2)

Teacher initiated activities: for example, linking mathematics with stories and other learning areas

❖Refer to the children's book "*Seaweed Soup*" (KG2)

1. What key Maltese words/expressions might you use during the narration, in order to convey the general and mathematical meanings of the story to Maltese speaking children?
2. Prepare some simple props that you would use to help in the narration of the story.
3. Describe a teacher-initiated **mathematical** activity that might be carried out later; the activity should be prompted by the story and should be related to the key idea of 'one-to-one correspondence'.
4. Outline a learning opportunity/activity, prompted by the story, that may be offered later, related to the learning area (a) **Science**. (b) **Art / Crafts.**
5. Imagine that after you finish reading the story, one of the children starts imitating a crab walking, making the other children laugh. This gives you an idea – to plan a music/movement activity linked to the mathematical idea of pattern. Explain this teacher-initiated activity.

Final reflection …

[For mathematics education …]

…Teachers matter more than other factors, and teachers in the early years matter the most!

Van Hiele, P.M. (1986). *Structure and Insight: A Theory of Mathematics Education*. Orlando, FL: Academic Press.

Thank you!

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