

# Fostering fundamental computational skills, a global challenge

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## Koji Watanabe, Professor from Miyazaki International University in Japan, argues that fostering fundamental computational skills is a global challenge

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The international community recognises cultivating fundamental computational skills as a critical challenge in achieving the Sustainable Development Goals (SDGs) by 2030. The mathematics education of a country plays a crucial role in fostering these basic computational skills. Therefore, a comprehensive approach that considers various components of school education (educational goals, teachers, teaching materials, and children) is necessary. Additionally, the concept of quantity in developing basic computational skills is context-dependent and requires attention.

The study seeks to address the challenges the international community poses regarding mathematics education. We strive to gain a detailed understanding of the current situation and develop teaching materials and educational practices based on this understanding. Our specific focus is on cultivating basic computational skills in developing countries.

We aim to assess the actual state of basic computational skills, including the concept of quantity among children, and develop effective teaching materials and educational practices to elucidate their effects.

### Computational abilities of children in developing countries

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Research on the actual computational abilities of children in developing countries is still in its early stages and has a long way to go. There needs to be more research that reveals the true extent of mathematical proficiency among children in developing countries. The overall picture of low academic achievement is depicted in various international assessments (such as PISA and TIMSS), but the delineation between what students cannot and can do needs to be clarified.

Furthermore, there is a need for more teachers who are well-versed in mathematics. While some educators might deepen their knowledge of instructional techniques for mathematics, a significant number still need a fundamental understanding of the subject. This highlights the perceived need for opportunities and resources to enhance teachers' own mathematical learning.

### The significance of quantitative literacy

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For instance, let us consider three apples and three dogs. Disregarding the distinction between apples and dogs, the common element of 'three' is focused on. Through this abstraction, the concept of 'three' is extracted.

In this abstraction, we move beyond concrete items like apples and dogs and recognise a semi-concrete entity encompassing their commonality. This leads to the abstract concept of the number 'three'. Notably, the instances of 'three' within the context of scenes involving apples and dogs represent a form of quantity. This quantity is discrete and can be counted.

However, mathematical education goes beyond discrete quantities and involves continuous quantities like length and area. These specific contexts enable learning about rational numbers, equations, and calculations. Understanding the concept of 'quantity' is essential for learning elementary arithmetic. Therefore, it is crucial to emphasise the perspective of 'quantity' through instructional materials and methodologies.



## **A case study in Zambia**

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In Zambia, many children approach simple calculations like  $8+7$  or  $15-9$  differently. Instead of using methods like column addition or subtraction, they draw eight sticks and then add seven more sticks, to represent the number and count them to find the total.

Therefore, they often do not leverage the structure of the decimal positional numeral system. Because counting is the prevalent calculation strategy, acquiring decimals and mastering fraction calculations will likely be challenging. Mastery of the positional numeral system, fundamental for calculations, seems to be a prerequisite before delving into computations involving fractions.

## **The inherent challenges of measuring academic performance**

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Assessing children's abilities and comprehension can be challenging. Combining quantitative and qualitative methods is used to understand their skills comprehensively. In the quantitative realm, test construction uses test theories like item response and classical test theories to measure computational ability.

Additionally, interviews take place to capture the thought processes involved. Moreover, an analysis of the country's mathematics curriculum and textbooks is necessary to enhance the validity of these investigations.

Collaborative research fosters many viewpoints, enabling the integration of insights from various regions, cultures, and educational systems. This enriched perspective enhances our understanding of the complexities of mathematics education globally. By acknowledging and respecting the diversity of approaches and challenges, collaborative research has led to more effective strategies and solutions that can uplift mathematics education globally.

Establishing ongoing feedback loops between researchers and educators facilitates the refinement and adaptation of strategies over time.

This iterative process can result in more contextually relevant and impactful interventions. The synergy between research and practical applications is crucial in addressing low academic achievement and paving the way for tangible improvements in mathematics education.

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