Bridging the Gap: Exploring Mathematics Transition from Basic to Higher Education

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Siyaphumelela Network Conference - 2024
The Wanderers Club – 25 to 28 June 2024

Introduction

- The transition from basic to higher education represents a critical period in students' academic journeys, particularly in the field of mathematics.

- As students move from foundational levels of education into more specialized and advanced studies, the challenges they face can significantly impact their academic success and future career opportunities.

- Mathematics is a cornerstone of education that underpins many disciplines and is essential for various professional fields.

- However, the shift from basic education, typically characterized by a broad and general curriculum, to higher education, which demands deeper and more specialized mathematical understanding, can be daunting for many students.

- The differences in curriculum content, teaching methodologies, and academic expectations often create a gap that students must navigate. Understanding this gap and finding ways to bridge it is crucial for educators, policymakers, and students alike.

Significance of the study

- The importance of this study lies in its potential to uncover the underlying factors that contribute to the transition difficulties in mathematics education.

- By examining the alignment of curricula, pedagogical approaches, and the preparedness of students, this research seeks to provide insights into the current state of mathematics education transition.

- Additionally, it aims to propose actionable strategies and interventions that can support students in overcoming these challenges.

Aim

- Investigate the challenges and factors that influence the transition of students from basic to higher education in the field of mathematics.

Research Questions

- What are the main gaps in mathematical knowledge and skills between basic and higher education?

- How do different pedagogical approaches impact students' transition in mathematics?

- What support systems are most effective in aiding students' transition from basic to higher education in mathematics?

Theoretical Underpinnings

Constructivist Theory:

- Emphasizes the importance of building on prior knowledge and experiences Vygotsky (1978) .

- Learning as an active, constructive process where students integrate new information with existing cognitive structures.
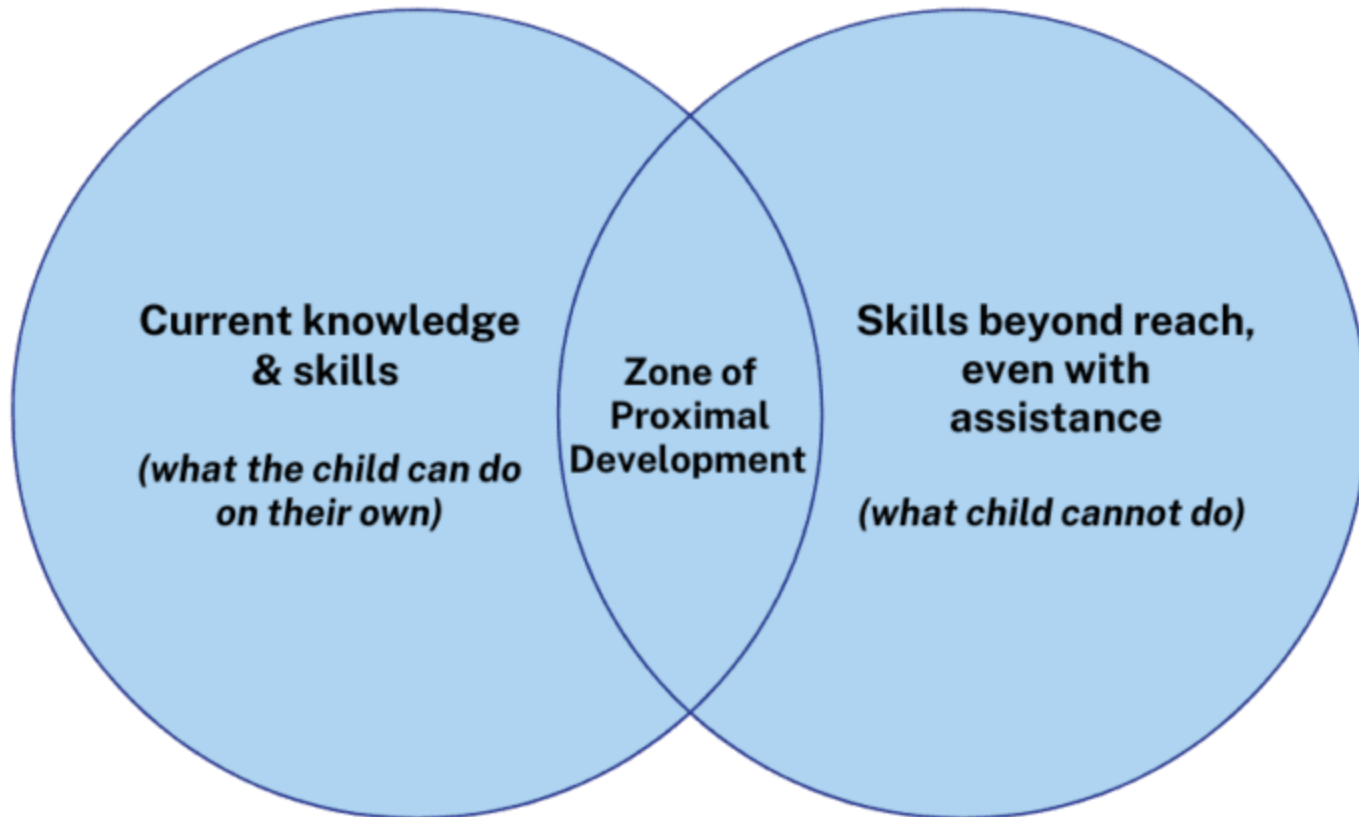
Zone of Proximal Development (ZPD):

- Concept by Vygotsky (1978) highlighting the gap between what learners can do independently and what they can achieve with guidance.

- Importance of targeted support to help students reach higher levels of understanding and skill.

Transition Theory:

- Focuses on the process of change and adaptation during educational transitions (Schlossberg, 1984).

- Identifies key factors influencing successful transitions and strategies to support students through these changes.
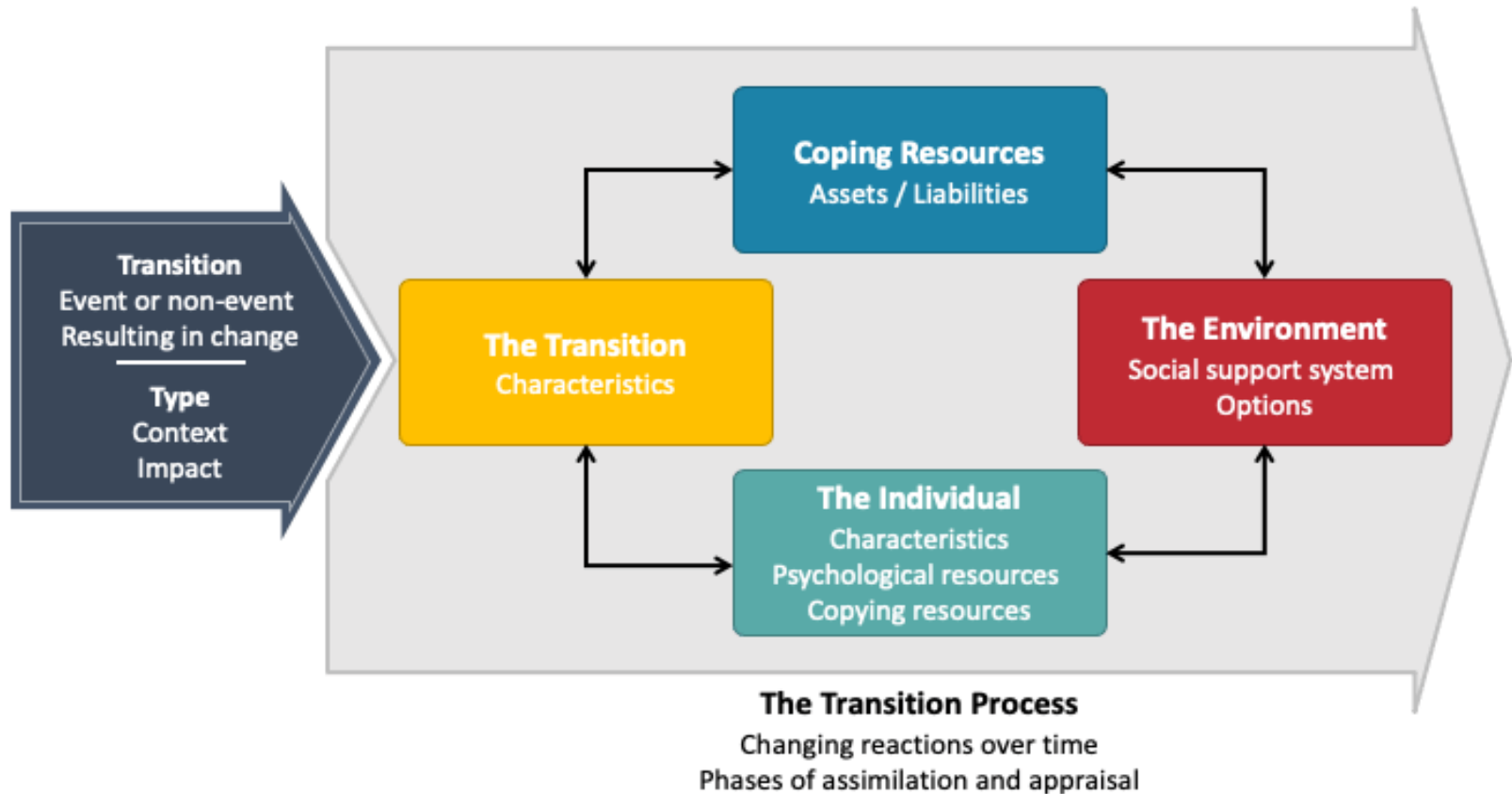
Zone of Proximal Development

Current knowledge & skills

(what the child can do on their own)

Zone of Proximal Development

Skills beyond reach, even with assistance

(what child cannot do)

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SCHLOSSBERG TRANSITION THEORY

The Individual in Transition (Schlossberg, 1984)

Transition
Event or non-event
Resulting in change
_____
Type
Context
Impact

Coping Resources
Assets / Liabilities

The Transition
Characteristics

The Environment
Social support system
Options

The Individual
Characteristics
Psychological resources
Copying resources

The Transition Process
Changing reactions over time
Phases of assimilation and appraisal

Methodology

- Analysis of curriculum documents and academic performance data.

- DBE Diagnostic Reports spanning five years of basic education analyzed to identify the gaps in Maths/Mathematical Literacy education.

- Comparison of curriculum content, teaching methods, and student outcomes across different educational levels.

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Gaps and Challenges

- Discrepancies between the knowledge and skills taught in basic education and those required in higher education.

- Challenges faced by students in adjusting to new academic environments and expectations.

- Differences in resource availability (e.g., textbooks, technology, support services) that impact student learning.

- A notable shift in students' mindset towards Mathematics/Mathematical Literacy between these educational levels

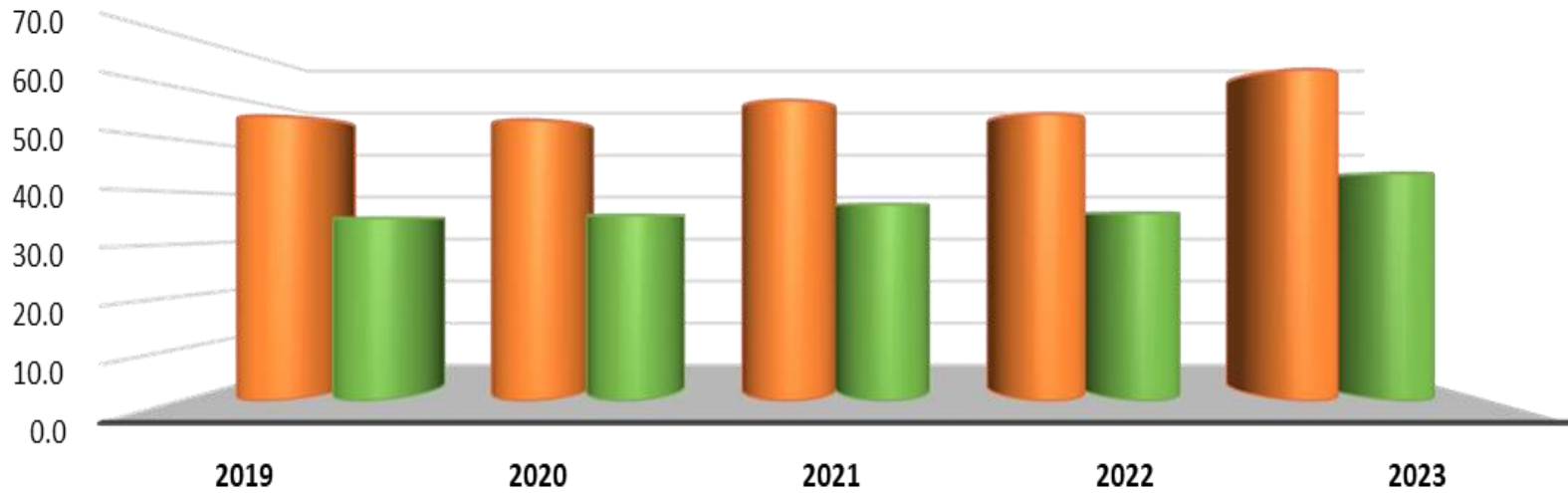- Declining pass rate in Higher education over the years

Overall achievement rates in Mathematical Literacy (Percentage)
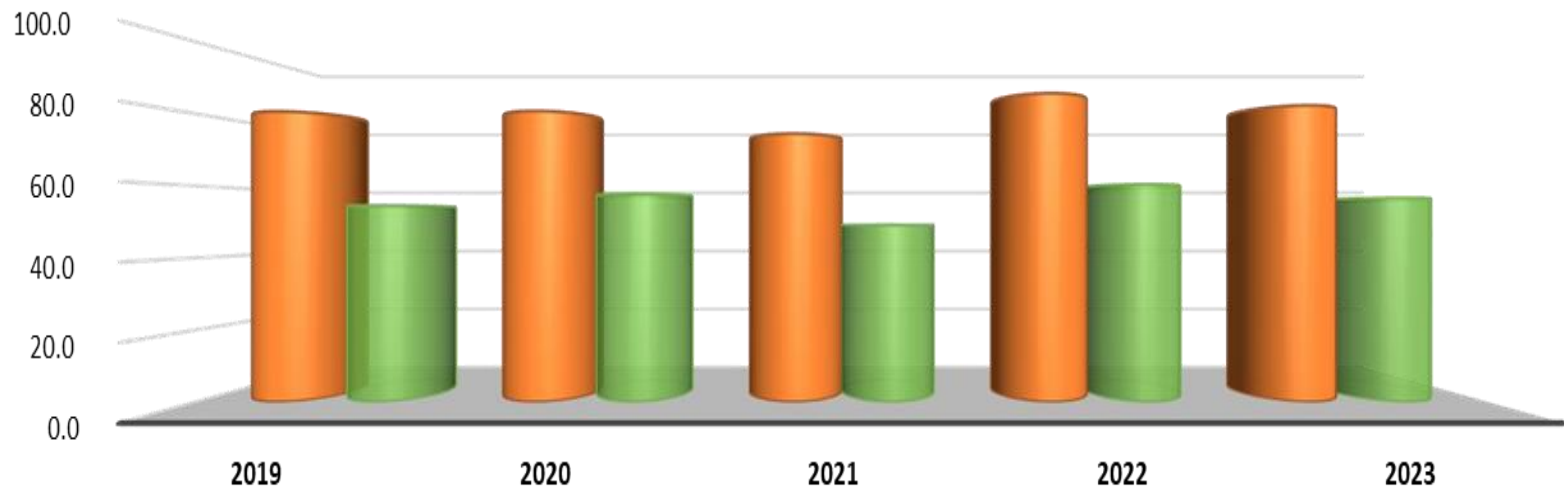
	2019	2020	2021	2022	2023
🟧 % achieved at 30% and above	80.6	80.8	74.5	85.7	82.3
🟩 % achieved at 40% and above	54.5	57.7	49.1	60.4	56.7

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Overall achievement rates in Mathematics (Percentage)

	2019	2020	2021	2022	2023
🟧 % achieved at 30% and above	54.6	53.8	57.6	55.0	63.5
🟩 % achieved at 40% and above	35.0	35.6	37.6	36.0	43.6

$$x + x + 4x + 5x =$$

4IR at UJ

Modern Computer

Typewriter

Tablet

$$x + x + 4x + 5x =$$

—

= 2 apples

What is the difference here?

$$x + x + 4x + 5x$$

- X = 4IR similar (because they are aliens)

- Again cell phone = 4IR

- Link between X and 4IR (GET TO THE CORE)

- HOW IT DIFFERS WITH INDIVIDUALS AND CURRENT STATE OF MIND…

- Identified gaps present significant hurdles for first-year students as they navigate higher education.

- The ongoing concern revolves around bridging these gaps and facilitating a smoother transition from basic to higher education.

What is that bridging and transition?

How do different pedagogical approaches impact students' transition in mathematics?

1. **Traditional vs. Constructivist Approaches**

Traditional Approach: This approach often involves direct instruction, where the teacher is the primary source of knowledge and students are passive recipients. While it can be effective for teaching procedural skills and ensuring that students can perform mathematical operations, it may not foster deep understanding or problem-solving skills, which are critical during transitions to higher levels of math education.

Constructivist Approach: This method emphasizes active learning, where students build their own understanding through exploration and problem-solving. Constructivist approaches, including inquiry-based learning and discovery learning, can help students develop a deeper understanding of mathematical concepts. This understanding is crucial during transitions, as it equips students with the ability to apply concepts to new and more complex problems.

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2. **Inquiry-Based Learning**: Inquiry-based learning encourages students to ask questions, explore, and engage deeply with mathematical problems. This approach can be particularly beneficial during transitions as it promotes critical thinking, fosters a growth mindset, and helps students become independent learners. These skills are essential for success in more advanced mathematical studies.

3. **Collaborative Learning**: Collaborative learning involves students working together to solve problems and understand concepts. This approach can ease transitions by developing communication and teamwork skills, which are increasingly important in higher education and professional settings. It also allows students to learn from each other, exposing them to diverse ways of thinking and problem-solving.

4. **Flipped Classroom**: The flipped classroom model, where students review instructional content at home and engage in problem-solving activities in class, can help during transitions by providing more class time for hands-on practice and individualized support. This approach can address gaps in understanding before they become problematic at the next educational level.

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What support systems are most effective in aiding students' transition from basic to higher education in mathematics?

1. Academic Support

- Tutoring Programs: Offering one-on-one or small group tutoring sessions to address individual student needs.

- Supplemental Instruction: Providing additional classes or workshops that reinforce and expand on regular coursework.

- Math Labs/Help Centers: Establishing dedicated spaces where students can receive assistance from instructors or peers.

2. Curriculum and Instructional Strategies

- Bridge Programs: Implementing summer or transitional programs that prepare students for the rigors of higher-level mathematics.

- Curriculum Alignment: Ensuring that high school curricula are aligned with college-level expectations to smooth the transition.

- Differentiated Instruction: Tailoring teaching methods to accommodate diverse learning styles and paces.

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3. Technology Integration

- Online Resources: Utilizing online platforms and tools such as Khan Academy, Coursera, or other educational websites to provide additional practice and instruction.

- Adaptive Learning Software: Implementing software that adjusts to the student's level of understanding, providing personalized practice and feedback.

- Virtual Tutoring: Offering remote tutoring options to provide flexible and accessible support.

4. Mentoring and Peer Support

- Peer Mentoring: Pairing students with older peers or alumni who can provide guidance, advice, and support.

- Study Groups: Encouraging the formation of study groups where students can collaborate and support each other's learning.

- Mentorship Programs: Connecting students with mentors who can offer academic and career advice.
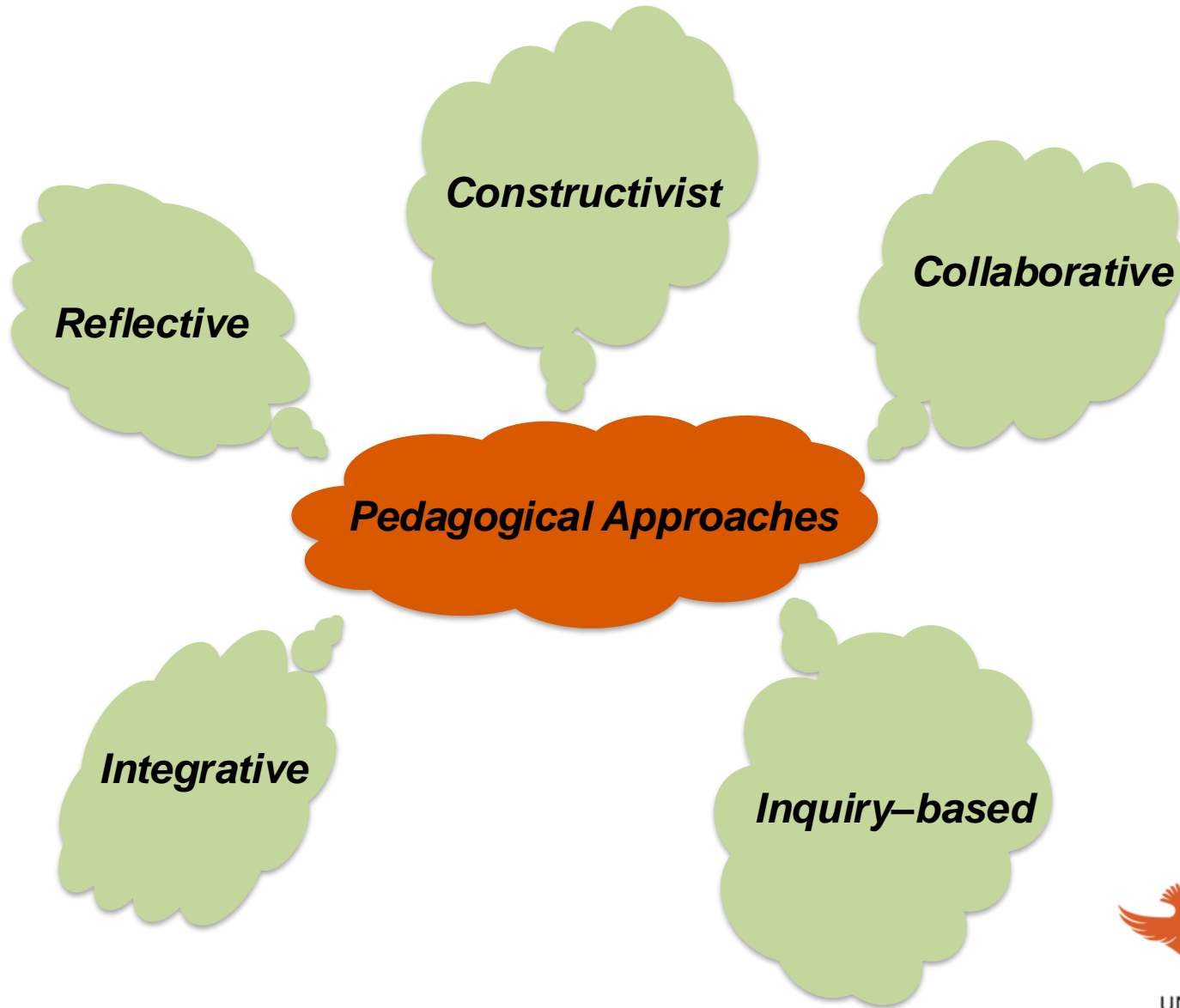
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- The central question at hand is whether to re-educate first-year students using basic education syllabi or implement collaborative approaches, such as intensive tutoring and mentoring, to mitigate these challenges.

- With disparities identified between the two education systems, the focus lies on effective strategies to support students in overcoming these obstacles and thriving in higher education.

- The study highlights the need for educational institutions to reassess their Mathematics/Mathematical Literacy curriculum and teaching methods to better prepare students for the transition to higher education.
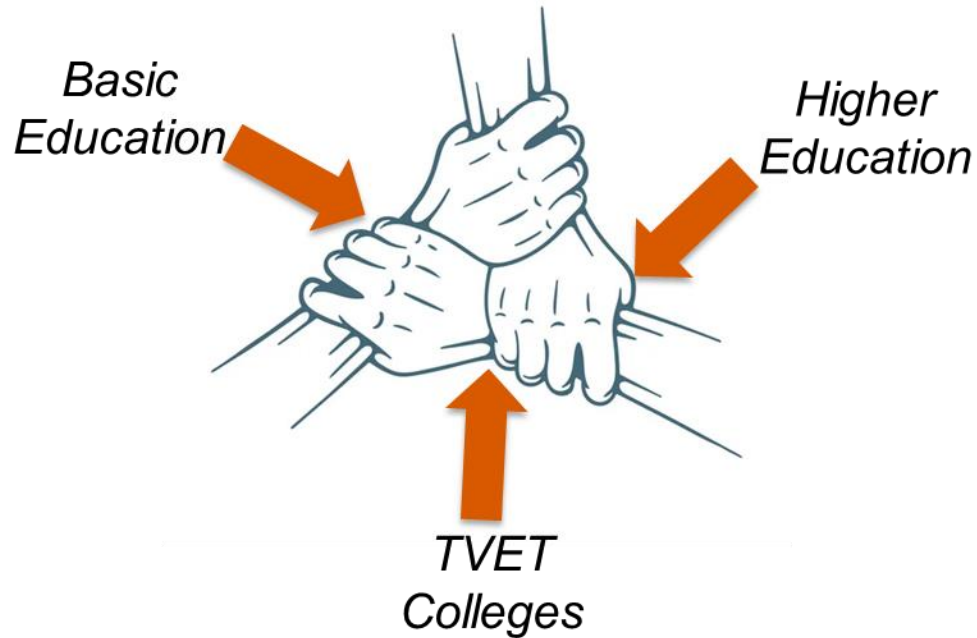
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Collaboration

- With disparities identified between the two education systems, the focus lies on effective strategies to support students in overcoming these obstacles and thriving in higher education.

- Furthermore, it underscores the importance of aligning **curricular standards** and **pedagogical approaches** between basic and higher education levels.

ACKNOWLEDGEMENTS

- University of Johannesburg
  - Dr V. Motjoadi (Department of Academic Development Centre)

  - Dr S. Setilo (Department of Academic Development Centre)

  - Prof S. Ramaila (Faculty of Education)

- Siyaphumelela Network Conference (for sponsoring my presentation)

Thank you