1ST SOUTHERN AFRICAN CONFERENCE ON THE FIRST-YEAR EXPERIENCE

STELLENBOSCH
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Paper by

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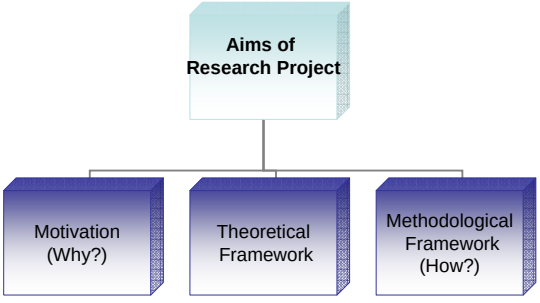
PAPER - THEME

SUCCESS IN FIRST YEAR MATHEMATICS: A COMPUTER-SUPPORTED PROGRAMME

PAPER - LAY OUT



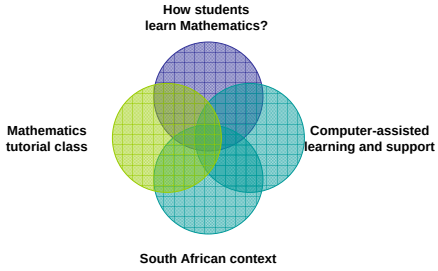
COLLECTIVE AIM

To develop a framework for a computer-based tutorial programme for first-year Mathematics university students within a South African context

RESEARCH AIMS

- To frame **learning** in **Mathematics** scientifically at higher education level
- To frame the impact of **computer-based teaching** on learning and as support to learning scientifically at higher education level
- To identify different role players in the unique **South African learning environment** at higher education level
- To identify different aspects of learning in the first year **Mathematics tutorial class**

RESEARCH GOALS



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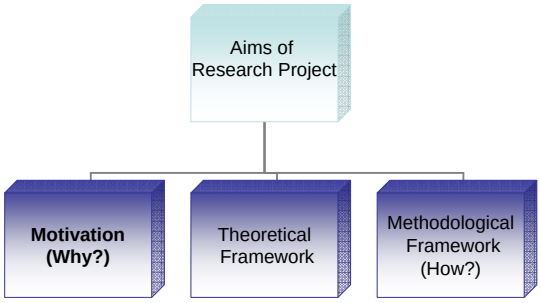


MOTIVATION

- **Perceptions** of first-year Mathematics students about Mathematics as subject and as a career
- Mathematics is a "Waste of Time" (Potecz et al., 2006)
- Application value of Mathematics
- "… they demand more to be prepared for the job market" (Engelbrect & Harding, 2003)

MOTIVATION

2006	836
2007	496
2008	403

2006	58%
2007	58%
2008	63%

- Decrease in the **number** of first year Mathematics students at universities
- Unsatisfied **throughput** in first year Mathematics

MOTIVATION

Factors leading to **underperformance** in Mathematics in higher education:

- Poor teaching in Mathematics at school level
- Large classes
- Medium of teaching
- Inefficient study methods
- Lack in practice of Mathematics techniques
- Underdevelopment of problem-solving and critical thinking skills

MOTIVATION

Factors framing the academic environment in the **South African context**:

- Diverse ethnic community (culture)
- Home language versus language of learning Mathematics
- Underprepared for university studies:
  - Background
  - Attitudes, beliefs and emotions (Mathematics anxiety)
  - Time management, study methods, learning culture
- Underprivileged (poor)

MOTIVATION

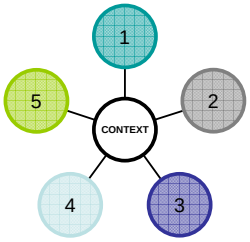
- Popular environment of **computer-assisted learning**
- Develop aspects of academic maturity and responsibility
- Different learning styles and assessment strategies
- "students are less likely to move away from studying Mathematics if they enjoy it …" (Berger et al., 2005)

MOTIVATIONAL COMMENTS

- **"… the web environment seems to facilitate aspects of academic maturity."** (Engelbrect & Harding, 2006)
- **"Technology has great potential to enhance student learning, but only if it is used appropriately"** (Bransford et al. in van der Westhuizen, 2007)
- **"… serious consideration should be given to actively involving students during the practical sessions."** (Eiselen, 2006)
- **Instructors should use "culturally sensitive teaching techniques and innovative teaching approaches that integrate Mathematics into a real-world context."** (Walker et al., 2000)

OVERVIEW - CONTEXT

1. Perceptions
2. Numbers & Throughput
3. Under performance
4. South African context
5. Computer-based learning environment



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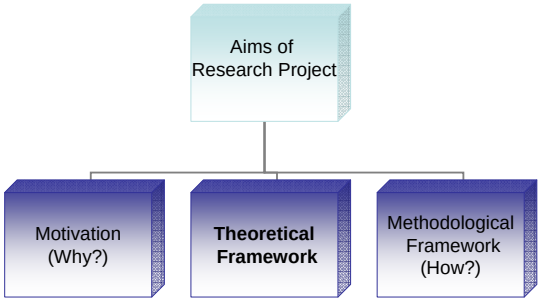


THEORETICAL FRAMEWORK

CONSTRUCTIVISM

"The strengths of constructivism lie in its emphasis on learning as a process of personal understanding and the development of meaning in ways which are active and interpretative. In this domain learning is viewed as the construction of meaning rather than as the memorization of facts."
(Oliver in Herrington, 2001)

THEORETICAL FRAMEWORK

PIAGET'S LEARNING THEORIES

"In the area of logico-mathematical structures, children have real understanding only of which they invent themselves, and each time that we try to teach them something too quickly, we keep them from reinventing it themselves. Thus, there is no good reason to try to accelerate this development too much; the time which seems to be wasted in personal investigation is really gained in the construction of methods."
(Piaget in Copeland, 1979)

THEORETICAL FRAMEWORK

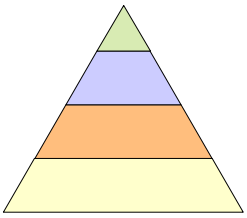
ZONE OF PROXIMAL DEVELOPMENT (ZPD)

"the distance between the actual developmental level ... and the level of potential development"
(Vygotsky in Oliver, 2001)

THEORETICAL FRAMEWORK

SCAFFOLDING

"The essence of scaffolding is that the assistance and help is gradually reduced as the learning progresses to the point where the learner is finally able to act independently"
(Oliver & Herrington, 2001)



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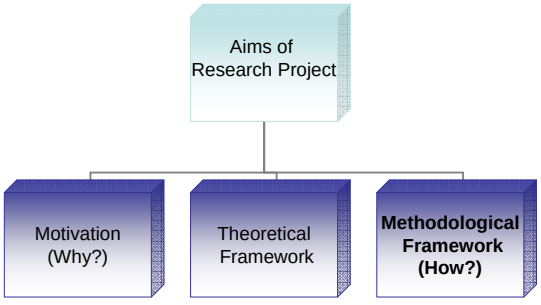

METHODOLOGICAL FRAMEWORK

Qualitative approach to research

- Takes place in the natural setting
- Uses multiple methods that are interactive
- Fundamentally interpretive and uses complex reasoning

Design-based research as the strategy of inquiry

"The dual objective of developing creative approaches to solving human teaching, learning, and performance problems while at the same time constructing a body of design principles that can guide future development efforts." (Reeves, 2000)

METHODOLOGICAL FRAMEWORK

Phase 1	Define design principles and guidelines for best practices
Phase 2	Design of the computer-based tutorial intervention
Phase 3	Conduct a pilot study to formatively evaluate and redesign the intervention
Phase 4	Implement the computer-based tutorial intervention in the main study
Phase 5	Evaluate the computer-based tutorial intervention to construct a body of design principles in the transfer study

METHODOLOGICAL FRAMEWORK

Qualitative **Data Collection** types:

- Observation
- Interviews (one on one & group) with different role players:
  - Students
  - Tutor
  - Lecturer
  - Computer facilitator
- Documents (journals, student work)
- Audiovisual materials

POTENTIAL CONTRIBUTION

- To provide **higher education institutions** with guidelines to develop a computer-based tutorial intervention for first-year Mathematics
- In practice to contribute to **student development**:
  - Computer skills
  - Popular learning environment
  - Learning Mathematics
  - Achievement in Mathematics
  - Development of learning potential

THE END

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