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First-year university students' algebraic thinking and its relationship to geometric conceptual understanding

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CHAPTER 2

THE RESEARCH CONTEXT: UNIVERSIDADE PEDAGÓGICA –MOZAMBIQUE

2.1 Universidade Pedagógica

Universidade Pedagógica (UP) mainly aims to train lower and upper secondary school teachers for different subjects including mathematics. In 2003 UP carried out a curriculum reform in mathematics led by the Mathematics Department (Ismael, 2003) in order to be in tune with the current political, economic, social, scientific, and technological changes experienced in Mozambique. In this context, UP intended to address through its courses empowerment of students with theoretical and practical tools suitable for social demands (labour market and development of the country and the entire world).

One of the major changes is the split between Physics and Mathematics. The previous curriculum was a dual course: Physics and Mathematics teacher training course. The current curriculum is Mathematics teacher training course. According to the current UP mathematics curriculum, “geometries” are distributed as follows in the first academic year: Euclidean geometry in semester I and Analytic geometry in semester II.

2.2 First Year University Geometry Course

In the first semester the students attend the Euclidean Geometry course. Below is an outline of the syllabus of this course whose structure mainly consists of an introduction; the main objectives of the course; the general topics; and methods and strategies for teaching and learning processes.

Euclidean geometry (plane and space)

In the introduction section it states that considering that the course of Bachelors and Honours in Mathematics Education intends to train pre and in-service teachers for lower and upper secondary school, it is a requirement firstly that these teachers should sufficiently grasp the

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content of these levels especially the geometric content. It has been observed that the students perform well in advanced mathematics; nevertheless they face difficulties especially regarding the rigour of school geometry content (Ismael, 2003). Hence this course attempts to fill such gaps.

The expected general goals for students are as follows:

- Define school geometry concepts;
- Demonstrate school geometry theorems;
- Visualise, interpret and compare geometric figures in the plane and space;
- Determine areas and volumes; and
- Solve geometric problems.

The general topics in the syllabus are as follows:

- Origin of geometry;
- Axiomatic approach of Euclidean geometry;
- Geometric constructions;
- Triangles;
- Quadrilaterals;
- Circumference and sphere;
- Elements of plane trigonometry; and
- Spatial geometry.

In the methods and strategies for teaching and learning processes it is stated that the sessions mainly consist of seminars and tutorials. The autonomy of students' work is prioritised.

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Analytic geometry (plane and space)

The introduction section states that this discipline aims to consolidate and deepen geometric and analytic content taught at high school so as to foster links to Euclidean geometry.

The expected goal for students is to "describe analytically observed aspects in the plane and space" (ibid., p. 29). The sessions mainly consist of lectures, seminars, and tutorials. The autonomous students' work is prioritized.

The general topics are as follows:

- Introduction;
- Vectors and vector arithmetic;
- Straight line in plane;
- Circumference;
- Coordinate transformations;
- Conics;
- Types of coordinate systems;
- Parametric equations;
- Straight line and plane in space; and
- Quadric surfaces.

2.3 Summary

The curriculum fosters a link between Euclidean Geometry and Analytic Geometry courses, therefore, a link between synthetic (driven by intuition) and analytic strategies (driven by reasoning). The conceptual model for algebraic thinking in geometrical understanding adopted by this study shows that in order to attain geometrical understanding both aspects of geometry (synthetic and analytic) should be acquired conjointly.

Technology and its mediating role for mathematical meaning making in relation to geometry has been widely acknowledged in mathematics education research (Noss and Hoyles, 1996). However, at UP, the use of technology in geometry at the time when this study took place had not yet been practiced due to unavailability of resources. Hence, this topic was not the concern of this study.

The next chapter provides the theoretical framework and the related literature for this study.

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