INTEGRATING MATHEMATICS AND TECHNOLOGY EDUCATION FOR CONCEPTUAL UNDERSTANDING OF GEOMETRICAL CONCEPTS

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Extended abstract

This study focuses on the use of learners' experiences when constructing and designing artefacts in the technology classroom, to effect change in the way in which we understand and teach geometry in formal mathematics classes. The study was conducted with Grade 9 learners at a secondary school in Margate in the KwaZulu-Natal Province of South Africa. The main focus of this paper is to explore how the experiences gained by learners in a technology education class studying the design and construction of multi-storied houses could inform the teaching of geometry in a formal mathematics classroom. The study is underpinned by ethnomathematics which acknowledges the unique identities and traits of each student taking into consideration the intersection of their cultures, historical traditions, socio-economic roots, and connects the learners' culture and mathematics.

Hiebert & Carpenter (1992) present a theory for understanding based on the interplay of external and internal representations. Key ideas in this theory are:

(i) In order to think about and communicate mathematical ideas we need to represent them in some way.

(ii) Communication requires that the representations be external. External representations could take the form of spoken or written language, written symbols (algebraic symbolism), pictures (diagrams, graphs, tables) or physical objects.

(iii) In order to think about mathematical ideas there is a need to represent them internally (internal representations) in a way that allows the mind to operate on them

(iv) As relationships are constructed between internal representations of ideas, they produce networks which could be structured like vertical hierarchies or webs.

The theory is based on assumptions that (a) some relationship exists between external and internal representations, (b) communication in different forms (verbal, symbolic and visual) play a key role in the teaching and learning of mathematics, (c) internal representations can be related or connected to one another in useful ways, and (d) the

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construction of structured mind maps or schemata that can be expanded into networks aids the understanding of new ideas in mathematics.

The project was assigned to 48 grade nine learners. Twelve subjects were then conveniently selected on the basis of the designs made and interviewed using open-ended questions to extract the procedures used in the drawings. They then had to construct models of artefacts representing the designs in their drawings. It was important to find out how the teaching of geometry would allow the learners to both reflect and utilize the geometry they know and used in technology education as a starting point for further study of geometry in mathematics classrooms. The learners' revealed the use of the some geometric concepts during the design of the artefacts. These included discussions on parallelism, shape, angles, congruency, similarity and comparisons.

This mathematical idea was further communicated by the construction of artefacts correctly measured and projected using available material and resources. Their internal representations were revealed when they gave explanations of why they projected the structures in the geometric artefacts. The descriptions of the figures drawn in the technology class were done in a geometric language without prior formal teaching of the geometric concepts. Findings revealed that the free environment allowing the learners to talk, explain and represent, provided in technology, showed that learners knew more geometry than anticipated.

Recommendations

The low and poor performance in geometry has to be overcome by both learners and mathematics teachers. The following suggestions may help to accomplish foundational and good performance in geometry:

- Learners could be given a chance to represent various objects and artefacts in the form of design and drawing.
- Syllabus and assessment standards per grade should not stop the learners from describing and representing their experiences with shape and space.
- Geometry must be presented by teachers in an interesting and joyful manner based on learners' experiences before dealing with proofs.