AN INVESTIGATION INTO THE FACILITATION OF MATHEMATISATION IN PATTERNING BY THREE STUDENT TEACHERS

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Extended abstract

In this paper the authors are investigating the patterning strategies used by three Mathematics Literacy (PGCE) students, as prospective teachers, during their first micro-lessons to small groups of Grade 8 learners. Different versions of problem solving were used in the three lessons which showed different developments of mathematisation in patterning, which highlighted the focus of the investigation. This lead to in-depth reflective discussions of the events in the classrooms which initiated insights in the use of problem solving as a teaching framework for Mathematics Literacy when deriving the nth term and deducing a formula. The discussions and reflections played an important role in the orientation of the student's academic-professional lives.

Three post graduate student teachers (STs) where monitored during their first micro-lesson session in the second month of their PGCE year. Grade 8 learners from an advantaged school in the region were taught by the individual STs in small groups with learners who were relatively acquainted with the use of patterning in mathematics. Different versions of the problem solving teaching approaches were used and different progression of mathematisation in patterning occurred, all based on the central theme of patterns. Reflective discussions by the STs of the use of problem solving as a teaching framework when deriving the *n*th term and a formula granted the opportunity to develop a research paper and presentation of the project at the AMESA conference. The research question thus focused on the use of problem solving and the development of mathematisation in the teaching of patterning in the grade 8 lessons.

THEORETICAL FRAMEWORK AND ASSESSMENT

We will refer to problem solving, mathematisation and the model used by Orton and Orton (1999) to analyse the generalising of number patterns in algebra. The *problem solving* paradigm is the teaching approach whereby a teacher poses problems to the learners without giving the predetermined methods and solutions and proved to be greatly effective in the ML curriculum. Learners are able to share ideas, discuss various methods and justify individual answers in a group setting with teacher facilitation. Freudenthal (1991: 67) states that *mathematising* is didactically translated into reinventing. If mathematics is to be taught as mathematising then teacher actions should be that of guided re-invention. *Horizontal mathematisation* infers an

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understanding of the problem, its language and the questions intention whereas *vertical mathematisation* marks the ability of learners to build more advanced mathematical constructs. Gravemeijer (1994: 94) explains that vertical mathematisation takes place when learners' informal descriptions and interpretations of problem situations develop into the application of mathematical language and algorithms.

Research by Anthony Orton and Jean Orton (Orton et al. 1999: 105) found that:

> Finding terms in number patterns gets progressively more difficult the further the terms are from those given in the question; more pupils can continue a pattern that can explain it; number pattern rules are described by a large proportion of pupils in relation to differences between terms, and generally, oral explanations of rules … are given by more pupils than written explanation.

Orton et al have identified a number of stages in the development of learners' generalising abilities. The *stages of development* were (Orton et al.: 117): *Stage 0*: no progress; *Stage 1*: next term provided; *Stage 2*: next and tenth terms provided; *Stage 3*: next, tenth, and fifteenth terms provided; *Stage 4*: next, tenth, fifteenth and *n*th terms provided.

These developmental stages which will be addressed in this paper along with the sub-stages of Stage 4 which focuses on the degree of generalising ability: *Stage 4a*: a correct verbal statement; *Stage 4b*: a creditable attempt at an algebraic expression; *Stage 4c*: a correct algebraic representation, but not necessarily the simplest.

These frameworks allowed sound evaluation and interpretation of the student's classes where horizontal mathematisation in patterning was noted as the progressive development through stages 1 to 3 and where stage 4 marked the beginning of vertical mathematisation where learners verbally and symbolically formulated the *n*th term.

INTERPRETATION OF CLASSROOM EVENTS AND FEEDBACK THEREOF

ST1 did not plan the inductive development of the learners' conceptual understanding through the stages (Orton) well. Learners therefore did not progress through the early developmental stages 1, 2 and 3 as the lesson was highly teacher-centred with minimal application of teacher as facilitator. ST2 had a problem at an accessible level which allowed a slight progression through the first three stages of generalisation however due to the unfamiliar use of the inverse proportion principle and the lack of meaningful facilitation by ST2 the application of generalisation was difficult. ST3 had distinct control over the application of the problem solving framework due to the interactive nature and the progression of the lesson which permitted achievement of the first three stages. However vertical mathematisation through stages 4b and 4c was not achieved. Numerous post-discussion and research allowed deep reflection and identification of shortcomings which further enhanced the learning experience for the student teachers involved.

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