THE EFFECTIVENESS OF A QUESTION-BASED FIRST COURSE IN ANALYSIS

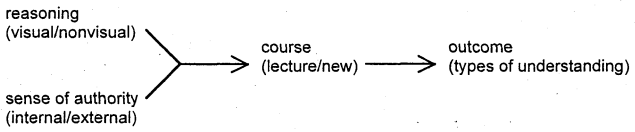
Lara Alcock
Rutgers University
lalcock@rci.rutgers.edu

Adrian Simpson
University of Warwick
A.P.Simpson@warwick.ac.uk

This presentation will review a substantive theory explaining different students' progress in learning Real Analysis, and thereby integrate established theoretical constructs in this area.

This theory was developed through inductive analysis of interview data. Participants were attending either a lecture course, or a new, classroom-based course in which they worked in groups through a sequence of problems in order to prove results themselves (based on Burn, 1992).

Learning outcomes are characterized as demonstrating *instrumental*, *relational*, *logical*, or *formal* understanding, where these are closely related to how the student justifies statements about sets of mathematical objects (Skemp, 1979, Tall, 1995). Factors found to be causal in student development are their *visual* or *nonvisual* reasoning style (Presmeg, 1986), and their *sense of authority* regarding the mathematics, where this is characterized as *internal* or *external* (Copes, 1992, Skemp, *ibid.*). The new course did not precipitate changes in these predispositions, but did promote improved student reasoning in restricted ways. Hence, the relationship between these factors may be represented as below:



The presentation will define the terms in more detail, and provide illustrative examples demonstrating the ways in which these factors interact to lead to the different types of understanding.

References

Burn, R.P., (1992), *Numbers and functions: Steps into Analysis*, Cambridge: Cambridge University Press.

Copes, L., (1982), "The Perry development scheme: a metaphor for learning and teaching mathematics", *For the Learning of Mathematics*, **3**(1), 38-44.

Presmeg, N.C., (1986), "Visualisation in high school mathematics", *For the Learning of Mathematics*, **6**(3), 42-46.

Skemp, R.R., (1979b), "Goals of learning and qualities of understanding", *Mathematics Teaching*, **88**, 44-79.

Tall, D.O., (1995), "Cognitive development, representations and proof", *Proceedings of Justifying and Proving in School Mathematics*, 27-38, Institute of Education, London.