How is proving constituted in Cypriot classroom?

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This report focuses on a research study the aim of which is to investigate the activity of proving as constituted in a Cypriot classroom for 12 year old students. By drawing on Activity Theory, this study explores the way the teacher is working with the students to foreground mathematical argumentation. Analysis from classroom discussions points toward a teacher-directed mathematical argumentation as an approach to establish justification as a socio-mathematical norm in the classroom

Keywords: Activity theory, proving, socio-mathematical norms.

BACKGROUND OF THE STUDY

In recent years, it has been established that proof and proving should be integrated across all levels of schooling (Hanna, 2000; Stylianides, 2007). In this context, explanation, justification and argumentation are aspects of proof that provide a foundation for further work on developing deductive reasoning and the transition to a more formal mathematical study. In the social environment of the classroom, where hypothesising, explaining and justifying geometric conjectures is encouraged, the tools and tasks used, the rules of the classroom, the way the students work together, the way the teacher negotiates meanings and other external factors all interact, interrelate and influence each other in forming classroom activity. The purpose of the present study is to explore the way the structural resources of the classroom setting shape students' argumentation. Research has responded to the need to conceptualise proof and proving in such a way that is can be applied not only to older students but also to those in elementary school (Stylianides, 2007). The question remains however to understand how proof is constituted in such classrooms.

METHOD

Cultural Historical Activity Theory (CHAT) provides this study with a theoretical basis to steer the identification of forces that interact to shape pre-proving activity in a complex environment. That is, CHAT is used both as a framework for conceptualising the research and formulating the research design. This study was conducted in a year 6 classroom in a public primary school in Cyprus. The content of the curriculum covered during the classroom observations was the area of triangles, and the circumference and area of circles. The overall process of analysis of the collected data was one of progressive focusing. The systematisation of the data led to the evolution of two activities: (i) activity of exploration which is concerned with the degree of exploring mathematics in the classroom. It includes the exploration of mathematical situations and exploration for supporting mathematical connections and (ii) activity of explanation which is concerned with instances of classroom discussion that are related with explaining the purpose of which is to clarify aspects of one's mathematical thinking that might not be apparent to others and, explaining why, that is justification the aim of which is to establish for somebody else the validity of a statement.

FINDINGS AND DISCUSSION

Analysis of the classroom episodes show the teacher frequently using the word 'play'. Two contrasting values have emerged through the teacher's ambiguous use of the term 'play'; play/learn. When providing opportunities for exploration and investigation, the teacher was presenting the exploration constructively as 'play.' The word 'play' had a negative value when the exploration was interpreted as 'play' instead of learning. Closing down a task clashed with the object of the activity of exploration. The use of play highlights a tension between the two activities of exploration and explanation. Exploration was understood by the teacher as worthwhile in order for the students to

seek out explanation but at the same time exploration in her eyes might have led to loss of focus, which might have resulted in different activity from explaining. By closing down the investigation, the students did not have the opportunity either to initiate a solution, or to test the hypothesis made, thus limiting their explaining and justifying. The 'play' contradiction relates to the notion of the play paradox (Hoyles & Noss, 1992) and the notion of the planning paradox (Ainley, Pratt, & Hansen, 2006). While a play-like exploration can facilitate learning, it is not automatically clear that it is the teacher who decides what counts as meaningful. Thus, the teacher may find it difficult to take advantage of such opportunities. The teacher had concerns about focus and discipline, which seemed to lead to such closing down. The intention therefore in leading the discussion around justification to establish this as a socio-mathematical norm is comfortably in line with maintaining focus. We might therefore conjecture that the students will have few opportunities in the near future to engage with proving related activity in a more independent way.

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