

# **TRANSITIONS BETWEEN INSTITUTIONAL SETTINGS: MACRO- AND MICRO-RUPTURES IN MATHEMATICS EDUCATION**

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## ***Introduction***

The time a student spends in education is marked by transitions. Major transitions include from kindergarten to primary school, from primary to secondary school, and, for many, from secondary school to University. Not only that, but there are ‘smaller’ transitions between Grades (or classes) which often involve a move to a different teacher. On top of that, there may be transitions for the student from a generalist teacher who teaches mathematics to a specialist mathematics teacher at some point during primary school (or at the transition to middle or secondary school), and transitions between academic and vocational streams (if permitted within the education system in question) may occur during secondary schooling.

The effect on students of all these different transitions has long been identified as an issue, usually of concern. Various studies have indicated, for example, that disaffection with schooling may grow, and under-achievement may begin, before and during such transitions (eg: Lord, Eccles & McCarthy, 1994; Galton, Gray & Rudduck, 1999). Even so, there is evidence that some transitions can be seen by students as positive in bringing new opportunities and being a sign of growing maturity (eg: Pietarinen, 2000).

The impact of transitions on the mathematics experience of students involves the students responding to a range of changes, including variations in mathematical content as well as differences in teaching approaches used by their teachers. The work of Artigue is particularly important in revealing issues associated with such transitions, especially in the contexts of the transition between upper secondary school and university (eg: Artigue, 1999; 2004) and between vocational and general education streams at the secondary level (eg: Grugeon & Artigue, 1996). The purpose of this paper is to outline the theoretical perspective on transition adopted by Artigue and relate this to a small-scale case-study conducted in the UK (Coad & Jones, 1999). The line of reasoning being put forward is that transitions in the mathematics experience of students involve macro- and micro-ruptures (or breaches) in their mathematics education. Understanding the origin and nature of such ruptures (or breaches) might inform further work aimed at suggesting possible remedies that enhance student learning around times of transitions.

### ***Theoretical perspective on Transition***

In developing her work on transitions between institutional settings, Artigue utilised elements of the anthropological approach to didactic phenomena developed by Chevallard (1992). Such work showed, for example, how ‘knowing fractions’ does not have the same meaning for French and British middle school institutions, due in part to the different cultural relationships these particular countries have with the metric system and the ways in which this shapes the respective importance and role given to decimal numbers and rational numbers in the curriculum (see Chevallard & Jullien, 1989). As such, as Artigue et al (2001) explain, “every institution which has to deal with some mathematical object develops an institutional relationship with this object”. This relationship, Artigue et al (ibid) go on to say, “defines the norms and values of knowledge as regards this object, for this particular institution”. As such, institutional relationships with a particular mathematical object or domain “vary across institutions” and students develop “personal relationships to mathematical objects, which are shaped by the different institutional influences”. Consequently, it is only if their personal relationship with an object is “close enough” to the institutional relationship at stake that students are considered by that institution as “knowing” the object (ie the piece of mathematics) in question.

In projects supervised by Artigue, this theoretical perspective was used to analyse examples of transitions between institutional settings; including the secondary-tertiary transition (focusing on the notion of derivative; see the thesis of Praslon) and a transition available in France to enable the best students from vocational high schools to enter general higher education (via one a year transition course; see the thesis of Grugeon). Such studies revealed an accumulation of what can be called micro-ruptures (or breaches) in the mathematics education of the students concerned. The result is a didactic gap that, in essence, students are asked to fill for themselves.

### ***A Small-scale Case Study from the UK***

In the UK, a small-scale case study compared the approaches used in the teaching and learning of mathematics in a secondary school and its four feeder primary schools (for a partial report, see Coad & Jones, 1999). The case study revealed a range of differences between the secondary school and the primary schools, and also across the primary schools themselves. Such differences included the amount of school time devoted to the teaching of mathematics, differences in the ways that students were grouped for mathematics teaching, differences in the type and format of teaching resources that were used with students, differences in the pedagogical techniques used by the teachers, and differences in the use of technologies for mathematics teaching and learning. Such analysis reveals elements of the micro-ruptures that accompany the macro-ruptures brought about by the overall change of institution.

### ***The prospect for further research***

Tilleczek and Ferguson (2007, pp44-45) suggest that the largest gap in knowledge about the impact on students of transitions remains in understanding fully the *meso* level. This is the level where intersections between culture and individual meet and where, as Tilleczek and Ferguson (ibid) say, the “experience and embodiment of social class, poverty, ethnicity, identity and age are played out”. This suggests that, in addition to research from an anthropological and sociological perspective, work on understanding the issues of transition may benefit from being aligned with research that takes an epistemological and cognitive viewpoint. It is such further work that may help to find ways to minimise the impact on students of *false starts* and enable them to gain more benefit from *fresh starts*.

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