ECONOMIC AND SOCIAL RESEARCH COUNCIL
END OF AWARD REPORT

For awards ending on or after 1 November 2009

This End of Award Report should be completed and submitted using the **grant reference** as the email subject, to **reportsofficer@esrc.ac.uk** on or before the due date.

The final instalment of the grant will not be paid until an End of Award Report is completed in full and accepted by ESRC.

Grant holders whose End of Award Report is overdue or incomplete will not be eligible for further ESRC funding until the Report is accepted. ESRC reserves the right to recover a sum of the expenditure incurred on the grant if the End of Award Report is overdue. (Please see Section 5 of the ESRC Research Funding Guide for details.)

Please refer to the Guidance notes when completing this End of Award Report.

Grant Reference	**RES-000-22-2890**		
Grant Title	**Mathematics learning, identity and educational practice: the transition into post-compulsory education**		
Grant Start Date	**1/Sep/2008**	**Total Amount Expended:**	**£77,193.06**
Grant End Date	**31/Dec/2009**		
Grant holding Institution	**University of Manchester**		
Grant Holder	**Dr Paul Hernandez-Martinez**		
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Co-Investigators (as per project application):		**Institution**	
Prof Julian Williams		**University of Manchester**	

1. NON-TECHNICAL SUMMARY

Please provide below a project summary written in non-technical language. The summary may be used by ESRC to publicise your work and should explain the aims and findings of the project. *[Max 250 words]*

The project aimed to understand how different educational practices in mathematics at School (GCSE) and in transition to College (AS level) impact on students' dispositions and identity, hence influencing their choices and future success in subjects that demand high levels of mathematics.
Teachers on the project thought that practices that seemed to help students in their transition often involved students taking control of their own learning (e.g. in projects, explaining mathematical concepts or discussing in class). Also, students and teachers reported that some practices that go beyond the scope of GSCE (e.g. quality experiences of College) helped in the transition. However, practices prevail in general transmissionist (where teachers are in control of the learning) as they are believed to secure schools a place in the "league tables". These practices leave little room for "understanding" or for developing "self-directing" learning skills. This is particularly true for students in middle sets (predicted B/C GCSE mathematics grade); when these students get to College, they face demands for which they might not be prepared: (i) demands for independence of learning and social behaviour (especially in maths, considered by many as a "lonely" subject); (ii) demands for conceptual understanding (particularly in algebra, "the maths problem" at College) and a faster pace of learning. Therefore, College teachers often misunderstand what these students know and are able to do in mathematics. We conclude that some practices on both sides of the transition are not designed to develop the skills that many students will need.

2. PROJECT OVERVIEW

a) Objectives

Please state the aims and objectives of your project as outlined in your proposal to the ESRC. *[Max 200 words]*

Aims
We aimed to understand how GCSE students can acquire a mathematical disposition and an identity that supports their further engagement with mathematics and choices of mathematically demanding subjects in post-compulsory education.

Objectives
The project will provide: (i) explanations of the effectiveness of GCSE and "transitional practices" regarding mathematics for variously positioned students over the period of transition into post-compulsory education, and (ii) accounts of and insights into institutional and educational cultures and how they afford individual student trajectories of identity.

The results will span the transition from GCSE to AS/A levels. Students' experiences in

regard to mathematics in post-compulsory education will thereby be traceable in part to transition, but also to roots in school experiences, and to the interaction of these two factors.

b) Project Changes

Please describe any changes made to the original aims and objectives, and confirm that these were agreed with the ESRC. Please also detail any changes to the grant holder's institutional affiliation, project staffing or funding. *[Max 200 words]*

Originally this was a 10-month project but it was agreed with the ESRC to extend it an additional 6 months. The need for extending it arose because the project started during the summer holidays, when students had already left school. This meant that the students that volunteered to be interviewed (invited via e-mail and post through the colleges' database system) were in their majority students with grades A/A* in their GCSE Maths exam and therefore our sample was not sufficiently diverse. This also meant that not all of the volunteers came from our feeder schools. We felt that the project would benefit greatly from collecting data from some extra students from our feeder schools with (expected) GCSE Maths grades B/C.

c) Methodology

Please describe the methodology that you employed in the project. Please also note any ethical issues that arose during the course of the work, the effects of this and any action taken. *[Max. 500 words]*

The project followed a methodology of **case studies** of transitional practices and of extended pre and post transition **interviews** with students.
The case study work was carried out in two 6th form colleges and four schools (2 feeder schools for each college: schools S11, S12 for C1 and S21, S22 for C2). The colleges serve different communities: C1 is an institution with open-access to mathematics courses which is the only provider of further education academic courses in its area, serving a mixed rural and urban community; C2 is a college with more demanding entrance requirements to mathematics courses that is situated in a deprived urban area with a very competitive educational market. Both have an excellent academic reputation. Their feeder schools also serve very different communities: S11 serves a rural white British mainly middle class community while S12 is in an urban area serving a white British mainly working class community. S21 is situated in an urban deprived area with an ethnically mixed population, while S22 is located in a suburban area and serves a white British mixed socio-economic community. The colleges with their respective schools formed our case studies: data consisted of interviews with teachers and managers (including the Principals of the Colleges, heads of mathematics departments, student liaison tutors and relevant teachers), observation of lessons, textbooks, student focus group and interviews and students' mathematical work. Our analysis of the cases was led by (i) our hypothesis that misalignments between college and school systems manifest in conflicting discourses and practices on both sides of the transition, (ii) what

we observed in the texts, students' mathematical work and the pedagogical practices, and (iii) what the teachers and students claimed was significant. This led us to an analysis of some of these discourses (e.g. independence of learning, different values of mathematics at school and college, different meanings of algebra) and practices (e.g. student-centred and teaching mathematical concepts beyond the scope of GCSE) and how they mediate students' trajectories of identity during transition.
We interviewed 40 students before their transition to college (at school, during summer holidays or during their first week at college) and from these we re-interviewed 32 students after the transition (8 of them withdrew from the project or did not progress into College). From these 32 students, 19 came from our case study schools. Analyses of these interviews led us to a socio-cultural re-conceptualisation of the notion of "resilience", to a re-conceptualisation of transition from the "learner's identity" point of view and to examine contrasting discourses of independent learning and how these impact students.
Throughout the project we adhered to our ethical principles as per the proposal: all participants were informed about the anonymity of the project's outcomes and students (and parents/guardians) signed a consent form; we supported the "voice" of all participants by being "on their side" helping them to tell their stories; and, all explanations and theorisations were "grounded" in the data "reality".

d) Project Findings

Please summarise the findings of the project, referring where appropriate to outputs recorded on *ESRC Society Today*. Any future research plans should also be identified. *[Max 500 words]*

Previous literature on transition from the institutional and teacher viewpoints sees transitional moments as dangerous, often posing a barrier to progression, mathematics being a particularly vulnerable subject. However, an analysis of our students' interviews revealed a more positive discourse of challenge and opportunity: specifically students relish be(coming) someone "new". In relation to mathematics, this translated into a need for a different "understanding" – a term we will problematise – and for being more "responsible" for their own learning. Thus, we suggest a re-conceptualisation of transition from the lens of the learner (*see* Impacts 1&5).
Further analysis of students' expectations for College led us to the topic of growing independence as an important aspect of transition. We found that even though students expect College to demand a certain degree of responsibility, some of them report they lack the self-directing skills needed. This was exacerbated by a widespread belief of mathematics being an "unsociable" subject (e.g. in mathematics "you work on your own") and by teaching practices (particularly in mathematics) on both sides of the transition (e.g. "spoon-feeding", transmissionist teaching) that are not designed to develop this independence (*see* Anticipated Impacts 1).
Our case study analyses suggested some important institutional issues in respect to transition. The performativity system in which schools are managed plays a fundamental role in shaping the teaching practices adopted to ensure a good place in the league tables. Teachers reported that the practices that seemed to help students in their transition often involved student-centred or student-led activities (e.g. projects, students' explanations of concepts, class discussions). In some cases, teachers and students said that certain practices that go beyond the scope of GSCE helped students' transitions. However, more often than not, teacher-centred, transmissionist practices prevailed over these other practices "to ensure the school a good performance". This

was particularly true for the middle sets, whose students will potentially obtain a C/B GCSE grade. When these students arrive at College, they will face a demand for conceptual understanding and a very fast learning pace which even some of the A/A* students often say they are not prepared for. In the voice of one of our teachers, we concluded that the "GCSE is just not fit for purpose" and therefore College teachers often misunderstand what students know and can do in mathematics.
This was particularly true in the case of algebra, identified by almost all our case study teachers and authorities as "the maths problem" in transition to College. Our analysis of textbooks and students' work showed that even students with high GCSE grades do not have a conceptual understanding of algebra (*see* Impacts 2 & Anticipated Impacts 2).
Finally, an analysis of the narratives of some highly successful working class students led us to a socio-cultural conceptualisation of the concept of "resilience" (*see* Anticipated Impacts 3).
Future research on a more general notion of transition is being developed, looking at the transition from Mathematics into Science (Physics in particular).

e) Contributions to wider ESRC initiatives (eg Research Programmes or Networks)

If your project was part of a wider ESRC initiative, please describe your contributions to the initiative's objectives and activities and note any effect on your project resulting from participation. *[Max. 200 words]*

This project was not part of a wider ESRC initiative. However, a dissemination conference ("Participation, progression and pedagogy in Post-14 Mathematics: implications for policy and practice") has been arranged for June 24th, 2010, in which this and other three ESRC funded projects will present results to practitioners and policy makers.
Also, Julian Williams (CoI) attends the ESRC targeted research initiative on Science and Mathematics Education meetings and has reported the work of this project there.

3. EARLY AND ANTICIPATED IMPACTS

a) Summary of Impacts to date

Please summarise any impacts of the project to date, referring where appropriate to associated outputs recorded on *ESRC Society Today*. This should include both scientific impacts (relevant to the academic community) and economic and societal impacts (relevant to broader society). The impact can be relevant to any organisation, community or individual. *[Max. 400 words]*

Our main results have been and will be presented at different national and international conferences, Steering Committee meetings and other meetings (e.g. with academics and authorities interested in transition issues) to obtain feedback, and relevant papers are being be developed from these.

Presentations:

1. Transition to post-compulsory Mathematics Education: problems for institutions but opportunities for students (in symposium) at the 2009 *British Educational Research*

Association Conference, University of Manchester, UK.
2. Algebra as a boundary object between school and college (in symposium) at the 2009 *European Conference in Educational Research*, University of Viena, Austria.
3. Students' expectations and the double-edged sword of liminality in mathematics educational transitions, at the 2009(2) *British Society for the Research into Learning Mathematics* Conference, University of Bristol, UK.
4. Working group: Transition to mathematics at A-level and University, at the 2009(3) *British Society for the Research into Learning Mathematics* Conference, University of Loughborough, UK

Papers:

5. Transition to Mathematics at Post-compulsory Education, submitted for publication to *Research in Mathematics Education*.

Other dissemination activities:

6. Website:www.education.manchester.ac.uk/research/centres/lta/LTAResearch/TransmathsGCSE/
7. Invited talk at the *Mathematics Education Research Seminar* at King's College London, November 2009.
8. Poster presentation at the 2009 *Researcher Showcase*, The Manchester Museum (open to the general public).
9.

b) Anticipated/Potential Future Impacts

Please outline any anticipated or potential impacts (scientific or economic and societal) that you believe your project might have in future. *[Max. 200 words]*

Presentations:

1. Independence of learning in the transition from GCSE to 6th form College, at the 2010 *British Educational Research Association* Conference, University of Warwick, UK.

Papers:

2. Algebra as a boundary object between school and college, to be submitted for publication to *Educational Studies in Mathematics*.
3. Socio-cultural aspects of resilience in Mathematics, to be submitted for publication to *British Educational Research Journal*.
4. Research Briefing for Policy & Practice, to be presented at a public event on April 30th, 2010, University of Manchester, and on June 24th, 2010, Institute of Education, London.

Other dissemination activities:

5. Dissemination Conference: Participation, progression and pedagogy in Post-14 Mathematics: implications for policy and practice, Institute of Education, London, June 24th, 2010.

You will be asked to complete an ESRC Impact Report 12 months after the end date of your award. The Impact Report will ask for details of any impacts that have arisen since the completion of the End of Award Report.

4. DECLARATIONS

Please ensure that sections A, B and C below are completed and signed by the appropriate individuals. The End of Award Report will not be accepted unless all sections are signed.

Please note hard copies are NOT required; electronic signatures are accepted and should be used.

A: To be completed by Grant Holder

Please read the following statements. Tick ONE statement under ii) and iii), then sign with an electronic signature at the end of the section.

i) The Project

This Report is an accurate overview of the project, its findings and impacts. All co-investigators named in the proposal to ESRC or appointed subsequently have seen and approved the Report.	☒

ii) Submissions to *ESRC Society Today*

Output and impact information has been submitted to *ESRC Society Today*. Details of any future outputs and impacts will be submitted as soon as they become available.	☒
OR	
This grant has not yet produced any outputs or impacts. Details of any future outputs and impacts will be submitted to *ESRC Society Today* as soon as they become available.	☐
OR	
This grant is not listed on *ESRC Society Today*.	☐

iii) Submission of Datasets

Datasets arising from this grant have been offered for deposit with the Economic and Social Data Service.	☒
OR	
Datasets that were anticipated in the grant proposal have not been produced and the Economic and Social Data Service has been notified.	☐
OR	
No datasets were proposed or produced from this grant.	☐