Developing a leading identity across the transition to mathematically demanding programmes at university

Laura Black

University of Manchester.

In a previous paper (Black et al. 2010) we drew on interview data with AS level mathematics (post-16) students to present the concept of 'leading identity' which, we argued, defines the student's motive for study and shapes their relationship with mathematics. We argued that whilst some students might focus on a leading identity of 'being a student' and thus, engage with the activity of 'studying' merely to gain qualifications, others focus upon 'studying' with a vocational future in mind and thus attend to the 'use value' of mathematical knowledge beyond the institution of schooling. In that paper, we presented the story of Mary, a student studying AS level Use of Maths, who had a leading identity of 'becoming an engineer'. We argued that this leading identity gave her enough motivation to persist in studying mathematics where others might have dropped the subject. In this paper, we wish to explore the sustainability of this leading identity for Mary as she experiences transition from college to university. We now have five interviews with Mary which cover the period from the start of her AS level studies to the end of her one year Foundation Degree in Mechanical Engineering at university. In telling Mary's transitional story, we ask: how does Mary experience transition in light of her 'leading identity'? And how does this affect her relationship with mathematics? Furthermore, we also seek to understand how Mary's transitional story is positioned within the landscape of cultural narratives about transition available to her.

Keywords: transition, leading identity, advanced mathematics

Theoretical background

In theorising Mary's transitional story we draw on Cultural Historical Activity Theory (CHAT) which focuses on transition and development in terms of movement between object orientated and socio-culturally mediated activities (Leont'ev 1981; Beach 1995, 2003). This line of theory implicates the construct of 'identity' since individual development is seen as a process of 'becoming' someone new – in line with their participation and transition between activities. As with many theorists, we recognise identity as multi-faceted and socially situated in practice or activity. Given the scope of activities we engage with on a regular basis, we have many different identities to draw on at a given moment in time. We refer to identity as our reflective understanding of who we are in relation to a given activity (Williams, Davis, and Black 2007); one 'becomes' what one 'does' and, importantly, one comes to 'think' what one 'says' through reflexivity. For example, we construct our identity as a mathematics learner upon reflection on our engagement in various forms of mathematical activity in the past. Thus, our notion of identity (or identities) is historical in origin and emerges from the subjectivities (how one views oneself) we experience in the process of doing activities.

In seeking to explore the notion of 'transition', we draw on the work of (Beach 2003) who emphasises the need to consider participants relation to transition – and the relationship between the different forms of activity they are transiting between. He provides us with a typology of different types of transition – of relevance here is 'lateral transition' – involving the individual's movement between two historically related forms of activity in a linear direction. Thus we can see students move from schooling to university and eventually to the workplace as a lateral transition since a) individuals move through these activities in a fairly linear fashion (albeit with some exceptions e.g. returning to education after a period of work) and b) these forms of activity are historically connected through the positioning of education (both schooling and university) in terms of its 'value' as preparation for future labour (Williams 2008). Participation in one form of activity is superseded and replaced by activity in another and some notion of progress is embedded in the individual's transition. (Beach 2003) argues that by acknowledging the unidirectional nature of an individual's lateral transition between activities (and the sense of progress and development which goes along with that) – we can begin to understand the ways in which students might engage with mathematical knowledge differently as they experience transition from schooling to 'working'.

Furthermore, (Beach 2003) argues that the notion of 'leading activity' is an important methodological tool in terms of understanding transition both in terms of individual progression and in terms of macro level change (these two are entwined in such a way that you cannot have one without the other). He draws on (Leont'ev 1981) to define leading activity and its role in development suggesting that human life
"is not built up mechanically ... from separate types of activity. Some types of activity are leading ones at a given stage and are of greater significance for the individual's subsequent development, and other types are less important. Some play the main role in development and others a subsidiary one. (1981, 95) Thus, we might argue that schooling is a leading activity since for many it plays a significant role in our development. Nevertheless, what counts as 'significant' is not merely defined in terms of the individual but "is as much to do with whether it is leading or not as the societal sequence of activities. It is in this way that activities mediate between large-scale societal change and the local coupling of individuals with activities." (Beach 2003, 125) It is from this framework that we developed the notion of leading identity in our previous paper (referred to earlier). We argued that the identity made available by one's leading activity at a given moment in time is a *leading identity*. This reflects a hierarchical organisation of motives in understanding the self and directs the organisation of all other identities available. For example, we might suggest that Mary's leading identity as 'a student wanting to become an engineer' hierarchically subordinates the other identities she constructs and which are available to her (e.g. being female).

However, whilst this approach places emphasis on the students' motive for engaging with mathematics – it should be distinguished from constructs such as 'motivation' and 'goal orientation' which have also been referred to in the literature (e.g. (Dweck 1986). The latter reflect types of behavioural approaches in relation to task (e.g. mastery goal orientation, performance avoidance etc.) which are internal to the individual and appear generalisable across tasks. A CHAT approach on the other hand, places motive in the dialectic between individual and the activity (along with its socio-cultural and historical baggage). For instance, students' motives for studying mathematics are often defined in terms of the 'grades' they can achieve and the 'status' such grades bring in what is apparently an elite subject. However, this motive

is only made relevant by the activities which take place in mathematics classrooms (e.g. cramming for tests) and the wider institutional discourses in which they are situated.

Methodology and Data Analysis

This data comes from two connected projects. The first investigated students' participation in post compulsory mathematics education (aged 16-17 years) in England with the aim of comparing two Advanced Subsidiary (AS) level programmes: Mathematics and Use of Mathematics with a view to understanding how pedagogy impacts on students' dispositions towards studying mathematics, and electing to study mathematically demanding courses, (e.g. Science, Technology, Engineering etc.) at university. As part of this project, we conducted interviews with 40 students focusing on their background history, their experiences with mathematics, career aspirations and disposition towards future study.

(http://www.education.manchester.ac.uk/research/centres/lta/LTAResearch/tlrp/)

The second project is currently investigating how students experience mathematics education across the transition from A-level to mathematically demanding degree programmes at university. It looks to explore how such experiences interact with students' background social factors (e.g. class, gender etc.) to shape learning outcomes, identities, dispositions, and the key choices made surrounding transition into university. Mary was a participant in both of the above projects so we have 5 interviews spanning a period of 3 years.

(http://www.lta.education.manchester.ac.uk/TLRP/summary.htm)

Mary's interviews have been analysed using narrative analysis. This draws on the work of Bruner (1996) who emphasises the importance of narrative not only in construing how we understand ourselves in the world but also the 'reality' in which we operate. Thus, we present our students' interviews as biographical narratives, made up of inter-connecting sub-stories which can then be connected (or disconnected) through a reformulation process. The latter involves the identification of a central 'plot' within or across a number of interviews and sub-stories told by the student are considered in terms of their proximity to this (Goodson and Sikes 2001). On this occasion, we have used the constructs of leading activity and leading identity as the central plot. A leading activity is identified where we see a significant shift in the student's motive to engage with a particular activity or others like it and where this shift in motive is implicated as significant in shaping the student's trajectory. This can be seen within a particular sub-story the student recounts where s/he reflects on the shift in some way or it may be more apparent when comparing sub-stories regarding the same activity(ies) at different points in time (i.e. between two different interviews). The construct of leading identity can be identified where the student makes 'I statements' pertaining to the afore mentioned leading activity. Identity statements may refer to either their state of being (in the past, present or future) (e.g. I am, I will be, I was etc.) or themselves in action (e.g. I do, I got, I will do). The use of leading activity and leading identity to formulise a central plot means that our analysis connects the sub-stories students tell to present the 'whole story' as it emerges across the interview(s). Inevitably, some sub-stories told within the interviews are not included in our analysis; we have selected data which is of significance to the overall plot (i.e. the student's leading identity).

Mary's Story: Prior to University

In our previous paper, we presented Mary's earlier experiences and attitudes towards education and mathematics as a 'canonical' story which was shared amongst a small

number of students in our sample (5 out of 40 students). This story was identified as 'when troubles come, aspirations remain the same' and in Mary's case, we told of her leading identity of becoming an engineer which enabled her to persist with studying mathematics despite various troubles (i.e. being placed in a low GCSE set, dropping statistics at AS level (Use of Maths) due to likely failure). We argued that this leading identity emerged out of Mary's engagement with her GCSE Engineering programme (Double Award) during which she undertook various design projects (the leading activity). Mary, herself, identified such projects as crucial in shaping her aspiration to become an engineer and spoke of how this experience developed an awareness of her 'needs' as a student ('I like hands on stuff') and her future potential self.

> "That whole process [making something from scratch] and that accomplishment and that feeling I got, I loved it and I just thought I really want to keep that and be part of it. One of my dreams is to do something massive, and be like, "Yes, I did that"

In our previous paper, we argued that Mary's relationship with mathematics was shaped by the motive provided by her leading identity of becoming an engineer. Thus, she spoke of its use value in an engineering context in addition to its exchange value in terms of the grades she might obtain and it was this perception of the use value of mathematics which enabled her to persist with the subject even in the face of potential failure. This contrasted with other students in the sample who were more focused on the exchange value their grades could provide and who spoke of dropping mathematics and adjusting their aspirations in the face of similar troubles.

Mary at University

We catch up with Mary near the end of her Foundation Degree in Mechanical Engineering. She is attending X University, although this was not her original choice (more on this later), after obtaining 140 UCAS points through her A-level results. As in previous interviews, Mary remains highly committed to engineering as a career, although her aspirations have become a little more refined. Nevertheless, she remains keen to keep her options open and see what options a mechanical engineering degree might provide:

> "You know maybe do aeronautical. I wasn't, I'm still not 100% sure because there's a lot of choice in the stuff— […] But I think what I was going to do was stay with mechanical engineering and do maybe a Master's in aeronautical aerospace you know, something like that.

However, whereas before university Mary struggled to gain the grades she needed/wanted, she now describes herself as a successful student. She tells us she is maintaining 'a B or A sort of level' which 'is good and a bit surprising'. On her mid year exam she tells us she gained an A/A- and describes the transformation 'From like D's and E's to like an A so I was kind of like, 'ok.' 'I thought they did a mistake'. Thus, we can see a distinct transformation in Mary's identity from struggling to successful student.

This change in Mary's narrative seems quite counter intuitive – given her troubles at A and AS level and the perceived importance of A-level grades for entry and performance at university, we might expect her to present a more troubled account of her move to university. However, as mentioned above, transition from one organisation to another can be an affordance for an individual in that they experience becoming someone or something new (Beach 2003). Indeed, as Beach argues a sense of progression is embedded in uni-directional, lateral transition since it this principle which historically connects the two organisations concerned (in this case, school and university). The sense of a new beginning for Mary was certainly evident in her interview data where she tells us of the changes in her identity that she has made:

> "….getting onto the course, getting onto it I think wasn't hard but doing it was a bit of a different manner. I had to change my whole attitude where I thought, ah, maybe I'm not gonna be that good, or you know, looking at my past grades this is crap you know, but I had to kind of change my attitude and think, 'wait, this is a new start'.

Here, Mary comments 'I **had** to kind of change my attitude' which suggests she felt her 'new start' was a necessary part of her transition in order that she progress in line with the activities she participates in.

Leading identity and transition to university

When asked why this change has come about, Mary directly implicates the motive derived from her leading identity in the narrative. She tells us:

"I think it was just because I finally knew what I wanted to do. […] I've always wanted to do a sort of Maths and I knew I liked making things[…] I can't wait to get my job and you know, call myself an engineer. It'll be such a great moment in my life I think."

However, as noted above, this motive is not solely the product of Mary's past experience but is also partly located within the structure of the activities and institutions with which she engages. As such, Mary talks of her progression in terms of finally finding a place where she belongs – a place where her perceived potentiality aligns with the motive generated by the activities which constitute her engineering course. This sense of belonging comes through most strongly in her description of her relationship with her fellow students on the Foundation degree:

> "Yeah, I've got very nice guys who I hang out with […] it's really nice to kind of have that support from you know, really good friends to have that support from them, and you can see that they're the kind of people that really wanna get somewhere on the course, and it's really nice to have that."

When asked why she thinks they are such a good group of people to work with she tells us: "I think cos they all wanna get somewhere in their lives. […]And we're all kind of there for the same reason, so that kind of brings us together."

Thus, Mary tells of belonging to a community of participants who engage in the same activities with the same motive in mind – for Mary, her leading motive is now shared with her fellow students (i.e. knowing where they want to go in life) - a community generated by the engineering activities which make up the Foundation Degree programme. Thus, we see what appears to be a dialectic relationship between Mary's leading identity and her sense of 'togetherness' with the community and activities which constitute her course. On the one hand, she is able to find this sense of togetherness precisely because she has a leading motive to become an engineer but simultaneously, the alignment of her leading motive with the activities and community which constitute her course further resources her leading identity and thus her motive for studying ('I can't wait to get a job..and call myself an engineer').

Leading identity, transition and Mary's relationship with mathematics

So does this transition bring about a new relationship with mathematics for Mary? In our earlier analysis, we highlighted how Mary's motive to 'become an engineer' shaped her relationship in a way which enabled her to perceive the use value of mathematics beyond the walls of the classroom. Yet there was an apparent contradiction in Mary's account between this notion of use value which she saw as powerful in terms of her future as an engineer and the limited exchange value which her low grades provided in the here and now (at AS level). We argued that this represents wider conflicts within the education system with the current emphasis on 'performance' in mathematics being mostly disconnected from its eventual 'use' in the labour market (Williams 2008). However, Mary's transition to university has resolved this conflict in some sense - Mary is now a successful student and therefore,

her positive relationship with mathematics is not just framed in terms of its use to her future but also draws on a new identity – that of, successful student. – " [I'm] suddenly getting good grades without even trying sometimes". As such, we might suggest that Mary feels a new sense of alignment between the exchange value her 'good grades' provide and the use value of the mathematics she is learning. This is referred to in the quotation above where she suggests that doing the kind of mathematics she likes ('the maths behind the designing and making') is one reason for her new success in the subject.

A sense of alienation in developing and maintaining a leading identity

However, although Mary's transition to university may be seen as a fairly positive story – her interviews contained repeated references to a family narrative regarding her 'designated future' and the sequence of leading activities which this implicates. Mary comes from an immigrant Pakistani family which she describes as: "we have a very backwards sort of family. It's a very Asian sort of, you know, girls should stay at home to do the cooking— […]Where the guys go out and work." Thus she suggests that a more acceptable sequence of leading activities under this narrative may be seen as 'schooling followed by motherhood/domestic work'.

On the one hand, Mary speaks of her resistance to this expected sequence of activities. She speaks of having to convince her parents and her sister that 'Engineering was something I've always wanted to do' and informs us that 'my step-granddad he doesn't agree with it still.' But she tells us '… I've just started to ignore him now because it is just, I'm so happy doing this course…' So Mary tells us that her trajectory of 'becoming an engineer' has implicated resistance to a designated identity laid out in her family narrative. However, a sub-story regarding why she chose to go to *X university* and therefore, undertake a Foundation Degree (involving an extra year of study) rather than go to her first choice of institution, suggests that this resistance has created tensions for her. Mary tells us that she felt X university would have better resources ('flight simulators' and an 'aeroplane cut in half') which she was not sure her first choice of institution would have (having never visited it). She then tells us

> "and then I thought about my grades and how you know, obviously I didn't do the Maths and stuff and I've heard from my older sister, who had friends who did Engineering—[…] Quit the course because they found the Maths too hard […] and I thought to myself well if I spend an extra year kind of getting used to it then hopefully I have two years to kind of be good. […] It kind of took me to, I kind of, wasn't really pushed but I was more kind of towards *X university* anyway. […]So I went with *X university* instead."

So it seems that in order to sustain her leading identity of 'becoming an engineer' Mary is required to negotiate and even subordinate the various other identities available to her (e.g. being female and Asian). Mary's account of why she ended up at *X university* provides evidence of this – she has reached a compromise with her family by 'staying near home' (thus fulfilling her family's wishes & being the dutiful Asian daughter) whilst still pursuing her engineering dream. Thus, to some extent she seems aware that her leading identity of 'becoming an engineer' necessarily implicates alienation from the culturally normative expectations her family holds for her as an Asian female. Nevertheless, Mary resists the idea that the 'Foundation Year' is a 'cost':

> "Yeah I thought to myself taking an extra year would that make me look dumb, would that you know, just waste my time or something but, doing the actual course I found that, you know I actually needed it cos I thought if I go into first year not knowing what integration is and differentiation was—[…] Then I'll be really stuck."

Thus, in some sense, the compromise she has made with her family has provided access to mathematical knowledge (integration and differentiation) which she sees as necessary for her future studies and it has provided a slower pace to her progression and perhaps even eased her transition to university.

Conclusion

In this paper, we have highlighted the transitional story of one student, Mary, as she progressed from school/college and into university. We have shown that, by adhering to a particular leading identity (becoming an engineer), Mary has found a deeper motive to the activity of studying. For Mary, studying is not simply about gaining a qualification but rather it is seen as preparation for the next stage of her life – working as an engineer. We have argued that the motive provided by her leading identity may be resourcing a positive transition providing her with enough confidence to make a new start. Therefore, we feel Mary's story makes a valuable contribution to previous research on student learner identities. This has tended to explore the identities of highly successful students on mathematically demanding courses in elite institutions in Higher Education (Solomon 2007; Brown and Macrae 2003) or has provided generic accounts of transition which do not specifically focus on mathematically demanding courses and the role mathematics plays in transition (Ball, Maguire, and Macrae 2000).

Running alongside our representation of Mary's transitional story, we have highlighted Mary's ongoing relationship with mathematics which is framed in terms of its use value to the activity of 'doing engineering' both inside the classroom (education system) and in the workplace. This appears no longer disconnected from the 'exchange value' her mathematical knowledge provides. The question we might then ask: is how can we encourage students to find ways of understanding their leading identity and its relationship with 'studying' as an activity? How might we encourage students to reflect on their motives for study? And consequently, how might we help them to see the 'use value' of mathematics?

Additionally, we have also argued that Mary's transitional story is embedded in wider cultural narratives about future aspirations and the sequence of and relations between leading activities which such narratives adhere to. Mary expresses a desire to follow a normative pathway by moving from schooling into the workplace (both can be classed as leading activities). Furthermore, in describing this pathway she draws on a liberal humanist stance suggesting she has 'choices' (and thus agency) which she makes on the basis of what she 'enjoys'. But this jars with her family narrative (and possibly the sequence of leading activities which may be expected of her in that narrative i.e. schooling – domestic work - motherhood). Ultimately, it seems that she has to negotiate this narrative and we have shown in the data how she has sought a compromise in 'doing engineering' in a way that appeases her family. For Mary, undertaking a Foundation Degree provides a slower rate of change and progression in her transition and provides a pathway to university which allows her to ease a sense of alienation from her family.

References

Ball, Stephen J., Meg Maguire, and Sheila Macrae. 2000. *Choice, pathways and transitions post-16*. London: RoutledgeFalmer.

Beach, King. 2003. Consequential Transitions: A Developmental View of Knowledge Propagation Through Social Organisations. In *Between school and*

work: New perspectives on transfer and boundary-crossing, edited by T. Tuomi-Gröhn and Y. Engeström. Amsterdam/Oxford: Pergamon.

Black, L., J. Williams, P. Hernandez-Martines, P. Davis , and . G. Wake. 2010. Developing a 'Leading Identity': The relationship between students' mathematical identities and their career and Higher education aspirations. . *Educational Studies in Mathematics* 73 (1):55-72.

Brown, Margaret, and Sheila Macrae. 2003. *Full Report of Research Activities and Results: Students Experiences of Undergraduate Mathematics: Reference Number: R000238564*. Swindon: Economic and Social Research Council.

Bruner, Jerome. 1996. *The Culture of Education*. Cambridge, Massachusets: Harvard University Press.

Dweck, C. S. 1986. Motivational Processes Affecting Learning. *American Psychologist* 41 (10):1040-1048.

Goodson, I.F. , and P. Sikes. 2001. *Life history research in educational settings. Learning from lives*. Buckingham: Open University Press.

Leont'ev, Aleksei Nikolaevich. 1981. *Problems of the development of the mind*. Moscow: Progress.

Solomon, Y. 2007. Not belonging? What makes a functional learner identity in the undergraduate mathematics community of practice?' *Studies in Higher Education* 32 (1):79-96.

Williams, J.S. 2008. Towards a political economic theory of value in education. *TLRP-WP-Maths working paper.*

Williams, J; , P; Davis, and L. Black. 2007. Sociocultural and Cultural–Historical Activity Theory perspectives on subjectivities and learning in schools and other educational contexts. *International Journal of Educational Research* 46 (1-2):1-7.