The ‘Mathematically Able Child’ in Primary Mathematics Education: A Discursive Approach

Fiona Walls
UN ESCAP, Port Vila, Vanuatu
<lancewood@vanuatu.com.vu>

Grouping according to perceptions of ability is widely used in the teaching of mathematics in many countries. These practices may be viewed as operating within discursive complexes concerned with *the mathematically able child*. This paper uses Foucault’s theories of discourse to argue that such a child is discursively *produced*, and that the differentiating pedagogies that characterise mathematics teaching in many New Zealand primary schools are supported within such discourse. It investigates the *dispositif* surrounding the ‘mathematically able child’, and considers implications of dominant discursive accounts of mathematical ability for young learners.

In her evaluation of research about assessment in mathematics education, Morgan (2000) suggests that ‘rather than attempting to find “better” ways of assessing, a major aim of research into assessment in mathematics education…must first be to understand how assessment works in mathematics classrooms and more broadly in education systems, and to understand what its consequences are for individuals and groups within society’ (p. 238). In their quest for ‘better’ assessment including taking greater account of children’s use of mental strategising, recently implemented programmes in primary mathematics education such as the National Numeracy Strategy (UK), Count Me In Too (NSW), and the New Zealand Numeracy Development Projects (Ministry of Education, 2003), might be viewed as constructive of normalising views of the mathematically able child. This paper interrogates commonly accepted methods of assessment and ability-based grouping procedures in primary classrooms using the theories of Michel Foucault to investigate the ways in which the discourse of education, within a complex of related discourses and ensembles of practice might construct an ideal of the mathematically able child, and considers what such practices might mean for young learners.

Investigating the ‘Mathematically Able Child’

Foucault’s Use of ‘Discourse’

Notable mathematics education research has drawn upon Foucault’s theories of discourse including that of Walkerdine (1997, 1998) who argues that the discourse of schools inscribes girls as mathematically distinct from boys and pathologises deviations from a ‘rational norm’, and Dowling (1998) who demonstrates how the discourse of mathematics textbooks might construct ‘myths’ about mathematical ability supporting student differentiation and creating disadvantage.

Foucault defined the term *discourse* as an *episteme* or ‘group of statements that belong to a single system of formation’ (Foucault, 1969, p. 121). Central to Foucault’s approach is the idea that discourses are *productive*, thus he argued that penological discourses *produce* the ‘criminal’, and medical discourses *produce* the ‘insane’ or ‘healthy’. In this view, ‘sinners’, ‘the insane’ or ‘slow’ ‘average’ or ‘gifted’ learners of mathematics are made visible and ‘signified’ through discourse. His historical studies embracing such themes as discipline and punishment (Foucault, 1977) demonstrate how discourses constitute the ‘sayable’, transmute over time and space, and are engaged in a continuous process of *production.* Foucault examined the ways in which dominant discourses are implicated in managerial systems of power and control based on notions of 'normality' and 'abnormality', binary opposites that have contributed to and moulded the formation of 'modern' institutions such as prisons, hospitals, armies and schools (Foucault, 1977). He viewed all social systems and institutions as *ensembles of practice* (Foucault, 1980) operating within discursive domains, and the relations between discourse and institutional apparatus as a *dispositif* (Foucault, 1980).Within such discourses, 'criminals' require 'punishment', the 'insane' require 'treatment', and the 'uneducated' require 'schooling'. Foucault argued that as the histories of such institutions are obscured with time, their purpose and methods become accepted as 'common sense' or 'best practice'. Where such systems create and maintain social disadvantage, he suggested that it may be possible to look to founding discourses to provide alternative views of 'best practice'.

Investigating the Discourse of Education

This paper first investigates how *the mathematically able child* might be seen as a discursive product, and then examines the institutional apparatus surrounding such a product. In their advice to researchers intending to use Foucault's notion of discourse, Kendall and Wickham (1999) recommend 'recognising a discourse as a corpus of statements whose organisation is regular and systematic, identifying the rules of the production of such statements, identifying the rules that delimit the sayable (which of course are never rules of closure), identifying rules that create spaces in which new statements can be made, and identifying rules that ensure a practice is material and discursive at the same time'(p. 42). While essentially non-Foucaultian since it suggests that discourses are contained within closed boundaries, Figure 1 (below) provides a heuristic device for identifying possible domains within a discursive complex that might be co-productive of notions of the mathematically able child.

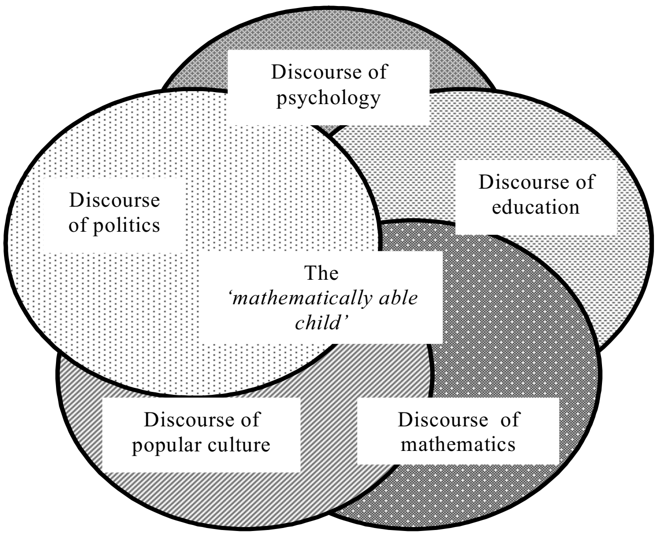

Figure 1: Possible elements of the discursive complex in which the 'mathematically able child' may be produced

While acknowledging the contribution of other discourses, I have selected one of these domains, the discourse of education, to examine for evidence of coherent discursive constructs of the *mathematically able child*. In the following sections of this paper, I examine and analyse a range of statements gathered from diverse sources including education policy documents, curriculum materials, and school information brochures, all of which have been published since the introduction of the New Zealand's national curriculum framework in 1992. I also use the statements of teachers and students collected during interviews and classroom observations conducted during three year ethnographic study of New Zealand primary classrooms (Walls, 2003). I look particularly for consistency within the discourse, what currently constitutes the 'sayable', and how classrooms might reflect commonly-held discursive accounts of the mathematically able child.

'The Mathematically Able Child': Visions of 'Normality'

The discourse of education is publicly articulated through speeches, reports and curriculum materials produced by what Foucault would term 'experts' within the educational domain. The following extracts typify 'official' accounts of educational 'ableness'.

> It is a principle of the *New Zealand Curriculum Framework* that all students should be enabled to achieve personal standards of excellence and that all students have the right to the opportunity to achieve to the maximum of their potential. (Ministry of Education, 1992, p. 12)

> The main goal of the project is to provide detailed information about what children can do so that patterns of performance can be recognised, successes celebrated, and desirable changes to educational practices and resources identified and implemented. (Flockton & Crooks, 1995, p. 1)

> The activity in New Zealand schools is focussed on a single goal: to ensure that all students are taught the skills, knowledge, attitudes, and values necessary for them to meet their life-long potential. (New Zealand Government, 1998, p. 7)

Implicitly and/or explicitly, the 'able child' is consistently produced within these statements as one who acquires 'essential' attributes, matches a developmentally appropriate norm within a 'natural' performance range defined and substantiated by rigorous research, whose learning is limited by a finite capacity ('potential'), and whose performance is maximisable ('personal excellence') given optimal educational conditions.

Backgrounded by this general view of educational 'ableness', versions of 'mathematical ableness' are similarly constructed. The following extracts provide typical accounts of *mathematical 'ableness'* according to experts.

> Mathematics provides a means of communication which is powerful, concise, and unambiguous…mathematical understanding and skills contribute to people's sense of self worth and ability to control aspects of their lives…in an increasingly technological age, the need for innovation, and *problem-solving* and decision-making skills, has been stressed in many reports on the necessary outcomes for education in New Zealand. Mathematics education provides the opportunity for students to develop these skills, and encourages them to become innovative and flexible problem solvers. (*Mathematics in NZ Curriculum*, Ministry of Education, 1992. p. 7)

> In the past, teachers weren't coming from the point of view of strategy development for children. The aim of this framework [of developmental stages of children's number knowledge and operational strategising] is to get teachers to empower children to use more advanced strategies to solve numerical problems. It provides the knowledge to assist children to make the jumps to harder, faster and better number strategies. It also gives teachers the ability to assess students' progress and set tasks through which they can improve children's numerical ability.' (Education Gazette, 2001, p. 4)

Mathematical ability is expressed as possession of empowering mathematical knowledge and skills, especially those required for problem solving. Such ability is viewed as something which can be developed through 'enabling' teaching practices.

Identifying and Managing 'Abnormality'

Significant variability in children's mathematical 'ableness' consistently appears as a taken-for-granted within official education discourse, as the following statements show.

> It is a principle of the New Zealand Curriculum Framework that all students should be enabled to achieve personal standards of excellence and that all students have a right to achieve to the maximum of their potential. It is axiomatic in this curriculum statement that mathematics is for all students, regardless of ability, background, gender or ethnicity…students of lower ability need to have the opportunity to experience a range of mathematics which is appropriate to their age level, interests, and capabilities. Equally, students with exceptional ability in mathematics must be extended and not simply expected to repeat different permutations of work they have clearly mastered. (Ministry of Education, 1992, p.12)

> Evaluation of students' achievement is an essential part of mathematics education…Evaluation includes diagnostic assessment procedures which enable teachers to discover difficulties that individual students may be having…Diagnosis may also reveal that the student is very talented and is simply bored by lack of stimulation. Diagnostic assessments enable teachers to plan further learning activities specifically designed to meet the learning needs of individual students. (Ministry of Education, 1992, p.15)

> The achievement objectives defined in *Mathematics in the New Zealand Curriculum* are set out in levels and strands. However, curriculum levels do not automatically equate with a given year. Each learner is an individual and so the development and rate of learning will differ from one student to another. The students in each class are likely to be working at a range of levels. Some students will also be identified for Development Band [extension for gifted and talented students] activities. The task for the teacher is to design units of work that enable this range of abilities to be catered for …part of the planning process in mathematics is the analysis of barriers to learning…the teacher needs to analyse what gets in the way of student progress. (Ministry of Education, 1997, p.19)

> Students have a right to achieve to the maximum of their potential…the development band is not designed to hold students back but rather to increase their understanding and knowledge in mathematics and help them develop higher order thinking skills. (Ministry of Education, 1996, p.8)

> Group your students for instruction by their assigned strategy stage…where there is a wide range of strategy stages within your class, you need to consider either cross-grouping between classes or compromising by putting together students from close strategy stages to reduce the number of teaching groups. (Ministry of Education, 2003, Book 3, p. 2)

Within these statements, differential treatment is presented as a *need* of those of 'lower ability' and a *right* of the 'exceptional', pathologising students who fail to measure up to the able norm, and privileging those who exceed it. The teacher of mathematics is produced within this discourse as an expert with a responsibility to diagnose 'learning needs', monitor 'progress', reduce 'barriers' to learning, design 'appropriate work', provide 'extension', and bridge 'gaps', that is, to fashion the mathematically able child by means of appropriate methods of management. The following statement which describes the recently implemented New Zealand Numeracy Development Project, reinforces this view.

> With reading we always had guidelines and check sheets. We knew exactly what children's knowledge was. In maths we didn't really know that. Now we can test a child and know where they are placed on the framework and determine what we should teach them. (Education Gazette, 2001)

As this sample of statements shows, mathematical learning is consistently constructed as a process of developmental progression along a 'natural' path, measurable by means of clearly defined and finely detailed indicators, and focussed around a product: the *mathematically able child* who will ideally become in time the *mathematically able citizen*. Dissection and ordering of mathematical knowledge and skills into progressive sequences of learning steps - expressed as 'cycles' in the Beginning School Mathematics resource (Ministry of Education, 1994), 'levels' in the *Mathematics in the New Zealand Curriculum* (Ministry of Education,1992) and 'stages' in the New Zealand Numeracy Development projects (Ministry of Education, 2003), provide official versions of normalising criteria by which *mathematical 'ableness'* might be discerned.

Within the wider discourse of education, the school and classroom can be regarded as political spaces where local inscriptions of mathematical ability emerge. An example of this can be found in the following excerpts from school information brochures which demonstrate localised responses to external demands for management of extremes in mathematical ability.

> As part of the planning and assessment process all teachers regularly provide enrichment activities, particularly in the areas of language/reading and maths. (River School, 2000)

> This school offers: 'A comprehensive primary education with an emphasis on literacy and numeracy, with special help in reading, language and mathematics for children with difficulties.' (Spring School, 2000)

Viewed as educational experts within the classroom, teachers might be seen as taking on the managerial responsibilities of identification, organisation, enablement, and supervision of mathematical learners. The following typical comments provide revealing insights into this process.

Ms Roche: He'll never be a scholar…underachieves in everything…a slow learner…has an attitude problem…If I blackmail him, 'If that's not done you won't be going swimming!' he gets it done…I admit I snap but he has to learn…He's getting better. He gets the back of his maths book ruled up and the date. That's great progress for a kid like him. (Mitchell, Early Year 5)

Mrs Meadows: She's middle of the range, [for maths] you know. She'll never be top notch. I don't know what the parents' expectations are – is she expected to be higher, I wonder? Fleur, Mid Year 5)

Ms Linkwater: Her recall is really good [basic facts]…And some like Rochelle's group…I call them the Super Smarty Pants…SSPs I put on the board and they could work it out *(laughs)*. But it's a really nice way of saying those kids who really work hard with a good attitude, good setting out, yeah it's just that positive attitude and cope with the work. The reason I call them that is they have got the concepts, they work independently, and to work independently you have to be Super Smarties. (Rochelle, Early Year 5)

As these everyday utterances show, there are many discursive similarities between official constructs of the mathematically able child and those of schools and teachers. It is taken for granted that children can and should be measured, classified and discussed in terms of their 'ableness',that ability can be discerned from peer comparisons. Lack of mathematical ability is expressed as 'neediness' and 'underachievement'. In line with official notions of 'potential as fixed capacity', mathematical 'ableness' in the early years of primary schooling is seen by teachers as an immutable part of a child's personal makeup, and therefore a reliable predictor of future success. While innovation and problem solving are seldom mentioned by the teachers, additional criteria are used in the classroom such as recall of facts, how quickly new skills are acquired, and how independently the child is able to operate ('work') within classroom management systems. Although teachers appear to regard themselves as responsible for maximising potential, they also seem to believe they can only do so much with children like Mitchell who are naturally deficient, while those who are capable achieve independence.

As Foucault points out, negotiation of norms within domains of practice such as the classroom involve both subjugation and opposition (Foucault, 1977). Thus teachers' versions of the mathematically able child may be reinforced or resisted. A number of studies demonstrate that student judgements about mathematical ability including self-assessment and peers' assessment of peers tend to support those of the teacher (e.g. Clarke, 1994; Walls, 2003). The following statements show how children's constructs of mathematical ability, produced within classroom routines of assessment and grouping, provide evidence of both reinforcement and resistance.

Researcher: What makes a person good at maths do you think?

Jessica: If you practise quite a lot. And the little girl Marnie she's really good at maths, she got a hundred out of a hundred this time [basic facts speed test] 'cause she's really smart, but I don't think it's, like she practises or anything, well she probably does, but I don't think it's really that reason, I think it's because she was just born like that. And some people are born differently than others. (Early Year 5)

Researcher: How do you know Joe's really good at maths?

Georgina: Because he's in the highest group and he's always getting everything right.

Researcher: How do you know he's getting everything right?

Georgina: Because he always, like, puts up his hand every time, 'cause he's really fast and goes 'Shp! Shp! Shp! (mimics how Joe puts up his hand quickly time after time). (Mid Year 4)

Dominic: Mr Swift would probably put me at about 9 [compared with his self-rating of 10]. Because he usually doesn't see things, but I always get it right, but the first time he saw it [all correct] he said, 'Gee Martin,' and he's [Martin] about 10. Now he doesn't even check me...I'm one of the best in the class. (Mid Year 4)

Discussion

It can be seen even from the limited examples used in this paper that the discourse of education produces views of *the mathematically able child* which appear to adhere to 'rules' of the sayable within discursive formations. Experts such as mathematicians, teachers, educational researchers and advisers produce, by means of curriculum materials, teacher training programmes, school policies, and mathematics texts, a coherent picture of the mathematically able child, locally inscribed with little alteration within the everyday practices of school and classroom. Apparatus for 'identifying' and 'catering for' differences in mathematical 'ableness' are bound by principles that ensure that the constructed views of 'ableness' may be considered realities since they are both discursive and material at the same time. Although contradictions appear to exist within the discourse between what teachers *should* expect children to learn in mathematics, as instanced statements of *equality of opportunity*, and what children *are able* to learn as found in those of *readiness* and *catering for a range of abilities*, the predominant view appears to be that mathematical ability can be best understood in terms of *needs*, *potential* and *talent*.

The classroom can be viewed as a *surface of emergence* where the discourses which produce the mathematically able child are negotiated through the contingencies of everyday classroom practice. Teachers as experts are vested with the responsibility and the power to exercise professional judgement in deciding who is mathematically *needy*, *able*, or *exceptional* and how best to manage these variants. In this view, the prevalence of standardised and timed tests, competitions and quizzes that characterise much mathematics teaching in New Zealand primary classrooms, (Walls, 2003) can be understood as the apparatus of 'identification', and grouping and teaching by ability as the apparatus of 'catering for needs'.

Implications for Young Learners of Mathematics

Foucault was particularly interested in 'how discourses work to subjugate individuals and how individuals are constituted through "the multiplicity of organisms, forces, energies, materials, desires and thoughts etc"' (Swingewood, 2000, p. 196). In his view, education and schooling can be viewed as a discursive domain productive of idealised visions of the mathematically able child, and maintained through everyday assessment and grouping practices that compare, differentiate, hierarchise, homogenise, exclude – in other words, *normalise* (Foucault, 1977). Although a growing body of evidence suggests that ability grouping in the teaching of mathematics does not guarantee improved learning outcomes, particularly for children assigned to average and lower ability groups, (e.g. Ireson & Hallam, 1999; Harlen, W. & Malcolm, H.,1999; Hallam & Toutounji, 1996; Boaler, 1997) recent discourse of empowerment and maximised mathematical potential appears to have been used not only to justify, but also to require, increasing use of differentiation in primary mathematics education.

Within the discourse of mathematical 'ableness', there is a remarkable absence of consideration for student affect, despite the fact that feelings of anxiety or disheartenment are common in students' accounts of their experiences of learning mathematics, as the following statements illustrate.

Liam:	Sometimes I get real nervous, 'cause I might get a real bad score. I feel like my legs would shake…Kids might say, 'That sucks, you should've got higher than that.' (Mid Year 5)
Dominic:	I feel quite nervous [about tests], well, 'cause you don't know which group you will be in.
Researcher:	You could change groups?
Dominic:	Yeah…He changes the groups all the time but I've always been in the highest group. (Late Year 4)
Fleur:	I wish I was a bit better [at maths] but I don't exactly mind that much 'cause not everybody's good at everything…Because I'm quite a bit slower, because I struggle. They [other people] know a bit more, and what they're doing, they get the point of it all. (Early Year 5)

Discourse that creates a view of the mathematically able child as one who possesses valued mathematical skills and knowledge, and that asserts that acquisition of such attributes is constrained by individual potential, appears to dominate the teaching of mathematics, eclipsing notions of inclusivity, equality of opportunities, and reduction of learning barriers. While mathematical 'ableness' may have been discursively reconstituted with recent shifts in emphasis from 'recall of facts' to the 'use of effective problem solving strategies', discriminating institutional practices such as testing, grouping by ability for teaching, and monitoring of progress which both create and perpetuate normalising versions of mathematical ability, have increased as imperatives to 'maximise potential' demand refined methods of measurement and surveillance.

Foucault reflects that 'So many things can be changed, being as fragile as they are, tied more to contingencies than to necessities, more to what is arbitrary than what is rationally established, more to transitory historical contingencies than to inevitable anthropological constraints' (Foucault, 1994, p. 458). His view may be optimistic, but this paper suggests that if we are to consider the welfare and life opportunities of young learners of mathematics, changes in what could be construed as the 'contingent and arbitrary' nature of the discursively produced *mathematically able child* may be called for.

References

Boaler, J. (1997). *Experiencing school mathematics: Teaching styles, sex and setting*. Buckingham: Open University Press.

Clarke, D. (1994). The role of assessment in determining mathematics performance. In G. Leder (Ed.) *Assessment and learning of mathematics* (pp. 145-165). Victoria, Australia: ACER.

Dowling, P. (1998). *The sociology of mathematics education: Mathematical myths/pedagogic texts*. London: The Falmer Press.

Education Gazette (2001). *What is the Learning Framework for Number?* Education Gazette (80,3, pp. 4-5) March 2001. Wellington.

Flockton, L., & Crooks, T. (1995). *Graphs, tables and maps: Assessment results 1995*. National Education Monitoring Report 3. Wellington: Ministry of Education.

Foucault, M. (1969). *The archaeology of knowledge*. (Routledge Classics ed.) (2002). London: Routledge.

Foucault, M. (1970). *The order of things: An archaeology of the human sciences.* New York: Random House Inc.

Foucault, M. (1977). *Discipline and punish: The birth of the prison.* London: Allan Lane.

Foucault, M. (1994) Power. In J. Faubion (Ed.), *Essential works of Foucault 1954-1984*, (Vol 3). London: Penguin.

Foucault. M. (1980). *Power/Knowledge.* Brighton: Harvester .

Hallam, S., & Toutounji, I. (1996). What do we know about the grouping of pupils by ability?: A research review. London: Institute of Education, University of London.

Harlen, W., & Malcolm, H. (1999). *Setting and streaming: A research review*. Edinburgh: Scottish Council of Educational Research.

Ireson, J., & Hallam, S. (1999). Raising standards: Is ability grouping the answer? *Oxford Review of Education, 25*(3), 343-358.

Kendall, G., & Wickham, G. (1999). *Using Foucault's methods*. London: Sage Publications.

Ministry of Education, New Zealand. (1992). *Mathematics in the New Zealand Curriculum*. Wellington: Learning Media.

Ministry of Education, New Zealand. (1993). *The New Zealand Curriculum Framework*. Wellington, Learning Media.

Ministry of Education, New Zealand. (1994). *Beginning school mathematics: A guide to the resource.* Wellington: Learning Media.

Ministry of Education, New Zealand. (1996). Development Band Mathematics. Wellington: Learning Media.

Ministry of Education, New Zealand. (1997). Developing Mathematics Programmes. Wellington: Learning Media.

New Zealand Government (1998). Assessment for success in primary schools: Green paper. Wellington: Ministry of Education, May 1998.

Ministry of Education, New Zealand. (2003). *Numeracy professional development project* (Draft) Wellington: Learning Media.

Morgan,V. C. (2000). Better assessment in mathematics education?: A social perspective. In J. Boaler (Ed.), *Multiple perspectives on mathematics teaching and learning.* Westport, London: Ablex Publishing.

Swingewood, A. (2000). *A Short History of Sociological Thought*, (Third Edition). Hampshire: Macmillan Press.

Walkerdine, V. (1997) Difference, cognition and mathematics education. In A. Powell & M. Frankenstein, (Eds*.), Ethnomathematics: Challenging Eurocentrism in mathematics education* (pp. 201-214). New York: State University of New York Press.

Walkerdine, V. (1998). Counting girls out: Girls and mathematics. New Edition. London: Falmer Press

Walls, F. (2003). *Sociomathematical worlds: The social world of children's mathematical learning in the middle primary years.* Unpublished PhD Dissertation, Victoria University of Wellington, New Zealand.