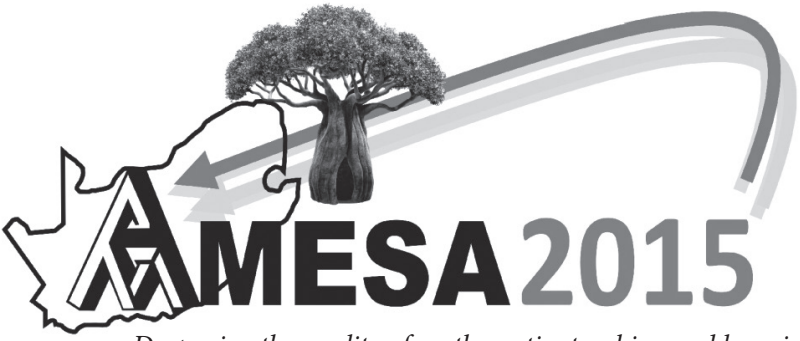

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ON THE SOCIOLOGY OF KNOWLEDGE AND ENSURING LEARNING FOR ALL IN SOUTH AFRICAN PRIMARY MATHS EDUCATION

Peter Pausigere
South African Numeracy Chair, Rhodes University

This paper focuses on South Africa's recent primary maths education curriculum restructuring in relation to the classification of knowledge. It discusses how the current educational changes at the primary level embody strongly classified maths knowledge. Sociologically, such knowledge orientations resonate with middle class learners. Analysing local primary maths policy documents and drawing from Bernstein's central thesis about the social class basis of education and using the concept of classification, the study explains how strongly classified intra-connected primary maths knowledge intends to provide access to specialised and powerful knowledge to children of different social classes.

INTRODUCTION

This article ocuses on the social class knowledge assumptions in the recently restructured South African primary maths education's Curriculum and Assessment Policy Statements (CAPS). It investigates the social class ideologies dominant in the local primary maths knowledge curriculum and explains how such class-based interests can be interrupted to enable learning for all children. Drawing from Bernstein's (1975, 1990, 2000) sociology of education theory and specifically from his central arguments about the social class nature of education and using the concept of *knowledge classification* the paper explains how middle class ideologies and interests are foregrounded in the local primary maths knowledge curriculum, as revealed in CAPS.

The study discusses possibilities for interrupting middle class cultural reproduction tendencies and thus enables increased knowledge access to working class learners in South African primary maths classes. Whilst generally social class inequalities have been reported in South African primary maths education (Fleisch, 2008; Hoadley; 2007), evidence from the 2012 to 2014 Annual National Assessment (ANA) results and their analysis in relation to social class (poverty quintile) indicates that 40% of the learners in fee-paying middle class schools achieve considerably better marks than 60% of the disadvantaged learners in public schools (DBE, 2012; 2013; 2014). Large scale national research from the 2001 and 2008 Department of Education systemic evaluations, findings from TIMSS 1999 and 2003, the OECD education policy review and the National Planning Commission diagnostic overview cite educational inequality as a critical issue (Graven, 2014). Official statistics also confirm that two thirds of local children live in poverty stricken households, with South Africa having been noted as one of the countries with the highest and extreme levels of social and economic

inequalities in the World for so long (Spreen and Valley, 2014; Graven, 2014). Thus marginal groups' learners (lower ability students and working-class children) are given differential access to knowledge and are ironically regarded as 'failed mathematicians' (Muller and Taylor, 2000 in Hoadley, 2007, p. 682). This evidence prompts this study to investigate how local primary maths knowledge may be offering unequal chances of success for children of different social classes. Thus this study interrogates two key research questions:

What are the social class assumptions in the South African primary maths knowledge curriculum?

How can these dominant social class group knowledge ideologies be revoked in formal education experiences?

These two research questions and the educational knowledge code category of *knowledge classification* and how it relates to social class help structure the analysis and ensuing discussion in this paper. Informed by Bernstein's sociological theoretical perspective, policy document analysis and key primary maths education literature the study explains how strongly classified and connected primary maths knowledge ensures access to powerful and specialised forms of knowledge for children from different social class groups.

THEORETICAL FRAMEWORK: THE SOCIOLOGY OF KNOWLEDGE

This study draws on Bernstein's (1975, 1990, 2000) theory about the sociological nature of knowledge, which analyses how middle class culture and ideologies are reproduced through education. Bernstein's concept of classification will be used to interrogate and understand knowledge structures and the social class assumptions within the South African primary maths education as revealed in curriculum policy documents. Elsewhere I have (Pausigere and Graven, 2013) examined official teacher identities promoted in curriculum documents using a Bernsteinian lens. Bernstein's (1990, 2000) structuralists approach postulate that school knowledge and official pedagogic practices privileges middle class interests and ideologies, which marginalises working class children. The argument that curriculum has a middle class social base and origin is also noted in education literature (Maton and Muller, 2006; Spreen and Vally, 2014; Cooper and Dunne, 1998) and is illustrated locally in Hoadley's (2007) primary maths education empirical study. It is important to explain Bernstein's concept of classification as this will help illuminate how middle class socialisation articulates and relates with school knowledge.

The classification of knowledge

Classification refers to the relationship between subject categories or contents (Bernstein, 2000). With strong classification, areas of knowledge and subject contents are well insulated into traditional subjects and this gives rise to a collection code (Bernstein, 1975). Weak classification refers to an integrated curriculum with blurred boundaries or reduced insulation between contents (Bernstein, 1975). According to Bernstein, integrated codes had a stronger ideological life in the late 60s and early 70s in Great Britain with collection codes prevalent in Britain before the 1960s. Locally an integrated code was evident in the 1997 Outcomes Based Education curriculum reforms, with the recent educational changes indicating strong classification of collection codes.

Besides the relations between subject contents, another key aspect of classification is the strength of the boundary between educational and everyday knowledge. Thus in his later work Bernstein (2000) distinguished between horizontal (everyday knowledge) and vertical (school knowledge) discourses, with the latter consisting of specialised symbolic structures of explicit knowledge. Such content derives from the parent discipline and its internal determinative logic. Furthermore and importantly for this study school discourse has a 'verticality dimension' which is characterised by hierarchical integration and subsumption of knowledge (Bernstein, 2000; Maton and Muller, 2006; Muller, 2007). The hierarchical integrative aspect of educational knowledge enables greater combinatorial power within knowledge forms (Muller, 2007). As the subject of maths is within the modalities of horizontal knowledge structures of vertical discourses the study will explain how hierarchical intra-subject connections can benefit primary maths education and the equality cause. Some of the most influential primary maths studies have pointed that connected primary maths concepts and knowledge supports conceptual understanding (Kilpatrick et al, 2001) and enables learners to be numerate (Askew et al, 1997).

The sociology of knowledge classification

Both strong and weak classification respectively carries old middle and new middle[20] class knowledge-orientation perspectives (Bernstein, 1975). The middle class

[20] The new middle class consists of people who work in the service provision industry such as teachers, police officers, nurses, lawyers etc. and old middle class is made of employees who work in the production and distribution of goods and services for example retail proprietors, business managers, commercial farmers, technicians. The working class is made up of skilled and unskilled manual workers such as farm labourers, miners, fishery workers, shop floor workers, bricklayers, security guards,

sociological account of knowledge is important for this study and how working class children can access primary maths knowledge. However the middle class schooling narrative has resulted in one of the oldest education dilemmas for the working class learners. They are sentiments that weak classification legitimatise the inclusion of the working class culture at school and provides opportunities for knowledge acquisition (Bernstein, 1975; 2000). Furthermore weak knowledge classification aligns with both the progressive agenda aimed at empowering learners and education's social justice imperatives (Hoadley, 2007; Spreen and Vally, 2014).

However weakly classified knowledge might lead to the perpetuation of inequalities through limited access to specialised and powerful forms of knowledge (Bernstein, 2000; Hoadley, 2007; Muller and Maton, 2006; Muller, 2007). Worse still weakly classified knowledge creates contextual and 'orientation to meaning' ambiguities which lead marginal classes' children to *misrecognise* school knowledge (Hoadley, 2007, p. 680; Bernstein, 2000). The need for higher order cognitive competences is found in the working class parents' preferences for strong classification of the 'visible pedagogy of the collection code at the primary level' (Bernstein, 1975, p. 127). Taking note of the sociological theoretical perspectives and empirical research in primary maths and science the study will argue that strong classified and intra-connected primary maths knowledge provides epistemological access for *all* learners.

RESEARCH METHODOLOGY

The research methodology used in this study is educational policy sociology research. This methodological approach has its roots and origins in policy document analysis and the modern sociology of education (Ball, 1997). This study thus analyses South African primary maths policy documents using Bernstein sociological framework. The key local primary maths education policy documents analysed in these study are the CAPS' Foundation and Intermediate phases' primary maths subject guidelines, the Foundations for learning campaign and ANA reports. Curriculum policy documents reveal the officially valued 'knowledge and skills' which embed national ideologies and social class assumptions. As Bernstein's work generally focuses on the social class nature of education it provides the study with conceptual, descriptive and analytical tools to examine the interrelationship between social class and primary maths knowledge in the South African education policy context.

The analysis, synthesise and presentation of information obtained from policy documents was theory-driven and informed by the research questions. The coding and

domestic workers etc.

exploration of primary maths education policy documents data was guided by Bernstein's theoretical perspective about the sociology of knowledge and the classification concept. Thus the two research questions underpinning this study and the sociologically reinterpreted primary maths policy documents help structure the analysis and ensuing discussion in this paper.

DISCUSSION

The Sociology Of South African Primary Maths Knowledge

This section of the paper discusses the research findings of this study interpreted through Bernstein's thesis about the social class nature of knowledge and his key concept of classification. Thus in the purview of the research questions, sociological theoretical underpinnings and pertinent literature I explain how the recent CAPS curriculum changes at the primary level are orientated towards strongly classified primary maths knowledge which has a middle class social origin. The ensuing discussion argues for strongly classified and intra-connected primary maths knowledge which provides access to disciplinary knowledge and enhances conceptual understanding to learners of different social classes.

The South African primary maths' knowledge strong classification sociological assumptions

South Africa's primary maths policies emphasise the need for the acquisition of key mathematics conceptual knowledge. Across foundation and intermediate phases the local primary maths consists of the key content area of numbers; geometry (space and shape); functions, patterns and algebra; measurement and statistics (DBE, 2011a; DBE, 2011b). These five content areas relate with some of the key branches of mathematics, for example arithmetics (number theory), geometry and algebra and sub-divisions within the mathematics discipline such as measure theory and statistics. It has been theoretically noted that content-rich subjects within horizontal knowledge structures (maths, science, logic, and physics) derive their contents from the parent discipline (Bernstein, 2000; Muller, 2007). Similarly the recontextualised South African primary school maths derives its elementary-level refocused contents from the disciplines and sub-disciplines of mathematics. Recontextualising from a horizontal knowledge structure parent discipline of the strongest grammars serves to indicate the strong classification within the local primary maths knowledge. The old middle class prefers strong classification for it was 'domesticated through strong classification…of the family and public schools' and this leads to 'cultural reproduction' (Bernstein, 1975, p.121). Thus the key contents of the local primary maths indicate strong classification

which has been sociologically explained as embedding middle class ideological interests.

Strong classification is also indicated in the policy documents specification of the mathematical competences to be acquired from each content area. The acquisition of key foundational mathematical skills is highly prioritised in the recently introduced primary maths education policies. The main content area of 'numbers, operations and relations' which makes 60% and 50% of the foundation- and intermediate-phase mathematics content ensures that learners are *'numerate'* and thus acquire '*secure number sense and operational fluency*' (DBE, 2011, p. 8; DBE, 2012; DBE, 2013). Mental mathematics is also highlighted as promoting the *development of number sense and number concepts* through it's emphasise on 'number bonds and multiplication table facts' (DBE, 2011a: 8; DBE, 2012; DBE, 2013; DOE, 2008). The content areas of data handling (statistics) and measurement provide contextualised opportunities for the *use, understanding and development of numbers* (DBE, 2011a; DBE, 2011b). The local primary mathematics curriculum documents, also ensures that learners engage in problem-solving activities, thereby enabling for the *understanding of higher order mathematical concepts* (DBE, 2011a; DBE, 2011b). The content areas of geometry and algebra are noted as essential for providing a foundation for *spatial understanding* and *developing formal algebraic work* (DBE, 2011a; DBE, 2011b). The South African primary mathematics education broadly focuses on improving the learners' number sense, operational fluency and the development and understanding of numbers and higher order mathematical concepts. The development of such fundamental mathematical skills have been identified in influential and international primary mathematics studies as being central for developing learners' mathematical proficiency (Kilpatrick et al, 2001; Askew et al, 1997). Furthermore the local primary maths documents highlight the importance of geometry and algebra which help in laying the basic skills for understanding proofs, abstract mathematical concepts and formalised algebra in secondary school. Theoretically an orientation to key critical concepts and skills of primary school mathematics results in learners to attain and acquire 'states of knowledge' (Bernstein, 1975, p. 92). Such a focus upon the basic and fundamental skills of primary school mathematics results in strong classification. From a knowledge social-class base perspective the higher status skills codes modality favours the dominant class with poor working class learners experiencing difficulties in recognising such key concepts (Maton and Muller, 2007). Similarly the mathematical competences and skills emphasised in local primary maths classes represent the ideological experiences of the middle class families.

The conceptual progression within the South African primary maths curriculum also shows strong knowledge classification (Pausigere and Graven, 2013). The

foregrounded core primary maths content and highlighted key mathematical skills have marked progression across the primary grades. This conceptual progression is divorced from relational ideas, everyday knowledge or the notion of relevance characterising integrated codes of weak classification. Thus number ranges increases, the introduction of different kind of numbers and the need to develop more efficient calculation strategies underpins the disciplinary progression in the main content area (DBE, 2011a; 2011b). The sequential conceptual development in algebra occurs 'in the range and complexity of relationships between numbers in the patterns' across the phases (DBE, 2011a, p. 18; DBE, 2011b). In the space and shape content area knowledge progression is achieved by focusing on new properties and features of shapes and objects, incrementally within grades. Conceptual development in the area of measurement is achieved through the introduction of new forms of measuring and new measuring units across the grades. Progression in data handling across the primary grades is attained by working with new forms of and new analytical tools for representing and reporting data (DBE, 2011a; 2011b). Knowledge progression in the primary level is underpinned by the key mathematics content areas and foregrounds the critical numeracy skills. It has been noted that conceptual progression in collection codes proceeds from surface to deep knowledge structures (Bernstein, 1975), in fact '"true" knowledge is characterised by knowledge progression' (Muller, 2007, p.70). Locally this is revealed in the sequential development of disciplinary content and skills in primary maths education subject guidelines. Such marked sequential knowledge progression is characteristic of strong classification which leaves 'the elite having access to the deep structures' of knowledge, thus 'access to realising of new realities' (Bernstein, 1975, p. 92). The conceptual progression within the local primary maths curriculum shows strong knowledge classification whose assumptions resonate with the middle class.

South Africa's primary maths policies emphasise on key mathematics conceptual knowledge, the acquisition of critical numeracy skills underpinned by sequential conceptual development and progression reflect strong knowledge classification. Sociologically this strong classification and structuring of local primary maths knowledge embed middle class assumptions. The next and final part of the paper answers the second research question and in the process explains how strongly classified intra-connected primary maths knowledge provides access to disciplinary knowledge and enhances conceptual understanding to children of different social classes.

Primary maths' knowledge that provides access to children of different social classes – strong classification

Besides having a middle class bias, strong classified knowledge is still the sine quo non for the South African primary maths equality cause. As local primary maths policies foregrounds key mathematical conceptual knowledge and critical numeracy skills – the transmission of 'basic competences' of the 'collection code at the primary level' are preferred by working class parents for that is the core, 'impersonal' and intellectual function of schools (Bernstein, 1975, p. 127-128). Sociologists of education disdain relegating subordinate social groups to lower status forms of educational knowledge, as these perpetuate social class inequalities and creates contextual and orientation to meaning ambiguities which lead working class children not to *recognise* horizontal knowledge structures (Maton and Muller, 2006; Bernstein, 2000; Hoadley, 2007). Thus there has been consensus that strongly classified vertical discourses provide epistemological access to 'powerful' and 'specialised' forms of knowledge to poor children (Muller, 2007, p. 80; Bernstein, 2000, p. 157). The need for exposing working class children to 'specialised knowledge of (primary) mathematics' is also illustrated in Hoadley's (2007, p. 702) empirical study. Similarly this study argues that the strong classification evident in the emphasis on key primary mathematical competences marked by sequential progression provides knowledge access to children of all social classes in South Africa. However the strong classification requirement only, is not enough – it's one part of the effort to redress knowledge social class inequalities.

Intra-connected primary maths knowledge

The argument for the need for intra-connected primary maths knowledge emanates from sociological knowledge perspectives (Bernstein, 2000; Maton and Muller, 2006; Muller, 2007), empirical research in primary maths (Askew et al, 1997; Kilpatrick et al, 2001) and primary science studies (Morais, Neves and Pires, 2004). The lack of emphasises on illustrations of connections between different mathematical ideas in local primary maths subject guidelines also instigated the need to explore such opportunities. Drawing from these studies and policy document analysis the paper explains the case for connected mathematical concepts for providing knowledge access for all learners.

Sociological the conceptual integration of knowledge within horizontal knowledge structures is called 'verticality' (Muller, 2007). The principle of verticality explores 'relations within knowledge forms' and focuses on the development of knowledge structures through 'the integration and subsumption of knowledge into more overarching… propositions' (Muller, 2007, p. 70; Maton and Muller, 2006, p. 25). Bernstein (2000, p. 161) clarifies that such integration is at the 'level of meanings' and not between 'segments or contexts as in horizontal discourse'. For illustrative purposes

I relate the proposition about the integrative nature of knowledge to one of the disciplines of mathematics. For example the area of arithmetics is made up of the following sub disciplines; numbers, the four basic arithmetic operations, decimal arithmetics, compound unit arithmetics and elementary statistics. These different categories of arithmetics show connections and relations within number theory. Thus these sub-branches are integrated and subsumed in the more overarching and generalising mathematical discipline of arithmetics. This relates to what was stated by Bernstein (2000) that integration within domains is at the level of meaning and procedures-hierarchically rather than segmental or contextual connections. Such within discipline connections are a key aspect of the structure and growth of horizontal knowledge structures.

Similarly the importance of primary maths connections in enabling conceptual understanding and supporting learners in being numerate is noted in the two most influential studies in primary maths education (Kilpatrick et al, 2001; Askew et al, 1997). The significance of linking mathematical concepts and ideas is also reiterated in a local primary maths study (Askew, Hamsa and Matthews, 2012). However these studies do not explain how primary maths conceptual connections enable successful learning and understanding for children from different social classes. The importance of conceptual connection in enhancing social class equality is similarly noted in primary maths science studies (Morais, Neves and Pires, 2004). Based on longitudinal empirical research in primary maths sciences, Morais et al (2004) posits that strong inter-disciplinary connections overcome the effect of children's social background. With both maths and science being regarded as horizontal knowledge structures with strongest grammars, I believe their knowledge structure similarities provide opportunities for this study to argue that intra-disciplinary primary maths connection can enable learning for all children.

Locally such connections can be promoted, for example, between natural numbers, integers, fractions, decimal, place value and problem solving; in the four mathematical operations of addition and subtraction, multiplication and division; or between the mathematical concepts of angles, fractions, percentages, ratios and pie charts illustrations. Within discipline connections expand and extend knowledge 'repertoires' and 'reservoirs' of working class children giving them the ability to 'gaze' and 'recognise' alternatives within the overarching knowledge principle (Bernstein, 2000). It broadens knowledge options from which learners can choose familiar alternatives to understand key concepts. The South Africa primary maths curriculum policy guidelines must make clear conceptual connections as has been the case in Britain's primary education – and this can provide epistemological lens for a range of alternatives for disadvantaged learners as well as a source for generating and promoting 'coherent' maths lessons (Askew et al, 2012).

Whilst having argued for the need for strongly classified intra-connected primary knowledge in local primary maths classes, the most important factor in enabling successful learning for children from different social background are competent teachers (Morais et al, 2004; Muller, 2007). It is the acumen of knowledgeable practitioners who can provide access and induct learners to strongly classified and intra-disciplinary connected primary maths knowledge. Such epistemological opportunities ensure learners' conceptual understanding and mathematical proficiency to children from different social classes and most importantly it exposes them to powerful and specialised forms of knowledge.

CONCLUSION

Whilst this paper has focused on the social class base of local primary maths *knowledge*, further research should explore the social class assumptions within local primary maths *pedagogic practices*. There is also need for empirical research to show how strongly classified intra-connected primary maths knowledge overcomes the effect of children's social background. Whilst the strong classification in local primary maths education reflects the interests of the middle class – such knowledge orientations are not detrimental for the working class children and can interrupt education social class reproduction tendencies. Informed by sociological theoretical perspectives and relevant empirical research the study also calls for intra-connected primary maths knowledge to revoke middle class ideological interests, ensure knowledge access to working class learners and narrow inequalities in South African primary maths class. The opportunities for within-discipline connections must be encouraged and made explicit in the policy curriculum documents. The primary maths epistemological positions advocated herein (and their sociological reifications) are not applicable to literacy or life skills which have different knowledge structures. Finally the call for strongly classified intra-connected primary maths knowledge require competent teachers who themselves 'stand on the shoulders of giants' (Muller, 2007, p. 79) and can ensure the same for learners from different social groups, thus interrupting cultural reproduction.

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