Exploring academic achievement in mathematics and attitudes towards mathematics: The role of Bourdieu's elusive habitus.

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This paper reports on the quantitative part of my doctoral study carried out in three state-funded secondary schools in England. Using Bourdieu's trilogy of habitus, embodied cultural capital and field, I have explored the interaction of social class, gender, ethnicity and attitudes towards mathematics, and their impact on mathematical achievement. The findings suggest that although cultural capital correlates positively with mathematical achievement, social class and habitus, which has been operationalised as mathematics-related career aspirations, have a more significant impact on mathematical achievement.

Keywords: habitus, cultural capital, field, attitudes towards mathematics, achievement

Introduction

As a curriculum subject, mathematics has long been held in high regard and commands a high level of respect amongst academics, students, teachers and society. At the same time, and likely related to this, mathematics remains a source of trepidation for many students. There is much empirical research utilising Bourdieu's theory of taste and consumption which has been linked with 'cultural capital,' and the use of Bourdieu's ideas has had a profound impact on educational research (DiMaggoi, 1982; Lareau, 2003). Bourdieu's work draws on earlier work by Marx, Durkheim and Weber to overcome the binary problem of objectivism and constructivism, through the notion of "structuralist-constructivism or constructivist structuralism" (Bourdieu and Wacquant, 1992, p. 11).

Furthermore, scholarly interest in the relationship between students' attitudes towards mathematics and mathematical achievement has increased. Yet there is still relatively little research which attempts to explore the underlining complexities when dealing with attitudes towards mathematics using Bourdieu's conceptual tools, in particular his idea of habitus. This research paper provides results from my doctoral study which looks at the interaction of social class, gender, ethnicity and attitudes towards mathematics, and their impact on mathematical achievement in secondary schools in England. In this paper, I will draw on Bourdieu's social field theory as construct and lens for this study to explore attitudes towards mathematics and mathematical achievement across three state secondary schools in England.

The primary research question explored in the larger study, from which this paper derives, is: How do social class, gender and ethnicity affect attitudes towards mathematics and mathematical achievement in secondary schools in England? In addition, I will discuss the following specific secondary research questions which form part of the wider doctoral studies.

- To what extent do attitudes towards mathematics affect mathematical achievement within secondary education?

- How do perceived parents' attitudes towards mathematics and social class relate to students' attitudes towards mathematics?
- How do a student's cultural capital and habitus affect mathematical achievement?

I outline initial results from the quantitative element of the study. I begin by outlining my Bourdieusian theoretical framework. Then I describe my methodology before showing how habitus emerged as a key concept in understanding the relationship between attitudes and achievement in mathematics.

Operationalising Bourdieu's ideas: habitus, field and capitals

Bourdieu's major concept of 'habitus' is central to his theory of practice. Habitus is defined as:

> a system of durable, transposable dispositions, structured structures predisposed to function as structuring structures, that is, as principles which generate and organize practices and representations that can be objectively adapted to their outcomes without presupposing a conscious aiming at ends or an express mastery of the operations necessary in order to attain them (Bourdieu, 1990, p. 53).

Without habitus, the concept of capital and field will have no meaning (Bourdieu, 1977). The workings of habitus allow capital (resources) and field (structure) to be linked to practice (agency) (Reay, 2004). Similarly, "capital does not exist and function except in relation to field" (Bourdieu and Wacquant, 1992, p. 101). Students develop habitus through their earlier years of socialisation where they internalise external structures. The socialisation of external structures leads to the reproduction of stratification.

Habitus represents a disposition of a particular social group and it is expressed through ways of "standing, speaking, walking, and thereby feeling and thinking" (Bourdieu, 1990b, p. 70). One of the key aspects of habitus is that it is embodied and hence "it is an active subject confronting society as if society were an object constituted externally" (Bourdieu, 1990b, p. 190). Habitus is therefore "socially inscribed in the body of the biological individual" (Bourdieu, 1985, p. 113).

Habitus differs between and within social groups in that "the details of individuals' social trajectories diverge from one another" (Bourdieu, 1993, p. 46). In effect, no two individual habituses are the same. At best habitus can be seen as a continuum and a "product of social conditioning" (Bourdieu, 1990b, p. 116). In past survey research, habitus has been operationalized as future students' aspirations (Dumais, 2002; McClelland, 1990) and sense of value and belief in their abilities (Horvat & Davis, 2011). I have used this approach with specific focus on mathematics because habitus is a system of dispositional schemes which cannot be observed directly.

Nevertheless, the inherent difficulties in attempting to measure the concept of habitus presents a challenge. But "one component of habitus is one's belief about the future" (Dumais, 2002, p. 51) which is socially constituted to influence "thought, perception, experience and actions" (Bourdieu, 1990, p. 55). McClelland argues that habitus "represents the past as well as the present" (McClelland, 1990, p. 104). The past means parents' experiences as well as students' own earlier experiences of mathematics, which would shape their disposition towards the subject and therefore their achievement in mathematics.

Cultural capital research has also raised the difficulties of its empirical measurement. There are two main approaches that researchers have used in the measurement of cultural capital. The first approach is the method outlined by Bourdieu, in his focus on 'high culture', such as, visits to museums, classical music, concerts and art classes (DiMaggio, 1982; Dumais, 2002) This approach has been regarded by other researchers as very narrow and therefore these indicators have been expanded to include reading habits (Sullivan, 2001), educational resources at home (Teachman, 1987) and a variety of extra-curricular activities (Lareau, 2003).

Lamont and Lareau (1988, p. 156) define cultural capital as "institutionalised, widely shared, high status cultural signals (attitudes, preferences, formal knowledge, behaviours, goods and credentials) used for social and cultural exclusion". Literature points to the fact that middle-class families, who possess valuable capital (economic, social and cultural), have several advantages that they can use to secure possible prospects for their children (Ball, 2003).Sullivan (2001) found that parental cultural capital was strongly associated with parental social class and students' cultural capital. In addition, social class has remained a significant predictor of students' GCSE grades. Equally important is the evidence from many studies that cultural capital participation in arts has an impact on educational outcomes.

A field is defined as "a network, or configuration, of objective relationships between positions … we can with caution, compare a field to a game… it follows rules or regularities that are not explicit or codified" (Bourdieu, 1997, p. 98). In this study, mathematics education is the field, with students, parents and teachers as actors who occupy different social positions and are in search of and possession of different forms of capital.

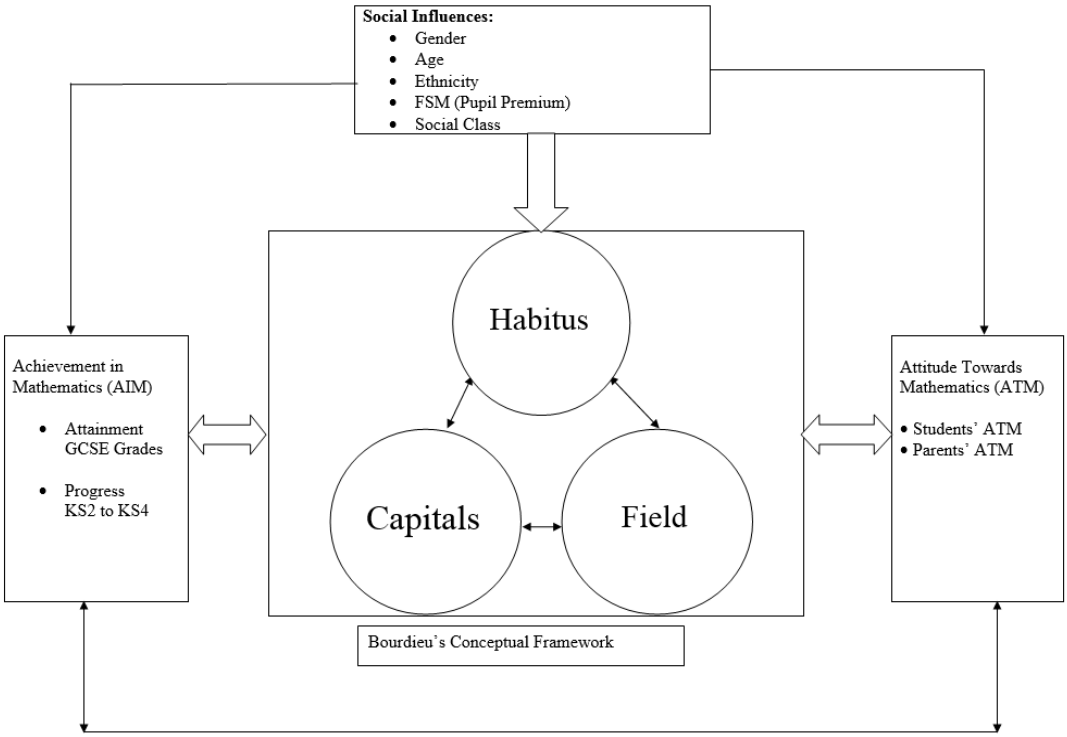

Figure 1: Conceptual Map for the Research

Figure 1 above shows how I have employed Bourdieu's influential tools in my conceptual map for this study. The interplay of social factors such as ethnicity, social class and gender with attitudes towards mathematics and mathematical achievement

will be explored using Bourdieu's conceptual tools of habitus, cultural capital and field. It is important to point out what Bourdieu asserts as the interconnection between habitus, capital and field as "(Habitus × Capital) + Field = Practice" (Bourdieu, 1984, p. 101).

Methodology

There has been a rise in the number of educational researchers who utilise mixed-method designs over the past two decades (Creswell, 2009). The popularity of mixed-methods can be credited to writers such as John Cresswell, Abbas Tashakkori, Anthony Onwuegbuzie and Charles Teddlie. They advocate mixed-methods because they allow them to challenge the dichotomies and philosophical standpoints which assert that qualitative and quantitative methods are incompatible (Hartas, 2010). They also allow researchers to integrate their findings and draw inferences which broaden the dimension of the research as well as providing a fuller picture of human experience and behaviour (Tashakkori & Creswell, 2007). My own mixed-methods doctoral study is being conducted across three comprehensive secondary schools in England with contrasting achievement data. These schools have Ofsted (Office for Standards in Education, Children's Services and Skills) ratings of 'Outstanding', 'Good' and 'Requires improvement' respectively. The pseudonyms for the three schools are Newton Academy in Middlesex, Obama School in Oxford and Ohms College in London.

I collected primary data using a survey instrument from 1106 students in Years 10 and 11. The survey consisted of 85 items which included five attitudinal subscales (enjoyment, value of mathematics, motivation, self-confidence and parents' attitudes towards mathematics), and cultural capital and habitus scales. The students' attitudes towards mathematics scale consists of four subscales adopted from Tapia (2002); the attitudes mathematics inventory and the parents' attitudes scale were adopted from the Fennema-Sherman Mathematics Attitudes Scale (Fennema and Sherman, 1976). In addition, I constructed habitus (aspirations to a career in mathematics) and cultural capital variables for the survey. I have also expanded the indicators of cultural capital to include use of social media sites, watching sports, playing sports and borrowing books from the library. Students responded on a five point Likert scale of strongly agree = 1, disagree = 2, neutral = 3, agree = 4 and strongly disagree = 5. However, on the habitus scale, students were provided with a list of eleven careers to choose from by using the following responses. Yes = 3, Maybe = 2 and No = 1. On each scale, the responses were added together to represent the corresponding attitude score, cultural capital and habitus indices.

Mathematics teachers often observe students' dispositions towards mathematics which can be captured using a valid and reliable scale such as the Likert scale for attitude measurements. The scales were tested by Tapia and Marsh (2002), who reported a Cronbach alpha of 0.89, and the reliability test that I carried out for this instrument showed the Cronbach alpha reliabilities for the sub-scales as follows: Enjoyment (0.909), value of mathematics (0.926), motivation (0.731), self-confidence (0.918), parents' attitudes towards mathematics (0.833) and overall attitude students' attitudes towards mathematics (0.86). Furthermore, qualitative data were collected through semi-structured in-depth interviews with 24 students who were selected using purposive sampling. This report only focusses on the quantitative data collected in November 2013 and analysed in SPSS for both descriptive and inferential statistics.

Results and Discussion

The first question investigated concerned the extent to which attitudes towards mathematics affect mathematical achievement in secondary education. I found that students in the 'outstanding' school had positive attitudes when compared with the two other schools. Analysis of data using ANOVA showed that there is a statistically significant difference at the $p<0.05$ level (the effect size measured by the Eta square is 0.01 and [$F(2, 1075) = 5.34$, $p = 0.005$]). By using hierarchical regression analysis, the R-squared value accounted for 3.8% of the variance in mathematical achievement when controlling for social class, gender and ethnicity. As the 'attitudes towards mathematics variable' was added to the model, the variance increased to 6.9%. This implied that students' attitudes towards mathematics account for an additional 3.1% variance in students' progress from Key Stage 2 (aged 11) to 4 (aged 16) and 3.5% for attainment in the GCSE public examinations taken at 15+. The correlation matrix shows a positive correlation between students' attitudes towards mathematics and mathematical achievement was statistically significant at 0.096 ($p<0.01$) and this supports the view that "attitudinal variables are significant indicators of mathematical achievement" (Enemark and Wise, 1981, p. 22).

Secondly, using the correlation matrices, I found that the correlation between perceived parents' attitudes towards mathematics and students' attitudes towards mathematics is 0.60 ($p<0.01$). This indicates that parents' attitudes help to explain 36% of the shared variance in students' attitudes towards mathematics scores. Social class makes a significant and unique contribution to mathematical achievement (with beta value of 0.709, $p<0.001$ when the overlapping effects of all other variables are removed). This confirms Bourdieu's model of social reproduction because students from middle-class families have a more positive disposition towards mathematics. It suggests that middle-class students benefit from cultural transmission from their parents, for educational success.

Finally, I used hierarchical multiple regression when controlling for social class, gender and ethnicity, cultural capital accounted for 4.5% of the variance in mathematical achievement. However, Mathematical Attainment correlates positively with cultural capital at 0.096 ($p<0.01$). The result is consistent with earlier studies by Dumais (2002) and DiMaggio (1982) who reported that cultural capital is positively associated with academic results. The beta coefficients show that social class makes a significant contribution to mathematics achievement at 0.71 ($p<0.005$) compared to cultural capital at 0.05 beta value. However, when habitus, which is operationalised as students' mathematics-related career aspirations, is added to the model after cultural capital, it showed a 2.3% increase of variance in GCSE achievement. Habitus showed statistically significant effect on achievement at a beta value of 0.134 ($p<0.001$).

This research did not confirm the view that cultural capital has an impact on educational attainment as reported by De Graaf et al. (2000) and Teachman (1987), but rather supports Dumais' (2002) claim that the impact of cultural capital on achievement is limited. Thus, the elusive habitus and social class have a greater impact on students' mathematical achievement. The use of habitus in this research can help us to understand how the constellation of perceptions which frame students' attitudes towards mathematics is mixed with cultural capital to impact on mathematical achievement. It is worth noting that although the use of habitus is not all encompassing here, the complete study will address the mediating effect of institutional habitus (the set of dispositions associated with an institution such as a school) and the mechanism by which specific cultural capital activities are used by students to secure mathematical achievement.

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