The relationship between implicit theories of intelligence, attainment, and socio-demographic factors in a UK sample of primary school children

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Abstract

Research emerging from the United States suggests that holding an incremental theory of intelligence (Growth Mindset) has a positive impact on academic success. However, limited empirical work has explored this relationship in a UK sample, and there has been a lack of research into the antecedents which might influence the development of certain intelligence beliefs. This study aimed to explore these gaps in existing literature. Data was collected from 710 nine-year-old pupils (UK Year 5). Participants completed attainment tests in Maths and English, and a questionnaire to assess their implicit theories of intelligence (Mindset). Socio-demographic information, including gender, ethnicity, Free School Meal status and Special Educational Needs status was also collected. Results showed that pupils eligible for Free School Meals or Special Educational Needs endorsed more of an entity theory of intelligence than pupils not eligible for either. Analysis of the whole sample showed that attainment significantly correlated with implicit theories of intelligence, however, this relationship did not exist for children with Free School Meal status or Special Educational Needs. These findings help to elucidate the relationship between implicit theories of intelligence and attainment in the UK, but also suggest the importance of external support in potentially facilitating pupils' belief systems. Results are discussed in relation to avenues for targeted intervention.

1. Introduction

Traditionally, research in education has focused on individuals' intellectual strengths and cognitive abilities ('hard' skills) as the key correlates to academic success. However, non-cognitive skills are increasingly considered to play an important role in determining academic outcomes (see Gutman & Schoon, 2013 for a review). As a result, there has been growing attention from researchers and policymakers alike to understand how to develop non-cognitive skills. It seems appropriate that individual differences such as persistence, motivation, and self-discipline appear to influence academic success, however what is less clear, is where such attributes stem from. One plausible explanation which has gained considerable attention over the past three decades comes from the work of Dweck and colleagues (e.g. Dweck, 1986, 2000; Dweck & Leggett, 1988) who suggest that it is not the ability or belief in ability (self-efficacy) that predicts the resilience or perseverance of learners, but an individual's belief about the nature of ability. These beliefs are known as implicit theories – or *Mindsets.*

According to Dweck's socio-cognitive model (e.g. Dweck, 2000; Dweck & Leggett, 1988), there are two distinct sets of beliefs that individuals hold regarding the malleability of personal traits and characteristics. In the case of intelligence, individuals who believe that success is based on a fixed, innate trait which remains relatively stable throughout the lifetime are said to have an entity theory of intelligence (or Fixed Mindset). Whereas, individuals who believe that intelligence is malleable and can be developed are said to hold an incremental theory of intelligence (or Growth Mindset), placing emphasis instead on learning and effort.

Research emerging from the United States (US) suggests that holding an incremental theory of intelligence has a positive impact on academic success (e.g. Aronson, Fried & Good, 2002; Blackwell, Trzesniewski & Dweck, 2007; Costa & Faria, 2018; Claro, Paunesku & Dweck, 2016; Dweck, 2017; Good, Aronson & Inzlicht, 2003; Romero, Master, Paunesku, Dweck & Gross, 2014; For a recent literature review, see Zhang, Kuusisto & Tirri, 2017). This relationship between academic success and implicit theories of intelligence (IToI) is thought to be driven by the resulting frameworks created by the two different beliefs, which in turn influence individuals' responses, values, and approaches to learning (Dweck, 2000). Incremental theorists are said to hold 'learning goals' in achievement situations which help to create mastery-oriented responses (Dweck & Elliot, 1983; Elliott & Dweck, 1988). With these goals in mind, an individual's aim is to increase their competence by developing effective learning strategies in learning, and embracing challenges that stretch their skills. Entity theorists however, are thought to place more importance on 'performance goals' which measure ability, with a focus on receiving positive evaluations of competence and avoiding negative ones. As a result, these individuals tend to avoid challenges which may risk the need to re-evaluate their assessment of their own ability. In holding the belief that intelligence is unchangeable, entity theorists tend to adopt a helpless response following failure (e.g. Da Fonesca et al., 2009; Dweck & Leggett, 1988).

Despite convincing evidence produced by Dweck and colleagues highlighting the important role of IToI in academic success, the majority of work looking at this relationship has been carried out outside of the UK, raising the question of the generalisability of these research findings cross-culturally. Furthermore, as highlighted in a recent (but yet unpublished) paper by Li and Bates (2017), limited independent replication of this relationship has been found where attempted. Therefore, a primary aim of this study was to examine whether the same relationship between IToI and attainment is reflected in a UK population of primary school children.

If IToI are related to attainment, it is important to explore how the distinct sets of beliefs and behaviours develop. Thus far, there has been a lack of investigation into the antecedents of an incremental framework, with existing research tending to focus on the role of praise. Dweck and colleagues propose that the messages communicated in the language that children hear have an important influence on their beliefs surrounding the malleability of traits (e.g. Gunderson, et al., 2013). Evidence from laboratory studies suggests that receiving process- praise for effort and action

(e.g. "you worked hard") encourages more mastery-oriented behaviours, whereas person- praise (e.g. "you are clever") is associated with more helpless responses (Cimpian, Arce, Markman & Dweck, 2007; Mueller & Dweck, 1998; Zentall & Morris, 2010). Beyond this work on praise, little research has explored other factors that may be related to intelligence beliefs; if subgroups of children are potentially more vulnerable to adopting such entity beliefs and associated helpless attitudes and behaviours, then this may suggest an avenue for targeted intervention. Therefore, the second aim of this study was to examine the relationship between attainment, IToI, and demographic factors, such as socio-economic status (SES), ethnicity, gender, and special educational needs (SEN). This paper aims to explore each of these factors as a potential predictor of the intelligence beliefs that UK pupils hold.

National statistics on the impact of SES on educational success highlight the stark gap in attainment between disadvantaged and non-disadvantaged pupils. According to the Department for Education (DfE; Hill, 2014), between 2013 and 2014, 67.4% of disadvantaged pupils achieved the expected standard of Level 4 in English and Maths by the end of Key Stage 2, compared to 83.5% of all other pupils. This attainment gap appears to widen throughout the education system; by the end of Key Stage 4, only 36.5% of disadvantaged pupils reached the expected standard of 5 GCSEs (General Certificate of Secondary Education; A*-C; including English and Maths) compared to 64% of all other pupils. This is one of the widest achievement gaps in the world (Laws, 2013) and emphasises the need for research to focus on supporting UK schools in closing the gap.

For many years, the widely-accepted explanation for this attainment gap, and target for education policies, has related to the apparent 'Poverty of Aspiration' associated with high levels of deprivation. However, this assumption has been challenged, with the suggestion that education policies and strategies have been based on a false premise (Ashmore, 2009). In fact, a number of studies have found no effect of socio-economic status on aspirations (Archer et al., 2013; Sinclair, McKendrick & Gill, 2010), suggesting that this assumption is an oversimplification. An alternative suggestion is to focus on expectations, not aspirations. That is, what individuals *expect* to achievement rather than what they *hope* to achieve. According to Goyette (2008), expectations are better predictors of attainment than educational aspirations, as hopes are not likely to incorporate any self-assessment of ability, whereas expectations might. Herein lies a potentially important link to IToI and highlights the need for further investigation. If pupils expect that they will not achieve educational success then this will in turn impact their beliefs, actions, and educational outcomes. Recent research (Claro, et al., 2016) examined the relationship between SES (family income), IToI and attainment for the first time, in a nationwide sample of high school pupils in Chile. They found that SES and IToI were strong (and comparable) predictors of academic achievement and that students from lower-income families were more likely to hold an entity theory of intelligence than students from higher-income families. Moreover, they found a significant interaction between family income and IToI in predicting academic achievement, indicating that being from a lower-income family exaggerates the negative effect of an entity theory of intelligence on academic achievement (or conversely, holding an incremental theory of intelligence may help reduce the negative effects of low SES on academic achievement).

In addition to SES, both gender and ethnicity are reported to impact pupils' educational success to varying degrees. In the US, compared to White and Asian students, African American students obtain lower grades and have higher dropout rates at practically every level of schooling, beyond that expected from SES (see Good, et al., 2003; Steele, 1997 for reviews on ethnicity-related attainment gaps). In the UK, it has been reported that the ethnicity attainment gap during compulsory education has narrowed over the last 10 years (Strand, 2015), but the gap is still present in higher education (e.g. Connor et al., 2004; Richardson, 2008). Equally, there remains an attainment gap between boys and girls in various school subjects (Easby, 2015). According to the DfE (2015), by the end of Key Stage 2, girls were generally outperforming boys in the UK, with 83% achieving the expected Level 4 in Reading, Writing, and Maths compared to 77% of boys. Girls are also more likely to reach Level 5 than boys in Reading (46% versus 38%) and Writing

(44% versus 29%), while more boys reached Level 5 in Maths (46% compared to 38% of girls). This differential pattern of performance appears to continue, influencing the subjects that pupils choose to study further (Department for Education and Skills, 2007).

Research aimed at exploring the factors underlying these attainment gaps have concluded that both sociological factors and cognitive processes may play a crucial role. Once again, these explanations point towards the role of expectations, with the suggestion that individuals may underachieve because they feel bounded by the expectations of others (e.g. teachers and parents; Jacobs & Eccles, 1992; Jencks & Phillips, 1998) and the prospect of confirming cultural stereotypes ("stereotype threat"; e.g. Aronson et al., 2002; Good et al., 2003). Thus, as implied by research such as Claro et al., certain groups of pupils may well be vulnerable to endorsing an entity framework but this has not been well established within existing literature. Exploring whether ethnicity and gender are related to the intelligence beliefs that pupils hold was therefore examined in this study.

In a recent review by the DfE (2015), SEN were reported to be the cause of the largest attainment gap recorded. Between 2012 and 2013, only 34% of pupils with SEN achieved the expected level in Reading, Writing, and Maths compared with 88% of pupils without any identified SEN (Simes, 2014). Debates surrounding the best way to support pupils with SEN to meet expected educational targets are rife. Warnock (2005) encapsulates these disagreements by highlighting the contradictions between 'categorising' pupils by 'fixed disability' (or 'labelling') and the need to offer provisions to meet the educational needs of individual children. In the context of the current study, the concept of labelling clearly relates to setting fixed expectations for individual children, both in terms of the expectations they hold for themselves and those held for them by others. To our knowledge, there has only been one study that has examined the relationship between SEN and IToI. Baird, Scott, Dearing and Hamill (2009) found that students with learning difficulties held significantly stronger entity theories of intelligence than students without learning difficulties. As a result, students with learning difficulties were also reported to have significantly lower self-efficacy, a greater preference for performance over learning goals, and were more likely to regard exerting effort as an indicator of reduced ability. Beyond this, there is a lack of research examining the relationship between IToI and SEN, and was therefore another focus of investigation in the current study.

1.1. The Current Study

The first aim of this study was to examine whether the previously reported relationship between attainment and IToI exists in a UK sample of primary school children. Our next goal was to investigate whether there are any demographic factors that might make some subgroups of children more vulnerable to endorsing an entity theory of intelligence. Of particular interest to the current study, and, on the basis of previous research and theory, it was predicted that FSM eligibility and SEN status would be associated with holding more of an entity theory of intelligence. Finally, we examined whether IToI might mediate the relationship between academic success (in English and Maths) and certain demographic factors.

2. Method

2.1. Participants

Data was collected from 710 Year 5 pupils (359 females) with a mean age of 9.93 years (SD_{Age} = 0.30 years; Min_{Age} = 9 years 1 month; Max_{Age} = 9 years 11 months). Pupils were recruited from 14 state-funded UK primary schools. The schools admitted pupils from catchments areas with a mixture of different socio-economic groups, and were representative of the typical and heterogeneous background of pupils in UK schools. Data was taken from the first time point of a larger, longitudinal study *[citation excluded for anonymity]*.

2.2. Measures

2.2.1. Demographic Information

Information regarding gender, first language, ethnicity, current Free School Meal (FSM) status, and SEN status were provided by the local city council. FSM status (FSM and no-FSM) was used as an indicator of SES; although it is not a perfect predictor for the true SES of a child, it is widely used as a proxy in UK educational research (Hobbs & Vignoles, 2007). SEN status, first language, and ethnicity were recoded into binary variables: SEN and no-SEN (including School Action, School Action Plus, and Statemented); English and Other (including all other reported first languages); and White British and Other (including all other ethnic origins) respectively.

2.2.2. Implicit Theories of Intelligence

Implicit theories of intelligence (IToI) were measured using three items from Dweck's (2000) Theories of Intelligence Scale. Although Dweck's original scale for children includes six items (three entity theory questions and three incremental theory questions), given the age of the sample and their involvement in a longitudinal study, Dweck (2000) recommends using the entity-only scale as these have been shown to be less compelling and thus less likely to suffer from social desirability and repetition effects (see Hong, Chiu, Dweck, Lin & Wan, 1999). The items are "You have a certain amount of intelligence and you really can't do much to change it"; "Your intelligence is something about you that you can't change very much"; and "You can learn new things, but you can't really change your basic intelligence."

Participants responded by showing their level of agreement with each item using a 6-point Likert scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). IToI scores were computed by combining scores from each of the three questions, with higher scores indicating more of an entity theory of intelligence. This measure has been found to have high internal reliability, with Cronbach's alpha values ranging from .94 to .98, and a test-retest reliability of .80 over a two week period (Dweck, Chiu & Hong, 1995). Within the current study, the Cronbach's alpha was lower (α = .65).

2.2.3. Maths and English Attainment

As a measure of English attainment, pupils' reading and writing ability was assessment using Progress in English 9 (for Key Stage Level 3 and 4; Kirkup, Reardon & Sainsbury, 2006). For this study, we used 3 out of the 4 exercises, focusing on pupils' spelling, grammar, and non-narrative reading comprehension. The maximum score that pupils could obtain was 28. Maths attainment was measured using Measuring Success in Maths: Year 5 (Lawson, 2008). This test is informed by past national tests and has been designed to assess National Curriculum Level 3 to Level 5 Maths. The test is scored out of a total of 75 and covers areas such as: counting, calculating, shapes, measurement, handling data, and understanding number facts.

2.3. Procedure

Participants were tested in class in their usual school environment. An experimenter read all of the Theory of Intelligence Scale items to participants twice. Participants were asked to rate their level of agreement with each item on a 6-point Likert scale ranging from 1 (strongly disagree) to 6 (strongly agree) for each item. Participants then completed the Progress in English assessment, followed by the Measuring Success in Maths assessment in accordance with the test instructions, without assistance. Participants were allowed 35 minutes to complete the English assessment and 30 minutes to complete the Maths assessment.

2.4. Data Analysis

Analyses proceeded as follows. Correlational analysis was used to investigate the relationship between IToI and attainment (in English and Maths) in this UK sample. The role of demographic factors was then examined, comparing IToI and attainment scores across the

following groups: FSM (FSM and no-FSM), SEN (SEN and no-SEN), language (English as a First Language and Other), and ethnicity (White British and Other). For demographic factors meeting the conditions of mediation (significant correlations with both attainment and IToI), analysis was carried out to explore whether pupils' IToI could explain (mediate) the relationship between demographic variable and attainment. To do so, we examined the indirect effects, reporting both the bias-corrected and accelerated bootstrap confidence intervals (BCa CI) and the Sobel test (Sobel, 1982) to understand the significance of this pathway. We report both here as, while Field (2018) recommends the use of confidence intervals, Dearing and Hamilton (2006) state that the Sobel test is best practice for examining mediation in large samples (i.e. N > 400). For a recent comparison of mediation models, see Rijnhart, Twisk, Chinapaw, de Boer and Heymans (2017), All analyses were carried out using IBM SPSS Statistics for Windows, Version 24.0 (Armonk, NY: IBM Corp).

3. Results

Mean scores for the whole sample, as well as for demographic sub-groups can be seen in Table 1.

Table 1. Mean scores and standard deviations of pupils' Maths attainment, English attainment and IToI

	Maths		English		IToI	
	N	M (SD)	N	M (SD)	N	M (SD)
Whole sample	695	14.10 (9.51)	702	16.73 (7.03)	688	11.10 (3.60)
Gender						
Male	351	15.11 (10.19)	354	15.64 (7.24)	346	11.09 (3.77)
Female	343	13.09 (8.66)	347	17.86 (6.64)	341	11.11 (3.43)
FSM						
Yes	117	10.31 (9.06)	120	13.37 (7.33)	118	12.47 (3.22)
No	528	15.05 (9.27)	532	17.68 (6.65)	523	10.74 (3.59)
SEN						
Yes	120	7.98 (7.22)	124	10.35 (6.88)	121	11.74 (3.38)
No	525	15.62 (9.27)	528	18.42 (6.06)	520	10.90 (3.62)
Ethnicity						
White British	525	13.99 (8.76)	541	16.91 (7.03)	531	11.13 (3.60)
Other	108	12.33 (8.60)	111	16.79 (6.75)	110	10.77 (3.49)
First Language						
English	577	14.54 (9.52)	585	16.91 (7.02)	575	11.12 (3.59)
Other	68	11.24 (7.85)	67	16.64 (6.71)	66	10.55 (3.54)

3.1. The relationship between attainment and IToI

Analyses revealed small but significant correlations between IToI and pupils' attainment. As expected, holding a stronger entity theory of intelligence was associated with worse performance in Maths, $r(678) = -.15$, $p < .001$ and English, $r(684) = -.19$, $p < .001$.

3.2. Comparison of attainment across demographic subgroups

The attainment of different subgroups of pupils were compared, and the directions of these effects were as would be expected (see Table 1). Specifically, pupils without FSM status performed significantly better than those with FSM status in both Maths, $t(643) = 5.03$, $p < .001$, $g = 0.51$ and English, $t(650) = 6.30$, $p < .001$, $g = 0.64$. Pupils with no identified SEN also outperformed pupils with SEN status in Maths, $t(218.49) = 9.88$, $p < .001$, $g = 0.86$ and English, $t(650) = 12.99$, $p < .001$, $g = 1.30$. Boys scored significantly higher than girls in Maths, $t(678.85) = 2.82$, $p = .005$, $g = 0.21$, while girls significantly outperformed boys in English, $t(695.88) = -4.22$. $p < .001$, $g = 0.32$. Finally, in Maths only, pupils with English as their first language performed significantly better than those with another first language, $t(643) = 2.76$ $p = .006$, $g = 0.35$. All non-significant group differences in Maths and English scores can be seen in Table 2.

Table 2. Non-significant differences in Maths, English and IToI scores across socio-demographic factors

	d.f.	t	p	g
Maths scores				
Ethnicity	643	1.38	0.167	0.14
English scores				
Ethnicity	650	0.16	0.877	0.02
First Language	650	0.30	0.762	0.04
IToI				
Gender	685	−0.07	0.945	0.01
Ethnicity	639	0.92	0.358	0.10
First Language	639	1.23	0.220	0.16

3.3. Comparison of IToI across demographic subgroups

Analyses revealed a significant effect of FSM eligibility and SEN status on pupils' IToI. As predicted, pupils with FSM status held a significantly stronger entity belief than those without, $t(643) = -4.79$, $p < .001$, $g = .490$. Pupils with SEN also reported significantly stronger entity beliefs than those without, $t(639) = -2.31$, $p = .021$, $g = 0.23$. There were no significant differences in IToI across any of the other demographic factors measured (see Table 2).

3.4. Examining the potential mediating effect of IToI for the association between demographic factors and attainment

Given the pattern of results presented previously, variables meet the conditions of mediation. Analyses were conducted to investigate the potential mediating effect of IToI for the association between attainment (English and Maths) and demographic factors (FSM eligibility and SEN status). To do so, we examined the indirect effects, reporting both the confidence intervals (using bootstrap methods) and the Sobel test (Sobel, 1982) to understand the significance of this pathway. We report both here as, while Field (2018) recommends the use of confidence intervals, Dearing and Hamilton (2006) state that the Sobel test is best practice for examining mediation in large samples (i.e. $N > 400$).

3.4.1. FSM

We first examined the potential mediating effect of IToI for the association between FSM status and attainment in Maths and English (see Figures 2 and 3). Analysis revealed a significant indirect effect of FSM status on pupils' attainment through IToI, suggesting partial mediation. This was the case in both Maths ($b = -.597$, BCa CI [-1.123, -.251]) and English ($b = -.465$, BCa CI [-.893, -.214]). A Sobel test was also run to examine whether the relationship between the predictor variable (FSM) and outcome variable (attainment) was significantly reduced by the inclusion of the mediator (IToI). The Sobel test was significant, again suggesting partial mediation occurring in this relationship for both Maths ($b = -.597$, $z = -2.695$, $p = .007$) and English ($b = -.465$, $z = -2.840$, $p = .005$).
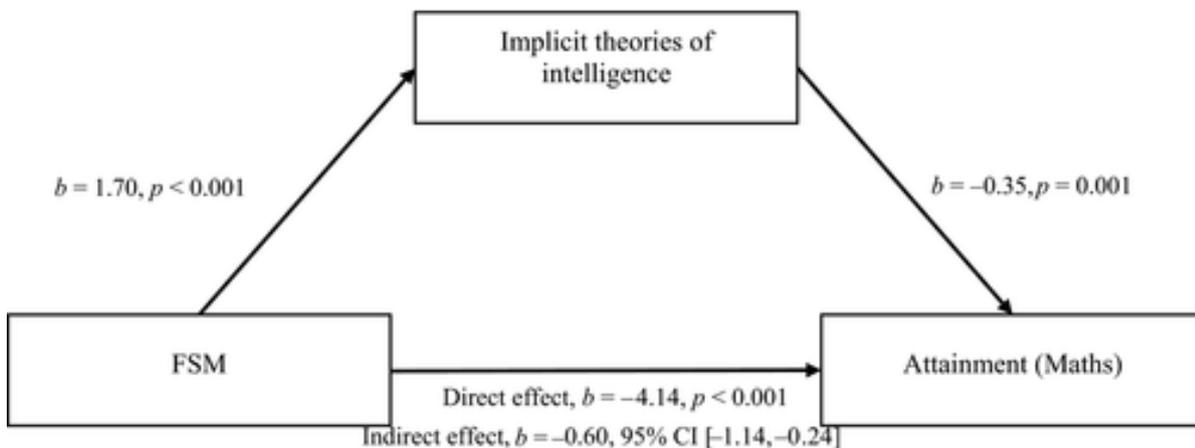

Figure 1

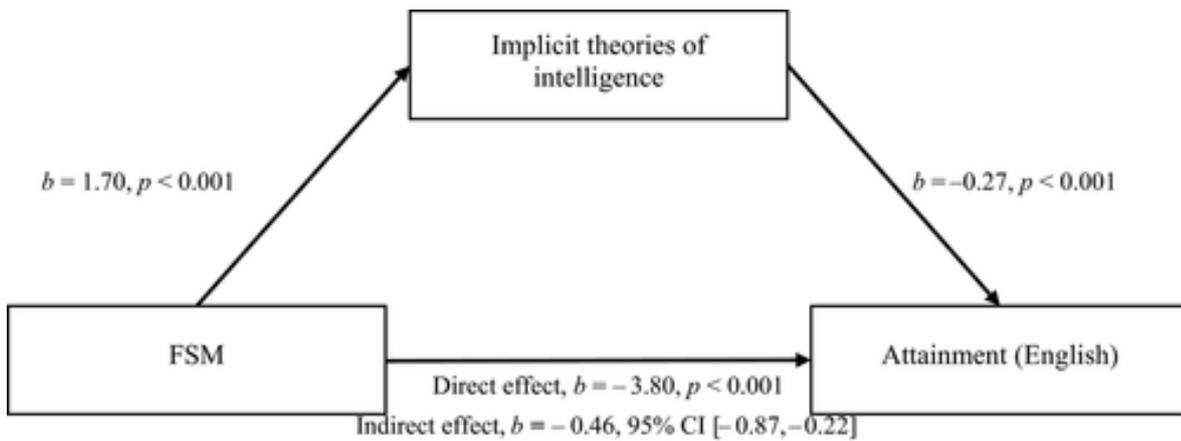Testing IToI as mediator of the relationship between FSM status and attainment in Maths

Figure 2

Testing IToI as mediator of the relationship between FSM status and attainment in English

Despite the significant indirect pathway suggesting some mediation through IToI, the direct pathway between FSM status and attainment remained significant for both Maths and English. Further exploration of this three-way relationship revealed that the relationship between IToI and attainment only existed for children not eligible for FSM in both Maths ($r(517) = -.16$, $p < .001$) and English ($r(520) = -.17$, $p < .001$). For those children eligible for FSM, there was no significant relationship between intelligence beliefs and attainment in Maths ($r(112) = .001$. $p = .990$) or in English ($r(115) = -.033$, $p = .722$). The simple slopes analysis for this relationship is represented in Figure 4.
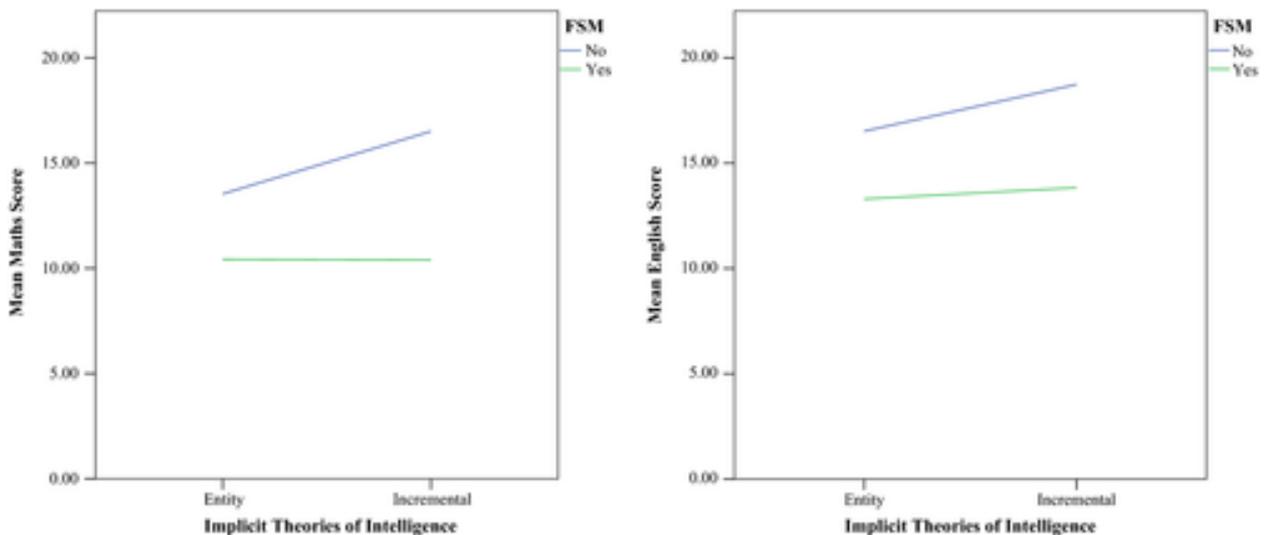

Figure 3

The relationship between attainment and IToI for pupils with and without FSM status. Note: IToI scores have been transformed using grand mean centring; pupils are classed as 'entity' if they scored 1 SD above the mean value of IToI or 'incremental' if they scored 1 SD below the mean value of IToI

3.4.2. SEN

As was the case for FSM status, there was a significant indirect effect of SEN status on pupils' attainment through IToI, suggesting partial mediation. Results are summarised in Figures 5 and 6. This was the case in both Maths (b = -.319, BCa CI [-.763, -.084]) and English (b = -.240, BCa CI [-.530, -.072]). The Sobel test was also significant, indicting partial mediation in this relationship for Maths (b = -.319, z = -1.976, p = .05) and English (b = -.240, z = -2.057, p = .04).
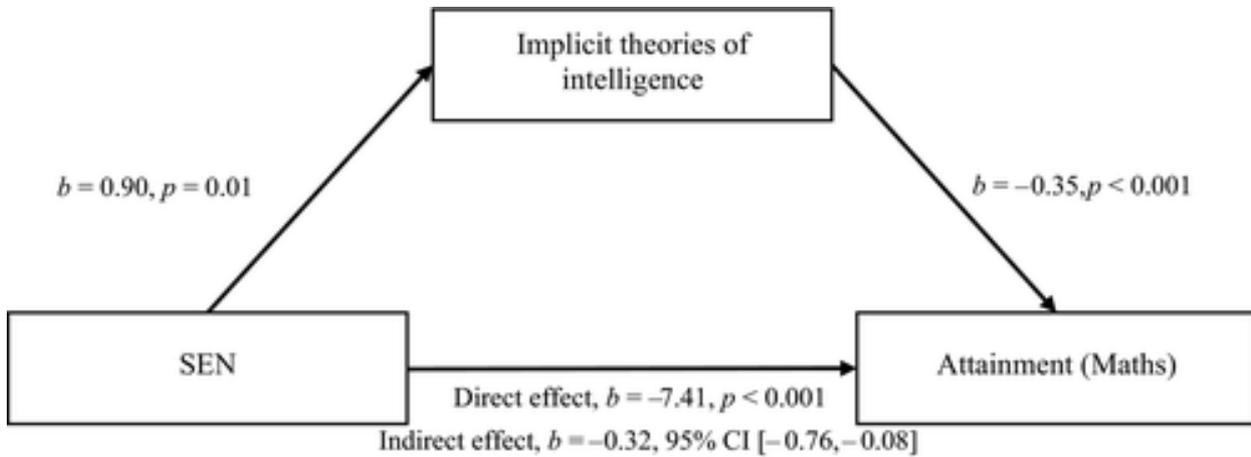

Figure 4

Testing IToI as mediator of the relationship between SEN status and attainment in Maths
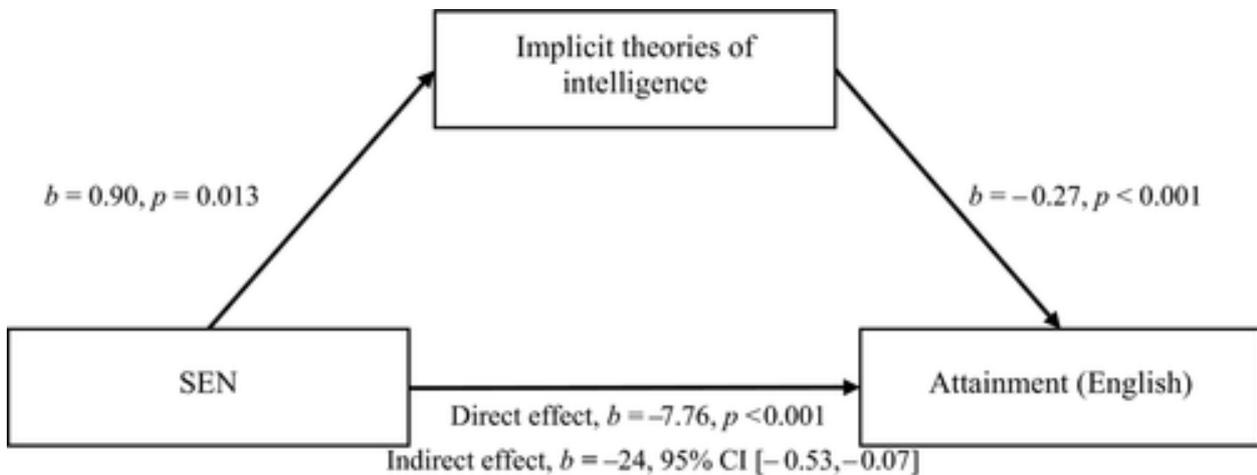

Figure 5

Testing IToI as mediator of the relationship between SEN status and attainment in English

Again, the direct pathway between SEN and attainment remained significant in both Maths and English. Further investigation revealed very similar findings to those reported for FSM status. Specifically, IToI only correlated with attainment for pupils without identified SEN, in both Maths (r(514)= -.16, p < .001) and English (r(517)= -.19, p < .001). This relationship disappears however for children with SEN in Maths (r(115)= -.016, p = .861) and English (r(118)= -.019, p = .840). The simple slopes graphs for this relationship are shown in Figure 6.
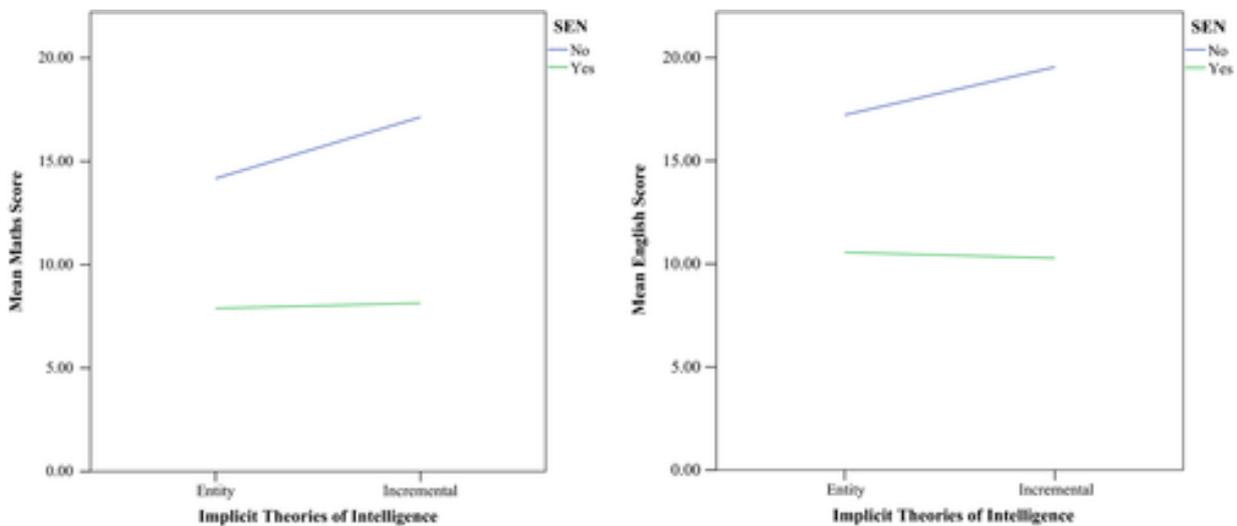
Figure 6

Open in figure viewerPowerPoint

The relationship between attainment and IToI for pupils with and without SEN status. Note: IToI scores have been transformed using grand mean centring; pupils are classed as 'entity' if they scored 1 SD above the mean value of IToI or 'incremental' if they scored 1 SD below the mean value of IToI

4. Discussion

In line with the work of Dweck and colleagues (e.g. Blackwell et al., 2007; Claro et al., 2016; Dweck, 2000; Romero et al., 2014; Zhang et al., 2017), holding an entity theory of intelligence was found to be negatively related to the academic attainment of Year 5 pupils in the UK. To our knowledge, this is the first large-scale investigation to provide evidence that the relationship between implicit theories of intelligence (IToI) and educational success are also relevant to UK populations. Although the relationships were relatively small, they were in line with the effect sizes reported in previous research (e.g. Da Fonseca et al., 2009; Gonida, Kiosseoglou & Leondari, 2006; Mouratidis, Michou & Vassiou, 2017; Romero, et al., 2014), and were present in both English and Maths performance, indicating that believing in the malleability of intelligence may play a role in improved outcomes across subjects. It was also found that measures of gender, FSM eligibility, and SEN status were all related to attainment in Maths and English in the expected direction, with girls attaining higher than boys, and eligibility for FSM status and SEN status being associated with lower attainment. Speaking English as a first language was related to increased performance in Maths.

As well as being associated with lower attainment, having an identified SEN and being eligible for FSM were both associated with holding more of an entity theory of intelligence. While the attainment gaps between these subgroups have been widely reported (e.g. Hill, 2014; Laws, 2013; Simes, 2014), little work has explored the role of these factors in IToI. Our finding that pupils with SEN were more likely to hold an entity theory of intelligence than those without is in line with previous research by Baird et al. (2009). It is not possible to conclude why children with SEN would have greater entity theory endorsement, but as proposed by Baird et al., it is possible that children with identified SEN may interpret this as a label that implies they have limited intellectual ability or potential. The label of SEN may also have an impact on the attitudes of other people regarding a child's potential. As has been shown in numerous studies, very subtle differences in the language children hear, even when positive, can very easily influence their motivational framework and views about intelligence, as well as other factors such as self-esteem (e.g. Gunderson et al., 2013; Mueller & Dweck, 1998,).

In line with the findings of Claro et al. (2016), we also found that children receiving FSM had significantly stronger entity theories of intelligence than those children not receiving FSM. However, neither this study nor Claro et al. can explain *why* pupils from lower-income families are more likely to endorse and entity theory of intelligence, but both do seem suggest that "structural inequalities can give rise to psychological inequalities" (Claro et al., pp. 8667). With previous research elucidating the potential negative impact of these psychological factors in predicting later academic success, such inequalities are important to consider.

As discussed earlier, research has also consistently highlighted the important role that expectations (both self and others) can have on a child's success. In their seminal "Pygmalion in the classroom" paper, Rosenthal and Jacobson (1968) highlighted the degree to which teachers' expectations can influence pupils' learning and outcomes through self-fulfilling prophecies. Although the National Curriculum Inclusion Statement states that teachers should set high expectations for all pupils, regardless of prior attainment, certain labels can lead to biases sufficient to alter the perceptions of actual child behaviour (Foster, Schmidt & Sabatino, 1976). If the expectation is that a child from a disadvantaged background (i.e. receiving FSM) or with an identified learning difficulty (SEN) will not achieve educational success, then these expectations may be communicated through 'communication leakage'. According to Van Oudenhoven and Siero (1985), while teachers might give students who they feel are not able to improve (versus those who they believe to be underachieving) more positive verbal praise, they also display a lot more negative nonverbal feedback. These low expectations through implicit signals have been found to lower pupils' own expectations, increase anxiety, and suppress performance (Jacobs & Eccles, 1992; Kishida, Yang, Quartz, Quartz & Montague, 2012). It seems logical that IToI may well play an important role in the expectations that one holds; if pupils believe that their abilities are fluid and improvement is possible, this will in turn impact their expectations for their own educational outcomes. This mechanism is unpicked in more detail in the proceeding paragraphs.

Finally, we examined whether the relationship between these demographic factors and attainment is mediated by children's IToI. Some evidence of partial mediation was found in the relationship between FSM and SEN with attainment in both English and Maths. These findings may reflect that some of the relationship between these demographic factors and educational success is explained by the IToI that pupils hold. This evidence may suggest that certain intelligence beliefs play a protective function (as proposed by Claro et al., 2016),which could provide a route for bridging the attainment gap associated with special educational needs and deprivation. However, further exploration of this relationship revealed some notable findings which may provide an alternative explanation for this mediation pattern. For children not eligible for FSM status or without identified SEN, the relationship between IToI and attainment reflected that of the whole sample, with an entity framework being associated with lower attainment. However, for children eligible for FSM status or with identified SEN, this relationship between intelligence beliefs was not present. To our knowledge, no previous research has examined these relationships in children with SEN. In terms of socioeconomic status, Claro et. al. (2016) found that IToI were in fact a more important predictor of academic success for pupils from low-income families. This discrepancy between findings could be due to a number of different factors. Firstly, it is likely that our measure of economic disadvantage (categorising participants by FSM or no-FSM) may not have been as sensitive as having familial-income data as was the case in Claro et al.'s study. Secondly, our sample was significantly smaller than Claro et al., with the FSM group being considerably smaller than the no-FSM group. It is important to note that the standard deviations in pupils' attainment and IToI scores were similar for pupils with and without FSM status and SEN status. Therefore, it cannot be argued that the lack of relationship in the current study was due to restricted variance.

It is also important to consider that the participants in the current study were much younger than those in the study by Claro et al. (2016). Dweck's items are very similar in meaning (evidenced by the exceptionally high Cronbach's alpha reported in previous research to range between $\alpha = .94$ and $\alpha = .98$) which may add to children's confusion when answering the questions. However, to try

and limit this, we followed the advice of Dweck (2000) by only using the three entity items. The Cronbach's alpha in our sample (α = .65) was lower than has been found in previous studies. It could be the case in the current study, with a UK sample, that the questions in Dweck's (2000) Theories of Intelligence Scale are not appropriately accessible for all pupils, and therefore this scale may not provide an accurate measure of certain children's IToI.

An alternative explanation is that beliefs alone are not enough for certain groups of children at this age to alter their educational outcomes in the absence of intervention or facilitating external influences. As expected, children from disadvantaged backgrounds or with additional learning needs endorsed more of an entity framework, but the relationship between IToI and attainment does not remain present for these subgroups of children. As described above, SEN are reported to be the cause of the largest attainment gap in the UK (DfE, 2015). By definition, pupils with SEN status require extra support from teachers and/or parents in order to access the National Curriculum. In an academic setting, children with SEN status may face challenges that other children do not and thus need additional support to be able to overcome these barriers. If they do not have access to appropriate levels of support or resources, perhaps they do not have the opportunity to put their incremental beliefs and mastery-oriented responses into action.

Equally, it is widely acknowledged that SES is related to parental school involvement, in that parents from lower socio-economic backgrounds are likely to be less involved in schooling than parents of higher SES (Hill & Taylor, 2004). Studies have demonstrated the positive influence of parental school involvement on behavioural outcomes (McNeal, 2001) and academic success for children and adolescents (e.g. Grolnick & Slowiaczek, 1994; Miedel & Reynolds, 2000). Factors affecting parental school involvement are also likely to have a direct impact on pupils' attainment and the level of support available to them at home, including parents' education level and attitudes towards the importance of education as well as other barriers including increased stress, nonflexible work schedules, and lack of resources (Hill & Taylor). McNeal highlights the complex nature of this relationship, arguing that parental engagement has a greater impact on behavioural outcomes (e.g. truancy and dropping out) than cognitive aspects, potentially putting children's own belief systems at odds with their behaviour. Inevitably, an individual's belief system does not operate in isolation, instead interacting with community and cultural contexts, potentially explaining the lack of relationship occurring between attainment and IToI for pupils with FSM eligibility. Certain circumstances (e.g. limited resources, support, and a quiet space in their home environment) might mean that children are unable to carry out their learning directed behaviour, even if they have the motivational framework to want to. The impact of these factors may be particularly salient for children of this age group (i.e. in primary education), as compared to the older students participating in the study by Claro et al. (2016).

These explanations are also consistent with the expectancy-value theory of motivation (Eccles et al., 1983). This model holds that a student's achievement motivation is predicted by both their expectations for success and their perceived value of the task. For certain subgroups of children, holding an incremental belief may have a positive effect on their expectations but not predict academic performance because it does not influence subjective task value. Specifically, Eccles' theory assumes three categories of task value; attainment value (importance of doing well on a given task), intrinsic value (the enjoyment gained from the task), and utility value (how the task relates to an individual's life and fits into future plans). It may be the case that the social barriers described deter the individuals' utility task value. This assertion is supported by the recent works of Lauermann, Eccles and Pekrun (2017) and Svoboda, Rozek, Hyde, Harackiewicz and Destin (2016).

4.4. Limitations and future directions

Given the cross-sectional design of the current study, it is not possible to establish causality between IToI and attainment; holding an entity theory of intelligence may lead to lower attainment, or lower attainment might lead to holding an entity theory of intelligence. However, as previous

research has suggested that experimental manipulations and interventions designed to encourage incremental intelligence beliefs lead to increased educational success (e.g. Blackwell et al., 2007), it seems probable that it is IToI impacting attainment. Future investigations should focus on exploring these links longitudinally within subgroups of children in order to provide firmer evidence of such relationships.

Within the current sample, pupils' FSM eligibility was used as the indicator of SES. According to data from the Family Resources Survey, Hobbs and Vignoles (2010) reported that children eligible for FSM are much more likely than other children to be in the lowest income families. Despite this, and the fact that FSM eligibility is widely used as a proxy for low SES in educational research, it is not necessarily a perfect indicator of true family income (see Hobbs & Vignoles, 2007, 2010 for a review) and, as already discussed, the current findings may suffer from imperfect proxy bias. Future research should therefore explore the use of other proxies to represent SES.

Altogether, the findings from this study suggest that the difference in IToI between different subgroups of children goes deeper than just differential frameworks. As expected, across the whole sample, IToI were related to attainment in English and Maths, reflecting findings from studies conducted outside of the UK. Despite this, while children with FSM status or an identified SEN show the predicted lower attainment, and stronger entity theory of intelligence, the relationship between attainment and IToI does not hold for these groups as it does for the rest of the sample. Given the disparity in findings between this study and Claro et al. (2016) it is important that future research explores why this might be. We have considered, with reference to previous research that this may be because specific subgroups of children do not have the appropriate support, resources, or task values that are required to put their incremental beliefs into practice. It may be the case that the impact of intelligence beliefs on educational success operates in a quintessentially different way across different groups of children at different ages. Establishing this is essential in order to understand how to target intervention towards the subgroups of children who need it most, whilst adapting such interventions to ensure that it has an impact on behaviour and educational outcomes. Intervention may not be a matter of 'one-size fits all'; clearly the potentially specific obstacles that some pupils face need to be carefully considered. It seems apparent that as well as encouraging children to hold an incremental theory of intelligence, interventions also need to focus on encouraging children and those around them to adopt behaviours that enable them access to additional support and resources.

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