Beliefs, exams and social media: a study of girls and boys in the UK.

Marina Della Giusta, Sarah Jewell and Danica Vukadinović Greetham

Department of Economics and Centre for the Mathematics of Human Behaviour

University of Reading

Abstract

Social media diffusion amongst tween and teenagers keeps increasing year on year and involving younger and younger children and studies have begun to appear indicating several changes in adolescent behaviour and mental health corresponding with increased social media use (Twenge, 2017; Twenge et al., 2017). Data derived from social media is also increasingly used to predict a variety of outcomes including personality (Youyou at al., 2014) and mental health (De Choudhury et al., 2013). We investigate the determinants of social media use and the connection between social media and teenagers' beliefs about education, which are known to be strongly connected to educational outcomes. We construct a representative sample of UK teenagers from British survey data and a sample of Twitter data specifically collected around the first national secondary school exam taken at age 16, which have important effects for further educational choices. Building on literature addressing the factors influencing teen's educational expectations (Anders and Micklewright, 2015) and the construction of beliefs (Gennaioli and Schleifer, 2010; Corazzini et al, 2010; Oxoby, 2014; Coffman, 2014; Alesina et al, 2015; Bordalo et al, 2016a; Bordalo et al. 2016b), we model social media use in the representative sample. We identify significant associations between differential usage (at both the extensive and intensive margin) and controls (socio-demographics, parental inputs and children cognitive and non-cognitive skills), particularly indicating that intensive social media usage is indeed associated with a range of negative factors as found in research on US teens (Twenge, 2017). We also find that beliefs become more gender stereotypical with age, and more so the more tweens and teens are in social media. We then use social network modelling to investigate dynamics in the Twitter sample, and identify significant gender differences in social media communication patterns and moods pertaining to scientific subjects, which indicate social media contribute to educational beliefs, potentially biasing them through the propagation of gender stereotypes.

JEL Codes: D03, D83, D84, D85, J16, J24

Key words: beliefs, social media, education, gender, social networks.

Acknowledgments: We thank Rachel Hampton for research assistance, and for helpful and constructive comments participants to workshops at Reading, York, the session Gender and Education at the European Economic Association Conference in Lisbon, and the EALE Conference in St. Gallen.

1. Introduction

Growth in social media use by teenagers has been staggering over the past ten years in the UK: 23% of 8-11 year olds and 72% of 12-15 year olds had a social media profile in 2016 (Ofcom, 2016). Children are messaging, sharing and liking throughout the day, including during school hours and late into the evening, with 9% of 11-15s communicating via social media at 10pm, and 2% messaging at midnight (Ofcom, 2016). Children's use of social media is so intense that research conducted in the US by Twenge (2017) argues it amounts to changes in behaviour and life experiences that set the generation born after 1995 and growing up with iphones apart: the IGen spends large and ever increasing amounts of time in social media and internet at the expense of time interacting in person, displays falling independence (staying at home more, postponing getting a driving license, not having or wanting own money to manage, seeing friends less), decreasing happiness and increasing mental health problems. In the UK, data from Longitudinal Survey of Young People in England (LSYPE) indicates that in 2013 around 79% of girls and 78% of boys aged 13 and 14 used Facebook and 44% of girls and 30% of boys used Twitter. The Understating Society Survey suggests that girls are more likely to belong to social networking sites and spend longer on them, thus information obtained through these channels is becoming a significant factor in both information collection and social pressure to conform. Little work has so far addressed how educational choices may be affected by information and peer influence exerted through social media, and we try to fill this gap making use of both survey and Twitter data collected around a critical set of exams teens in the UK take at age 15 called General Secondary Compulsory Education (GSCE). This set of exams is quite important in a number of ways as results affect subsequent performance and the likelihood of going to university quite dramatically both through standard human capital accumulation and their effect on teenagers' expectations (Anders and Micklewright, 2015; Rampino and Taylor, 2013).

In what follows, we firstly discuss the role of educational beliefs in educational attainment, and different influences on belief formation that have been identified in the literature. We then present models of socially constructed beliefs, that is beliefs that are formed participating in social networks and potentially absorbing stereotypes about specific types that can account for distorted beliefs about one's potential in different educational subjects. Making use of a sample drawn from the UK Understanding Society Survey we then model participation in social media and its effect on educational and related beliefs in a representative sample of tween and teenagers. In order to focus specifically on how beliefs about own performance in exams in different subjects may be biased by gender-based beliefs, we then model teenagers communications in a Twitter sample extracted specifically for this purpose, and investigate both subject-specific gender homophily and sentiment diffusion.

Although we are not claiming any causal links, we do find that twitter networks around these are different by gender, and particularly that girls exhibit strong gender homophily in GSCE maths conversations, suggesting that they discuss the subject differently from boys and especially that they tend to discuss it amongst themselves. Through sentiment analysis, we also find that girls are more negative about exams and more negative about science in general, and thus it is conceivable that exposure to social media during exam periods may in fact exacerbate the effects of both stereotyping and self-stereotyping on beliefs. We suggest implications in terms of both teen exposure to social media and using social media to diffuse counter stereotypical information.

2. The formation of beliefs around education

Expectations have been found to be strong predictors of educational attainment, even after controlling for demographic characteristics, family background and grades (Jacob and Wilder, 2010 for the USA; Jerrim, 2011; Chowdry et al, 2013; for the UK; Khoo and Ainley, 2005 for Australia; Attanasio and Kaufmann, 2009 for Mexico; Adrres et al, 1999 for Canada). Decision processes around exams are affected by a range of factors, including students' beliefs about labour markets and related choices (education, jobs, starting a family), which evolve over time depending also on parents, peers and the general expectations surrounding exams. For example, whilst it remains a fact that children from wealthier families are overwhelmingly represented in higher education (Anders, 2012), the process of expectation formation seems to be an important channel in that expectations change quite a lot during teenage years (Anders and Micklewright, 2015).

Parents

In general, preferences are found to be strongly linked to parental attitudes and preferences, as well as the amount of parental time invested in children (Alan et al, 2017; Zumbuehl et al., 2013; Filippin and Paccagnella, 2012; Black et al., 2009). The literature on the intergenerational transmission of beliefs, preferences and attitudes (Bisin and Verdier, 2001) identifies several possible channels: direct parental influence through education, location and school choices that affect the environment, and emulation (extensively discussed in developmental psychology). These channels have been shown to be gender specific in Denmark by Kleinjans (2010) who finds that the effects of parental income and education differ for daughters and sons, with transmission running through parental education of the parent of the same gender. In the UK, Johnston et al. (2014) find that gender role attitudes of mothers and children measured 25 years apart are strongly correlated and that both the human capital and the labour supply of daughters (and that of sons's partners) are strongly affected by their mothers' in the 1970 British Cohort Study, which does not include fathers' information.

Teachers

Teachers expectations also have an important role: an original study by Rosenthal and Jacobson (1968) in American primary schools found that teachers' expectations had a powerful impact on students' achievements and recent research found that teachers' diminished expectations of children with names associated with low socio economic status affect student's cognitive performance (Figlio, 2005). Teachers can unconsciously rate children differently on aspects of performance that are subjective, as has been shown in essays designated with either German or Turkish names (Sprietsma, 2009), or assessment of African American children's behaviour, which was rated as more disruptive and inattentive by teachers from a different ethnic group (Dee, 2005). Conversely, optimistic teachers' expectations have been found to particularly benefit the achievement of students from minorities in the US (Jussim and Harber, 2005). In Turkey, Alan et al. (2017) show that girls who are taught for longer than a year by teachers with traditional gender views have lower performance in objective math and verbal tests, and this effect is amplified with longer exposure to the same teacher.

Peers

Peer effects have also been extensively studied, including in education (Calvo-Armengol and Zenou, 2007). Sacerdote (2014) reviews the studies identifying peer-effects and finds that although some of these are highly context specific (notably test scores and exam performance), significant and strong peer effects have consistently been found in studies of risky behaviours (crime, drinking, smoking) and in career choices. Peers can also help reinforcing or mitigating stereotypical choices (Favara, 2012; Schone et al., 2017). The networks through which these effects occur have been extensively studied by both theoretical and empirical literature, and media and social networks influences on individual

decisions have been shown in the case of Fox News affecting voting in the US in 2000 (Della Vigna and Kaplan, 2007), and Bond et al. (2012) in the case of messages delivered through Facebook during the 2010 US congress elections. The structure of the network is important too: Centola (2010) presents the result of an online social network experiment in health behavior, showing how the structure of the network matters for adoption. In particular he shows how individual adoption of the prescribed behaviour is more likely when participants received social reinforcement from multiple neighbours and the behavior spreads farther and faster in clustered-lattice networks than in random ones. Corazzini et al (2010) explicitly test the evolution of beliefs in individuals communicating in a social network and find that the structure of the network is important in determining convergence of beliefs and that it is important to account for both the number of people individuals listen to as well as those they talk to, a point we return to in our analysis.

Stereotyping

The literature on educational attainment generally highlights a closure of the gender gap in education (http://reports.weforum.org/global-gender-gap-report-2016/; Goldin et al., 2006) and there are emerging worries about the disadvantages of boys. Rampino and Taylor (2013) for example report that girls systematically report more positive educational attitudes and aspirations than boys even after controlling for unobserved differences between children. Although in the UK girls on average have been performing better than boys in GCSE exams since the late 1980s, there remains a gender gap in the choice of science and maths subjects (Institute of Physics, 2013; Smith and Golding, 2015; Reuben et al 2014) that affects the selection of women out of STEM subjects (Science, Technology, Engineering and Maths) at University and in the labour market, with important effects on pay gaps, career gaps and individual and household outcomes later on (Petrongolo and Olivetti, 2006; Ceci and Williams, 2010; Bertrand, 2011).

So why do girls then opt out of maths, even if they do well in exams? Worldwide the achievements and choices in maths by girls have been found to be strongly connected with the wider gender norms of societies (Guiso et al, 2008), with the gender of professors (Carrell, Page and West, 2010), parental beliefs (Johnston et al., 2014; Eccles, Jacobs and Harold, 1990), and self-sterotyping (Coffman, 2014). In the UK, Favara (2012) expoits sex segregated schools and using the National Pupil Database (the register of all pupils enrolled in state maintained schools in England) shows that gender stereotyping affects educational choices from the age of 14 and this effect is larger for girls than for boys, and that it is attenuated for those attending a sixth-form-single-sex school. The importance of stereotyping and social pressure is consistent with recent findings from the Global Preference Survey (Falk et al, 2015) which suggest that women tend to exhibit a stronger social predisposition than men, and that they are more responsive to social cues (Eckel and F¨ullbrunn 2015, Zetland and Della Giusta, 2013).

Models of belief formation accounting for the effect of stereotying are provided in Gennaioli and Schleifer (2010) who show that significant biases in beliefs can arise from the use of representativeness heuristics (Kahnemann and Tversky, 1983) which lead to exaggerating small differences in some parts of the distribution of attributes of one group relative to another. The model is extended in Bordalo et al (2016) to explicitly discuss the effect of distorted math ability beliefs, arising from the fact that men are overrepresented in the right tail of the maths scores distribution (though on average maths scores do not differ by gender, Hyde et al., 2008) and find that indeed they can affect careers and discrimination. Oxoby (2014) shows how the process of forming beliefs about one's own ability incorporating irrelevant information on observable types (for example the proportion of individuals of one's own gender succeeding in a particular occupation, or in our case, in obtaining qualifications in STEM) can bias downward one's perception of one's own ability (or upward if the type-based biases are positive), and lead to inefficient allocations of agents across more and less skilled sectors in the labour market and a growing segregation over time through the feedback to agents from increased type-based biases in their beliefs, compounding the effect of self-fulfilling beliefs about social status (Piketty, 1998). Importantly, both the stereotype threat literature (Schmader, 2010) and the sociological literature

(Faunce, 1989) suggest that the effect of these type-based biases occurs more strongly the more often one is reminded of one's position in the status hierarchy, which would indeed correspond to one of the effects that occur through participation in social media, which can both amplify type-based beliefs, that when negative can activate a process of monitoring for failure and suppressing negative thoughts loading working memory that would instead be needed to perform the task at hand, as Schmader's work on the functioning of stereotype threat illustrates, and help propagate different kinds of sentiment across teen networks, depending on how the latter are constructed.

Since it is not possible to acquire representative samples with extensive information on personal and family characteristics from social networks, our strategy is to make use of two separate samples: we firstly use a representative sample to study general social media participation (in terms of participation and hours spent in social media) and its association with a range of controls describing extensive socio demographic information and the influences discusses above. With the same sample, we also analyse the role of social media in educational beliefs. Then we turn to a sample of actual social media data drawn from teenagers communicating in Twitter about GSCE exams in specific subjects, and through social network and sentiment analysis identify patterns that are indeed consistent with gender stereotyping.

3. UK Teens, social media and educational beliefs

We make use of the UK Understanding Society Data, an annual survey which follows around 40,000 UK household over time which began in 2009 as a successor to the UK BHPS longitudinal survey, and currently has six available waves. The survey collects information on social and economic variables at the individual and household level. We focus on the general population and Northern Ireland sample and exclude the ethnic minority/immigration boosts and BHPS samples so our sample is representative of the UK. A youth questionnaire is administered to those aged 10-15 in the household who are then eligible to enter the adult panel when they turn 16. We use the youth panel and merge information about the household and the parents (matched to the parent identifiers provided), available from the main adult panel. In total, our sample has 17,077 person-year observations but the number of observations will vary as not all our questions of interest are asked in every wave.

Social Media Use

We start by exploring the factors that are associated with social media use, estimating equation 1:

$$SOCMED_{it} = \beta_1 PAR_{it} + \beta_2 PARINV_{it} + \beta_3 NONCOG_i + \beta_4 SCHOOL_{it} + \beta_5 X_{it} + \alpha_i + u_{it} \quad (1)$$

SOCMED – refers to the use of media. – respondents are asked in all 6 waves, firstly, whether they belong to any social networking sites (do you belong to a social web-site such as bebo, facebook or myspace?) and then secondly, on a weekday how long they spend chatting on social media grouped into categories of none, less than an hour, 1-3 and 4+ hours (How many hours do you spend chatting or interacting with friends through a social web-site like that on a normal school day?).

α_i refers to an unobserved individual effect which is fixed over time and include factors that influence social media use that are fixed across our time period for individuals but are allowed to vary across individuals. These may include factors relating to personality and family background. Since some of our control variables are fixed overtime we cannot use fixed effects methods and utilize instead correlated random effects panel models. The correlated random effects approach is attributed to Mundlak (1978) with the means of the time varying variables included in the models as a proxy for fixed effects (the time invariant unobserved heterogeneity). We estimate firstly whether respondents belong to a social networking site using a correlated random effects probit estimator and then how long

they spend chatting using a correlated random effects multinomial logit. We report average marginal effects since the raw coefficients are not easily interpretable.

We include the following controls, which correspond to the factors discussed in our literature review:

PAR – refers to parents and family background variables which as discussed earlier have shown to be important variables for transmission of beliefs. We include information on family situation (both natural parents, step family or single parent – we exclude anyone who have other family settings) and number of siblings in the household (split into older and younger), based on information about relationships between household members. We capture parent's social class, based on information from the parent's interview, using which ever parent has the highest social class (grouped into managerial and professional, associate professional, managerial and routine, never worked and unemployed) and equivalised household income (equivalised using the OECD scale). Since not all individuals have a father (very few individuals did not have a mother present and these were omitted) we focus on mother's characteristics, again obtained from the mother's interview: mother age, whether mother works, mother's attitude to family life and whether mother has a degree. Mother's attitude to family life is based on the four questions in relation to family life asked in the adult panel (pre-school child suffers if mother works, family suffers if mother works full-time, husband and wife should contribute to hh income, husband should earn, wife should stay at home) – this is asked in wave 2 and 4 so the other waves are filled in with the lag or the future value. This is on a scale of 1 to 5 with 5 representing the most traditional.

PARINV – refers to variables relating to parental investment. We include a number of variables that could relate to parental investment in terms of time: activities done with parents: whether taken to live sporting events, whether taken to museums and/or theatre, whether discuss books, whether youth plays a musical instrument, along with number of days eat meal with family ((none, 1-2 times, 3-5 times, 6-7 times) and whether child thinks parent is very interested in child's education. We include a number of variables to pick up the perceived relationship with parents: whether they argue with and talk about things that matter with parents (most days, more than once a week, less than once a week, hardly ever)– these are reversed coded (so a higher value meant they more frequently argued or talked about things that matter), and the highest value for the mother/father is used. We also include level of happiness with family (on a scale of 1 (very unhappy) to 7 (very happy). These questions were not asked in every wave and the information was filled in from previous/future values for the intervening years.

NONCOG – relate to non-cognitive factors. A question on strengths and difficulties are asked to obtain five SDQ subscales (http://www.sdqinfo.com/a0.html): emotional symptoms, conduct problems, hyperactivity/inattention, peer relationship problems, pro-social: we use the three-subscale division of the SDQ into 'internalising problems' (emotional+peer symptoms, 10 items), 'externalising problems' (conduct+hyperactivity symptoms, 10 items) and the prosocial scale. These questions were asked in waves 1, 3 and 5 so intervening years were filled in where possible. Self-esteem questions are asked in waves 2, 4 and 6 (so intervening years were filled in where possible) and a total score was obtained by summing responses to a set of questions (I feel i have a number good qualities (reverse coded); I certainly feel useless at times-; I am a likeable person (reverse coded); I am inclined to feel I am a failure; at times I feel I am no good at all; I don't have much to be proud of; ypestj- I am as able as most people (reverse coded); I can usually solve my own problems (reverse coded);

SCHOOL – relate to school factors, there are few variables available to capture school factors so we include happiness with school work on a scale of 1 (very unhappy) to 7(very happy).

X – relates to other control variables and includes gender, ethnicity (white versus non-white), age (which ranges from 10 to 15), religion and controls for wave.

There is a clear gender difference in the use of social media with girls more likely than boys to spend longer chatting i.e. 11% of girls compared to 5% of boys chat for 4+ hours and 31% of girls compared to 22% of boys chat for 1-3 hours. The time spent on social media is also increasing with age. Whether an individual belongs to a social networking site and how long they spend on social media seems to be strongly determined by age and gender, and there are some noteworthy patterns, confirming findings by Twenge (2017) on US teenagers which indicate that belonging to social media is almost ubiquitous by the age of 13 and that it is time spent in them rather than belonging per se that is associated with negative aspects (see tables 1 and 2):

- Religious children are less likely to use social media and if they do for fewer hours
- Children with a step family or older (younger) siblings are less (more) likely to be in social media.
- Parental background matters: children with parents from managerial and professional backgrounds are less likely to use social media and spend fewer hours in them, especially for girls, and having a mother with a degree, a more traditional mother (girls only), or older mother (girls only) reduces the likelihood of belonging to a social networking site. The effects only hold at the extensive margin as time spent in social media is only associated (negatively) with mother education and age.
- Parental time investments also matter: children who talk with parents, are happy with their family) whilst those whose parents/other adults take them to museums, theatre etc. and discuss books with them (the latter a particularly strong effect as children get older) are less likely to use social media and use it fewer hours. Belonging to social media is also positively associated with going to sporting events with parents for boys, but not time spent in social media.
- Those with externalising problems are more likely to belong to a social network and spend more time in them, whilst those with internalising problems are less likely to belong to a social network.
- Children with more pro-social behaviour belong to social media, but there is no association with time spent in social media.
- Having low self esteem is positively associated with spending long hours in social media as is being unhappy at school.

Table 1: Social Media Usage

	All	Boys	Girls	Aged 13+
Average Probability	0.77	0.75	0.8	0.89
Female	0.093***			0.079***

	[0.011]			[0.012]
White	0.030	0.045	0.020	0.042**
	[0.020]	[0.031]	[0.027]	[0.018]
Age	0.099***	0.104***	0.093***	0.038***
	[0.003]	[0.004]	[0.004]	[0.005]
Religion (ref; none)				
Christian	-0.003	0.020	-0.023*	-0.003
	[0.010]	[0.015]	[0.013]	[0.010]
Other	-0.052**	0.007	-0.104***	-0.051*
	[0.024]	[0.034]	[0.035]	[0.026]
Parent and Family Background				
Family situation (both natural parents)				
Step family	0.003	0.001	0.007	0.032
	[0.047]	[0.069]	[0.066]	[0.045]
Single parent	0.001	-0.001	-0.007	0.019
	[0.034]	[0.050]	[0.046]	[0.029]
No of older sibling	0.047	-0.005	0.089**	0.045
	[0.029]	[0.047]	[0.037]	[0.034]
No of younger siblings	0.001	0.031	-0.026	-0.018
	[0.022]	[0.028]	[0.032]	[0.022]
Parents socio-economic class (ref: Routine and manual)				
Managerial and professional	-0.036	-0.005	-0.062**	-0.021
	[0.023]	[0.034]	[0.029]	[0.025]
Associate professional	-0.025	-0.023	-0.031	-0.004
	[0.025]	[0.039]	[0.032]	[0.029]
Never worked/long term unemployed	0.013	0.039	-0.014	0.008
	[0.021]	[0.034]	[0.027]	[0.025]
Equivalised monthly HH income ('000)	0.006	0.016*	-0.005	0.010*
	[0.007]	[0.009]	[0.010]	[0.006]

Mother work	0.016	0.025	0.010	0.027
	[0.014]	[0.022]	[0.019]	[0.017]
Mother's attitude to family life	-0.020	-0.006	-0.035	-0.008
	[0.016]	[0.022]	[0.024]	[0.021]
Mother has degree	-0.047***	-0.058***	-0.036**	-0.015
	[0.012]	[0.019]	[0.015]	[0.013]
Mother's age	-0.004***	-0.003*	-0.004***	-0.001
	[0.001]	[0.002]	[0.001]	[0.001]
Parent's Investment				
Youth Activities				
Adults takes youth to sporting events (often/sometimes)	0.022	0.037	0.001	0.015
	[0.023]	[0.035]	[0.030]	[0.023]
Adults takes youth to museums/theatre(often/sometimes)	0.003	0.003	0.006	-0.005
	[0.020]	[0.029]	[0.026]	[0.019]
Adults discuss books with youth (often/sometimes)	0.005	0.003	0.015	-0.006
	[0.016]	[0.024]	[0.021]	[0.016]
Youth plays a musical instrument	-0.021	-0.003	-0.037*	-0.001
	[0.017]	[0.026]	[0.021]	[0.017]
Number of days eat meal with family	0.011*	0.017**	0.004	0.006
	[0.006]	[0.008]	[0.008]	[0.007]
Parents very interested in child's education	-0.004	-0.022	0.019	0.023
	[0.020]	[0.027]	[0.030]	[0.017]
Relationship with parents				
Argue with parents	0.016	0.016	0.013	0.014
	[0.012]	[0.016]	[0.021]	[0.011]
Talk to parents	-0.018	-0.009	-0.026	-0.024**
	[0.013]	[0.016]	[0.023]	[0.011]
Happiness with family (1 to 7)	-0.001	0.001	-0.003	0.002

	[0.006]	[0.007]	[0.009]	[0.006]
Non-cognitive skills				
SDQ subscales				
Internalising Problems	-0.004	-0.005	-0.005	-0.002
	[0.003]	[0.005]	[0.005]	[0.003]
Externalising problems	0.004	0.001	0.008	0.001
	[0.004]	[0.006]	[0.006]	[0.004]
Pro-social behavior	0.006	0.003	0.008	0.007*
	[0.004]	[0.006]	[0.007]	[0.004]
Self esteem	-0.000	0.005	-0.005	-0.003
	[0.002]	[0.004]	[0.003]	[0.002]
Happiness with School work (1 to 7)	-0.009**	-0.007	-0.012**	-0.004
	[0.004]	[0.007]	[0.006]	[0.006]
Observations	11,067	5,439	5,628	5,622

Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1 Includes controls for wave, missing race and means of time varying variables

Table 2: Time spent in social media

	None	less than one	1-3 hours	4+ hours
Average Probability	0.32	0.35	0.25	0.08
Female	-0.141***	-0.046***	0.113***	0.074***
	[0.012]	[0.011]	[0.010]	[0.007]
White	-0.016	-0.022	0.045**	-0.007
	[0.022]	[0.022]	[0.021]	[0.012]
Age	-0.106***	0.015***	0.064***	0.028***
	[0.003]	[0.003]	[0.003]	[0.002]
Religion (ref; none)				

Christian	0.010	0.017	-0.009	-0.018***
	[0.011]	[0.011]	[0.010]	[0.006]
Other	0.084***	-0.006	-0.042**	-0.036***
	[0.026]	[0.025]	[0.021]	[0.012]
Parent and Family Background				
Family situation (both natural parents)				
Step family	-0.007	0.007	-0.015	0.015
	[0.054]	[0.066]	[0.058]	[0.035]
Single parent	0.024	-0.041	-0.017	0.034
	[0.043]	[0.049]	[0.046]	[0.034]
No of older sibling	-0.052	-0.006	0.030	0.028
	[0.034]	[0.043]	[0.032]	[0.022]
No of younger siblings	-0.021	0.026	-0.019	0.013
	[0.023]	[0.026]	[0.024]	[0.015]
Parents socio-economic class (ref: Routine and manual)				
Managerial and professional	-0.014	0.003	-0.001	0.013
	[0.028]	[0.034]	[0.030]	[0.016]
Associate professional	-0.000	-0.018	-0.011	0.029*
	[0.029]	[0.033]	[0.029]	[0.017]
Never worked/long term unemployed	-0.033	0.016	0.017	0.001
	[0.027]	[0.033]	[0.029]	[0.014]
Equivalised monthly HH income ('000)	-0.004	0.001	0.004	-0.001
	[0.006]	[0.008]	[0.008]	[0.005]
Mother work	-0.015	0.012	0.007	-0.005
	[0.016]	[0.021]	[0.018]	[0.011]
Mother's attitude to family life	0.032*	-0.019	-0.000	-0.012
	[0.018]	[0.021]	[0.019]	[0.012]
Mother has degree	0.040***	0.002	-0.037***	-0.004

	[0.014]	[0.013]	[0.013]	[0.009]
Mother's age	0.005***	0.001	-0.004***	-0.001**
	[0.001]	[0.001]	[0.001]	[0.001]
Parent's Investment				
Youth Activities				
Adults takes youth to sporting events (often/sometimes)	-0.004	-0.044	0.044	0.004
	[0.026]	[0.030]	[0.028]	[0.015]
Adults takes youth to museums/theatre(often/sometimes)	-0.018	0.052**	-0.019	-0.015
	[0.023]	[0.026]	[0.025]	[0.013]
Adults discuss books with youth (often/sometimes)	-0.012	0.028	0.014	-0.030***
	[0.018]	[0.021]	[0.019]	[0.010]
Youth plays a musical instrument	0.017	0.003	-0.005	-0.016
	[0.019]	[0.021]	[0.019]	[0.011]
Number of days eat meal with family	-0.009	0.008	0.005	-0.004
	[0.006]	[0.008]	[0.007]	[0.004]
Parents very interested in child's education	-0.008	0.023	-0.021	0.006
	[0.022]	[0.023]	[0.021]	[0.012]
Relationship with parents				
Argue with parents	-0.004	-0.024*	0.014	0.013
	[0.013]	[0.014]	[0.013]	[0.009]
Talk to parents	0.004	0.022	-0.002	-0.024***
	[0.014]	[0.015]	[0.014]	[0.009]
Happiness with family (1 to 7)	0.006	0.009	-0.007	-0.007**
	[0.006]	[0.007]	[0.006]	[0.003]
Non-cognitive skills				
SDQ subscales				
Internalising Problems	0.007*	-0.007	0.001	-0.001
	[0.004]	[0.004]	[0.004]	[0.002]

Externalising problems	-0.002	0.004	-0.004	0.001
	[0.005]	[0.005]	[0.005]	[0.003]
Pro-social behavior	-0.001	-0.000	0.002	-0.001
	[0.005]	[0.006]	[0.005]	[0.003]
Self esteem	0.000	0.006*	-0.003	-0.004**
	[0.003]	[0.003]	[0.003]	[0.001]
Happiness with School work (1 to 7)	0.015***	-0.003	-0.005	-0.007**
	[0.005]	[0.006]	[0.005]	[0.003]
	11,039	11,039	11,039	11,039

Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1 Includes controls for wave, missing race and means of time varying variables

Beliefs and Social Media

Respondents are asked several questions related to their beliefs, including whether they think it is important to do well in gsce exams, what would they like to do when they are 16 after completing those exams, when they would like to start a family and get married and what job they would like to do once completing full time education. In our sample there are noticeable gender differences in all these beliefs (see tables in Appendix): girls are more likely to state it is very important to do well in exams (see also Rampino and Taylor, 2013), and want to stay in education afterwards, but also more likely to say they want to marry younger and have children sooner and more likely to aspire to more gender sterotypical (and less well paid!) occupations as they get older.

We model beliefs about studying after GSCEs (at age 16) as the result of personal and parental background characteristics (controls are the same as in equation 1) and include time spent social media as a separate control. We estimate the equation 2, again using a correlated random effects approach as beliefs updating is dependents on priors that are only partially captured by our controls and we cannot assume the omitted factors to be homogeneous across respondents.

$$Belief_{it} = \beta_1 PAR_{it} + \beta_2 PARINV_{it} + \beta_3 NONCOG_i + \beta_4 SCHOOL_{it} + \beta_5 X_{it} + \beta_6 SOCMED_{it} + \alpha_i + u_{it} \quad (2)$$

And estimate separately each belief we are interested: whether they want to study full time at age 16, age at which they want to marry and age at which they want to start a family (grouped into under 25, 25-29, 30+ and not marry/no children), and job they would like when they finish full time education (group into 7 occupational groups). Tables a3-a6 in the appendix report our results and table 3 summarises the effect of social media on beliefs across all choices considered. We find that the coefficient of time spent in social media is negative, significant and indeed quite large (the second largest after mother education). This is true also for the belief to have children and to marry young (choices that can of course interfere with education): large amounts of time spent in social media are positively associated with these beliefs, with coefficients that are as big as those of religion, and in the case of having children early bigger even than gender. Interestingly, only one of the parental investments variables has a consistent positive effect on beliefs, and that is time spent discussing books. There are important gender differences and stereotypical beliefs emerging as well: girls are less likely to want a career in STEM or aspire to a professional career, so given the importance of social media in

beliefs formation it is quite possible that girls' beliefs are indeed affected negatively by type-based assumptions of the kind discussed in Oxoby, (2014) and Bordalo et al. (2016). To further assess what mechanisms may be at play in social media when it comes to influencing beliefs about education, we focus specifically on GSCE exams and a sample of tweets by boys and girls talking about them in Twitter.

Table 3: Beliefs, gender and time in social media

Study FT at 16 (wave 3 onwards)	5,076	0.358***	[0.058]	-0.155**	[0.067]	-0.134*	[0.081]
Age want to marry (waves, 2, 4 and 6)							
Under 25	3,099	0.020	[0.018]	-0.015	[0.029]	0.013	[0.035]
25-29	3,099	0.076***	[0.021]	0.072**	[0.034]	0.000	[0.039]
30+	3,099	-0.076***	[0.016]	-0.019	[0.025]	0.014	[0.032]
Not marry	3,099	-0.021*	[0.012]	-0.039**	[0.019]	-0.027	[0.023]
Age want to start a family (waves 2, 4 and 6)							
Under 25	3,011	0.045***	[0.016]	0.039	[0.025]	0.039	[0.028]
25-29	3,011	0.088***	[0.021]	-0.008	[0.034]	-0.008	[0.039]
30+	3,011	-0.137***	[0.019]	0.013	[0.031]	0.003	[0.036]
No children	3,011	0.003	[0.013]	-0.043*	[0.022]	-0.034	[0.026]
Job like after FT education (waves 1, 3 and 5)							
Managers and other professionals	2,622	-0.015	[0.013]	0.029	[0.021]	0.047*	[0.026]
STEM Professionals	2,622	-0.085***	[0.012]	-0.021	[0.018]	-0.010	[0.023]
Health professionals	2,622	0.123***	[0.016]	0.014	[0.025]	-0.005	[0.028]
Associate Professionals	2,622	-0.147***	[0.016]	0.010	[0.024]	-0.004	[0.025]
Culture, media and sports occupations	2,622	0.004	[0.019]	-0.051	[0.031]	0.003	[0.038]
Other/none	2,622	0.046***	[0.018]	-0.011	[0.030]	-0.034	[0.033]

Coefficients reported are average marginal effects, Controls are the same as in tables 1 and 2 plus means of the time varying variables

5. Twitter and exam beliefs

The Twitter dataset. Twitter is a social media platform where users can post short texts, or micro-blogs (currently still up to 140 characters in length) for viewing by other users. It is used both as a communication channel as well as a broadcasting tool (Honeycutt & Herring, 2009; Quercia et al., 2012). While Twitter does not publish any more statistics about its users in different countries and some recent research (Briggs, 2017) shows that overall, teenagers currently use more Instagram, Snapchat and private messaging applications, Twitter is still widely used by schools and students for timely communication and broadcasting.

Although private direct messaging is available on this platform, very often Twitter users direct or address their public tweets to other users by using *mentions* - the @ symbol - therefore conducting a conversation in public. For example, two users Alice and Bob might publicly exchange tweets "@Bob, what was the result today?", "4:3! @Alice", ensuring that these tweets are then displayed on their newsfeed. Therefore, we claim that there is a conversational relationship between two (or more) users if they mention each other reciprocally and repeatedly (Wu et al., 2011; Pramanik et al., 2016, Vukadinović Greetham & Ward, 2014). By collecting only public messages, we create a social network using mentions as edges between users. We argue that the nature of these conversations (being public) reinforces the social norms influence (Šćepanović et al, 2017, Charlton et al., 2016) and can thus shape beliefs.

Our Twitter sample is obtained from a larger dataset (see Charlton et al., 2016) collected by a digital marketing agency from October 2014 until March 2015. This dataset was collected by *snowball sampling* (Wasserman & Faust, 1994). Starting with a single seed user, their last 200 public tweets were retrieved (or all their tweets if they had posted fewer than 200 since account creation), and other users they had mentioned were identified. These users were then added to the sample, and so on, stopping when no new users can be added any more. In this manner 669,191 users were sampled and a total of 121,805,832 tweets collected. Limiting the history collected to the last 200 tweets enabled to collect a large, *wide* subgraph of the Twitter UK mention network.

From this large dataset, for this study, we then extracted all the tweets that contained keywords: 'maths', 'science', 'English', 'GCSE'. The extracted sample contained around 12k Twitter users exchanging around 28k messages containing words 'Maths, Science, English' during the 29/05/2008 till 05/11/2014 period, during which the exams took place. A smaller subset of 413 individuals had explicitly 'GCSE' mentioned in their messages. Tweets were sent from 15/02/2012 to 05/11/2014. We created an evolving, temporal network (Holme, 2015) with Twitter IDs as vertices. Edges were created in the following manner: if a user A mentioned another user B, a timestamped directed edge was created from A to B. In this way if there is an edge in both directions, we can assume that two users have a more meaningful relationship. We investigated the structural and dynamic properties of this network and its subnetwork containing 'GCSE' as the main topic of conversation. In particular we focused on the connections between the networks' structure and the users' gender and how the structure and topics change over time.

The tweets in the sets 'Science', 'Maths', 'English', 'GCSE' contain respectively terms 'science' or 'Science', 'Maths' or 'maths', 'English' or 'english' and 'GCSE' or 'gcse'. To begin with, we analyse each of the sets as an individual static network, where vertices are Tweeter users and an edge (it can be multiple) between A and B is created when a time-stamped tweet by A contains '@B'. For each tweet one directed edge is created, so if A tweeted '@B' several times during the observed interval, there will be several edges from A to B.

We calculate several standard network measures for the largest connected components of four networks given in Table 4 below, starting with the number of nodes and links. The average degree is the average of total nodes' connections; the number of cores describes how many layers of connectivity there are in the network. We also compute current flow betweeness and

page rank centrality measures. Based on betweenness, that perceives actors who are on the shortest paths between any other two as the most central in the networks, current flow uses randm walks instead of shortest paths that need to be globally known as this is a more realistic assumption in most of larger networks. (Brandes & Erlebach 2005; Newman, 2005). As the current flow betweeness is computationally expensive, for the largest of four networks 'Science' we used page-rank score instead (Brandes & Erlebach, 2005).

Table 4: Network statistics for four networks, 'Maths', 'English', 'Science', 'GCSE'.

Network	nodes	links	avg. degree	Cores	Nodes in maximum cores	F	M	U
GCSE	86	95	2.558	2	15	22	53	11
Maths	404	923	4.592	5	7	117	202	85
English	2250	4068	3.616	6	5	539	1268	443
Science	7337	12796	3.488	7	16	1769	3724	1844

We also give a number of users that were classified as female (F), male (M), or unknown (U) gender based on a Twitter user name and user description. In order to determine the gender of the Twitter user for each tweet, we used the *Open Gender Tracking* "global name data", which contains data gathered from US and UK resources in order to form a way to predict the gender of someone based on their name. Using their processed UK results - which assigned each name a gender if it had a >90% probability of being male or female- we were able to predict the gender of each Twitter user. This was done by separating the names of each Twitter user into individual words and then attaching a gender to a word if it matched one of the names in the UK processed data. The gender that was assigned to the earliest word of their name was used. Those who were not assigned a gender were classed as unknown. This was either due to the user being an organisation - e.g. a school - as opposed to an individual; their name being gender ambiguous e.g. Alex, or the Twitter user did not use their name in the name section.

In order to explore the homophily effects, we then created an exponential –family random graph model (Snijder et al., 2006) for each of the 4 networks. These models are often used to investigate the mechanisms of link formations in the networks based on some features or terms. The features specify networks statistics that are sufficient to represent probability distributions over the space of networks of the same size.

For our features, we have chosen the number of edges (*edges*), the tendency to reciprocate edges (*mutual*), the tendency to create an edge with a node with the same gender (*nodematch gen-U, gen-F* and *gen-M* for unknown, female and male gender respectively), and the expected number of edges for each possible number of shared partners (*gwesp*). Monte-Carlo maximum likelihood estimation is then run in statnet, R package (Handcock et al., 2003), and we checked the goodness of fit of other network statistics that were not put in the model (minimum geodesic distance, in and out degree distribution), which was satisfying for each of the models. The results over all networks show significant effects for homophily based on gender (including positive tendency of Twitter users of unknown gender to send messages to other Twitter users of unknown gender). For all networks except for 'Maths' the highest coefficients for homophily were for users of unknown gender. For 'Maths ' though the highest propensity between same gender was for females choosing to message other females.

Figure 1: The largest connected component of 'English' network. The size of nodes is proportional to their centrality (current flow betweenness standardised score) . Red is for female, blue is for male, grey is for unknown.

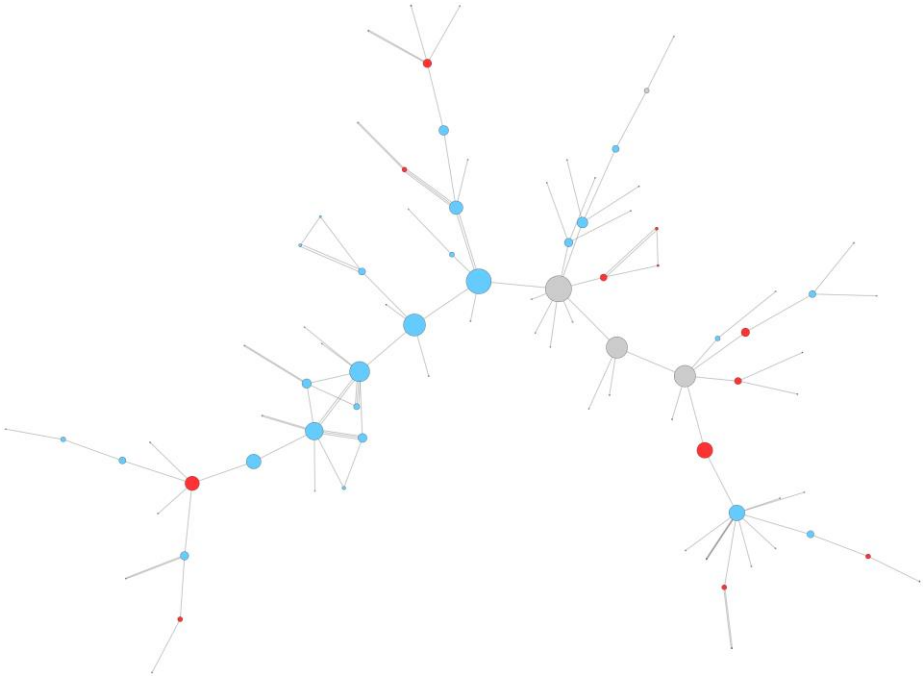

Figure 2: The largest connected component of 'GCSE' network, consisting of 86 nodes and 110 edges. The size of nodes is proportional to their centrality (current flow betweenness standardised score) . Red is for female, blue is for male, grey is for unknown.

Figure 3: The largest connected component of 'Maths' network. The size of nodes is proportional to their centrality (current flow betweenness standardised score) . Red is for female, blue is for male, grey is for unknown

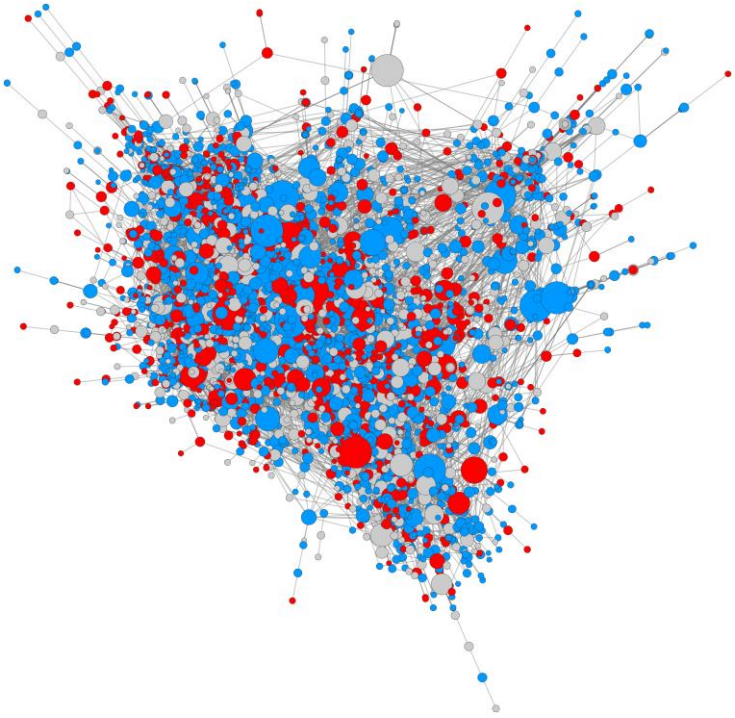

Figure 4: The largest connected component of 'Science' network. The size of nodes is proportional to their centrality (page rank score) . Red is for female, blue is for male, grey is for unknown

The mixing matrices for four networks are given in the Tables 2-5.

Table 5: The count of relationships cross-tabulated by gender in 'English' network.

From To	0	1	2	Total
0	227	79	269	575
1	188	157	348	693
2	418	207	1078	1703
Total	833	443	1695	2971

Table 6: The count of relationships cross-tabulated by gender in 'Maths' network.

From To	0	1	2	Total
0	35	21	67	123
1	42	81	109	232
2	57	34	181	272
Total	134	136	357	627

Table 7: The count of relationships cross-tabulated by gender in 'Science' network.

From To	0	1	2	Total
0	1164	595	1652	3411
1	884	946	1718	3548
2	1442	977	4160	6579
Total	3490	2518	7530	13538

Table 8: The count of relationships cross-tabulated by gender in 'GCSE' network.

From To	0	1	2	Total
0	5	2	3	10
1	4	9	9	22
2	9	11	43	63
Total	18	22	55	95

6. Sentiment Analysis

To assess the difference in attitudes towards STEM subjects at GCSE level between genders, we also ran all the Tweets through SentiStrength, a piece of software that detects the sentiment

of some given text, and then assigns it a positive and negative score: 1 to 5 for positive and -1 to -5 for negative. These scores were used to create an average sentiment for each tweet by calculating the mean of these two scores.

Linear regression results (reported in tables 13-15 below) indicate that:

- Both male and unknown users tweet significantly more positively than female users, and
- when concentrating on the subsets GCSE Maths, GCSE Science and GCSE English we could find no significant difference between female, male and unknown in regards to sentiment towards the subjects; however
- both males and unknowns tweet more positively about science in general than females.

Table 9: Sentiment towards GCSEs and Maths

	GCSE	***Maths***	***GCSE Week 1***	***GCSE Week 2***
Average Female Sentiment	0.189722	0.1442858	0.024131	0.01740
Male	-0.001841 [0.019435]	-0.0877903*** [0.0117994]	-0.011114 [0.014268]	0.03509* [0.01525]
Unknown	0.093983*** [0.018908]	-0.0004609 [0.0119916]	0.051734*** [0.012628]	0.06628*** [0.01324]

Standard errors in brackets Signif. codes: 0<'***'<0.001<'**' 0.01<'*'<0.05

Table 10: GCSE combined results

	GCSE Weeks 1&2	***GCSE & GCSE Weeks 1&2***
Average Female Sentiment	0.008918	0.059251
Male	0.008697 [0.011512]	-0.020008* [0.008158]
Unknown	0.056347*** [0.010161]	0.038307*** [0.007785]

Standard errors in brackets Signif. codes: 0<'***'<0.001<'**' 0.01<'*'<0.05

Table 11: Sentiment towards subjects

	GCSE Maths	*GCSE Science*	*GCSE English*
Average Female Sentiment	-0.06975	-0.03048	-0.05437
Male	0.02494 [0.03078]	0.11271* [0.04849]	-0.02265 [0.03094]
Unknown	0.02970 [0.02685]	0.09286* [0.04370]	0.03813 [0.02746]

Standard errors in brackets Signif. codes: 0<'***'<0.001<'**' 0.01<'*'<0.05

6. Conclusions

As social media continues to grow amongst every younger children, concerns have arisen in relation to its effects on children and teenagers (Twenge, 2017), and debates are focusing on the right amount of exposure as well as to how to use this medium to encourage positive attitudes and behaviours. Here we have modelled social media participation and use and addressed the effect of social media on teen beliefs about education, particularly to assess the extent to which gender stereotypical beliefs about education and related choices may be transmitted through them. Both beliefs and labour market outcomes differ substantially by gender in the general populations, and here we have attempted to focus on the effect of social media, a growing channel of influence on teenagers' beliefs, on girls' beliefs about GSCEs exams in maths and science. Making use of a representative sample of the UK population of 10-15 year olds, we have shown that social media use has an effect on beliefs about education, family formation and the labour market, and this is gendered and mediated by parental time investments. Making use of a sample of Twitter data specifically discussing GSCEs exams, we have then identified some strong and significant gender differences in the way communication is conducted, particularly around maths, and a strong tendency for gender based homophily in communication which could reinforce gender stereotyping or quite simply spreading more anxious or negative moods amongst girls than boys. Sentiment analysis on our Twitter sample finds that there are gender differences in sentiment, particularly in sceince, and that boys are more positive about all exams than girls.

Further work is needed in order to ascertain how the sentiment transmitted through the tweets may potentially affect both girls' and boys' exams beliefs and their interest in continuing the subjects once they have passed them, but we believe we have shown a potentially important avenue of research into the formation and updating of teenagers beliefs, which could have powerful policy implications in terms of the kind of communication campaigns that can be run to encourage wider engagement with STEM subjects by girls, as well as uptake of education more generally.

This suggests both that there may be thresholds for healthy social media participation and that as social media begins to be fruitfully used for interventions in health (Chang et al, 2014; Cavallo et al, 2013; DeAndrea et al., 2012), it may be possible to devise targeted counter-stereotypical messages to be delivered at critical exam times and assess their effect on teenagers moods and exam performance.

References

Akerlof, G.A. and D.J. Snower 'Bread and Bullets' Journal of Economic Behavior & Organization 126 (2016) 58–71

Alan, S., Baydar, N., Boneva, T., Crossley, T.F. and Ertac, S., 2017. Transmission of risk preferences from mothers to daughters. *Journal of Economic Behavior & Organization*, *134*, pp.60-77.

Alan, S., Ertac, S., I .Mumcu 2017.Gender Stereotypes in the Classroom and Effects on Achievement.

Alesina, A., Algan, Y., Cahuc, P. and Giuliano, P., 2015. Family values and the regulation of labor. *Journal of the European Economic Association*, *13*(4), pp.599-630.

Anders, J. The link between household income, university applications and university attendance. Fiscal Studies 2012, 33, 185–210.

Anders, J. and John Micklewright (2015) Teenagers' Expectations of Applying to University: How do they Change? Educ. Sci. 2015, 5, 281–305;

Andres, L., Anisef, P., Krahn, H., Looker, D. and Thiessen, V., 1999. The persistence of social structure: Cohort, class and gender effects on the occupational aspirations and expectations of Canadian youth. *Journal of youth studies*, *2*(3), pp.261-282.

Attanasio, O. and Kaufmann, K., 2009. *Educational choices, subjective expectations, and credit constraints* (No. w15087). National Bureau of Economic Research.

Black, Sandra E. & Devereux, Paul J. & Salvanes, Kjell G., 2009. "Like father, like son? A note on the intergenerational transmission of IQ scores," Economics Letters, Elsevier, vol. 105(1), pages 138-140, October

Bond RM[1], Fariss CJ, Jones JJ, Kramer AD, Marlow C, Settle JE, Fowler JH. (2012) A 61-million-person experiment in social influence and political mobilization. Nature. 2012 Sep 13;489(7415):295-8. doi: 10.1038/nature11421.

Bordalo, P., Coffman, K., Gennaioli, N. and Shleifer, A., 2016. Stereotypes. *The Quarterly Journal of Economics*, *131*(4), pp.1753-1794.

Bordalo, P., Coffman, K., Gennaioli, N. and Shleifer, A., 2016. Beliefs about Gender NBER Working Paper No. 22972

Brandes, U. and Thomas Erlebach (2005) Network Analysis: Methodological Foundations (Lecture Notes in Computer Science), Springer-Verlag New York

Briggs, Jacqui (2017) : "Young people and political participation: teen players." Palgrave MacMillan UK

Calvo-Armegol, A. E. Patacchini and Y. Zenou (2009)Peer Effects and Social Networks in Education Review of Economic Studies, 2009, 76, 1239-1267

Ceci, S. and Williams, W.M. (2010) The mathematics of sex: how biology and society conspire to limit talented women and girls, Oxford, New York: Oxford University Press.

Centola, D. (2010) The spread of behavior in an online social network experiment. Science. 2010 Sep 3;329(5996):1194-7. doi: 10.1126/science.1185231.

Chang, S.M., Lin, Y.H., Lin, C.W., Chang, H.K. and Chong, P.P., 2014. Promoting positive psychology using social networking sites: A study of new college entrants on Facebook. *International journal of environmental research and public health*, *11*(5), pp.4652-4663.

Charlton, N., Singleton, C., Vukadinović Greetham, D. (2016) "In the mood: the dynamics of collective sentiments on Twitter", Royal Society Open Science 2016 3 160162; DOI: 10.1098/rsos.160162.

Chowdry, H., Crawford, C., Dearden, L., Goodman, A. and Vignoles, A., 2013. Widening participation in higher education: analysis using linked administrative data. *Journal of the Royal Statistical Society: Series A (Statistics in Society)*, *176*(2), pp.431-457.

Coffman, K.B., 2014. Evidence on self-stereotyping and the contribution of ideas. *The Quarterly Journal of Economics*, *129*(4), pp.1625-1660.

Corazzini, L. F. Pavesi, B. Petrovich and L. Stanca (2010) An Experiment on Persuasion Bias in Social Networks

DeAndrea, D David C.; Ellison, Nicole B.; LaRose, Robert; Steinfield, Charles; Fiore, Andrew Serious Social Media: On the Use of Social Media for Improving Students' Adjustment to College *Internet and Higher Education*, v15 n1 p15-23 Jan 2012

De Choudhury, M., Gamon, M., Counts, S. and Horvitz, E., 2013. Predicting Depression via Social Media. *ICWSM*, *13*, pp.1-10.

DellaVigna, Stefano and Ethan Kaplan. "The Fox News Effect: Media Bias and Voting." Quarterly Journal of Economics 122 (August 2007): 1187-1234.

Eckel, C. C. and F¨ullbrunn, S. C. (2015). Thar SHE Blows? Gender, Competition, and Bubbles in Experimental Asset Markets. *American Economic Review*, 105(2):906–20.

Erasmus P. (2013) Relationship between emotional intelligence, study orientation in maths and maths achievement of middle adolescent boys and girls Proceeding of the Global Summit on Education (GSE2013)

Favara, M (2012) The Cost of Acting "Girly": Gender Stereotypes and Educational Choices IZA Discussion Paper No. 7037.

Figlio, D. (2005). Names, expectation and the black-white test score gap. *NBER Working Paper*, 11195.

Filippin, Antonio and Paccagnella, Marco, Family Background, Self-Confidence and Economic Outcomes (July 26, 2012). Bank of Italy Temi di Discussione (Working Paper) No. 875.

Gennaioli, N. and Shleifer, A., 2010. What comes to mind. *The Quarterly journal of economics*, *125*(4), pp.1399-1433.

Guiso, L. F Monte, P. Sapienza and L. Zingales (2008) Culture, Gender, and Math S*cience* 30 May 2008: Vol. 320, Issue 5880, pp. 1164-1165

Honeycutt C. and S. C. Herring (2009) "Beyond microblogging: Conversation and collaboration via Twitter". In Proceedings of the Forty-Second Hawai'i International Conference on System Sciences, Los Alamitos, 2009.

Holme, P. (2015) "Modern temporal network theory: a colloquium", Eur. Phys. J. B 88: 234. https://doi.org/10.1140/epjb/e2015-60657-4

Handcock, Mark S. David R. Hunter, Carter T. Butts, Steven M. Goodreau, and Martina Morris (2003).statnet: Software tools for the Statistical Modeling of Network Data.

Institute of Physics (2013) Closing Doors: Exploring gender and subject choice in schools, http://tinyurl.com/IoP-girls

Jacob, B.A. and Wilder, T., 2010. *Educational expectations and attainment* (No. w15683). National Bureau of Economic Research.

Jerrim, J., 2011. *Disadvantaged childrenâ€™s``low"educational expectations: Are the US and UK really so different to other industrialized nations?* (No. 11-04). Department of Quantitative Social Science-UCL Institute of Education, University College London.

Johnston, David W. & Stefanie Schurer & Michael A. Shields, 2014. "Maternal gender role attitudes, human capital investment, and labour supply of sons and daughters," Oxford Economic Papers, Oxford University Press, vol. 66(3), pages 631-659.

Jussim,L. and K.D. Harber, (2005). 'Teacher Expectations and Self-Fulfilling Prophecies: Knowns and Unknowns, Resolved and Unresolved Controversies' *Personality and Social Psychology Review* 9 (2): 131–155.

Khoo, Siek Toon and Ainley, John, "Attitudes, intentions and participation" (2005). LSAY Research Reports. Longitudinal surveys of Australian youth research report ; n.41 http://research.acer.edu.au/lsay_research/45

McPherson, M. Lynn Smith-Lovin, and James M Cook (2001): Birds of a Feather: Homophily in Social Networks, Annual Review of Sociology, Vol. 27: 415 -444

Mundlak, Y. (1978) On the pooling of time series and cross section data. *Econometrica*, 46, 69-85.

Newman, Mark E.J. (2005): A measure of betweenness centrality based on random walks. Social Networks, Volume 27, Issue 1, Pages 39–54

Ofcom, 2016 Children and Parents Media Use and Attiftudes report 2016 https://www.ofcom.org.uk/research-and-data/media-literacy-research/childrens/children-parents-nov16

Oxoby, R.J., 2014. Social inference and occupational choice: Type-based beliefs in a Bayesian model of class formation. *Journal of Behavioral and Experimental Economics*, *51*, pp.30-37.

Pramanik S, Wang Q, Danisch M, Bandi S, Kumar A, Guillaume JL, Mitra B (2016) On the role of mentions on tweet virality. In: The 3rd IEEE international conference on data science and advanced analytics (DSAA)

Quercia, D. L. Capra, and J. Crowcroft.(2012), "The social world of Twitter: Topics, geography, and emotions". In The 6th international AAAI Conference on weblogs and social media, Dublin, 2012

Rampino, T. and Taylor, M.P., 2013. *Gender differences in educational aspirations and attitudes* (No. 2013-15). ISER Working Paper Series.

Rosenthal, R. & Jacobson, L. (1968). *Pygmalion in the classroom*. Holt, Rinehart and Winston: New York.

Sacerdote, Bruce (2014) Experimental and Quasi-Experimental Analysis of Peer Effects: Two Steps Forward? Annual Review of Economics Vol. 6: 253-

Šćepanović, S. ,Mishkovski, I. , Gonçalves, B., Hieu Nguyen, T., Hui, P. (2017) "Semantic homophily in online communication: Evidence from Twitter", In Online Social Networks and Media, Volume 2, 2017, Pages 1-18, ISSN 2468-6964, https://doi.org/10.1016/j.osnem.2017.06.001.

Schmader, T., 2010. Stereotype threat deconstructed. *Current Directions in Psychological Science*, *19*(1), pp.14-18.

Schone, Pal, von Simson, Kristine and Strøm, Marte, (2017), Girls Helping Girls: The Impact of Female Peers on Grades and Educational Choices, No 10586, IZA Discussion Papers, Institute for the Study of Labor (IZA), https://EconPapers.repec.org/RePEc:iza:izadps:dp10586.

Smith, C. and Golding, J. (2015) Gender and participation in Mathematics and Further Mathematics: Interim Report for the Further Mathematics Support Programme, IoE UCL, http://tinyurl.com/ FM-Smith-Golding

Snijders, T. A. B.; Pattison, P. E.; Robins, G. L. (2006). New specifications for exponential random graph models. Sociological Methodology 36: 99–153.

Sprietsma, M. (2009). Discrimination in grading? Experimental evidence from primary school. ZEW Discussion Paper, 09-074.

Twenge, J.M. (2017) *IGen* New York: Atria Books.

Twenge, J.M., Carter, N.T. and Campbell, W.K., 2017. Age, time period, and birth cohort differences in self-esteem: Reexamining a cohort-sequential longitudinal study. *Journal of personality and social psychology*, *112*(5), p.e9.

Vukadinovic Greetham, D. and Ward, J. A. (2014) *Conversations on Twitter: structure, pace, balance.* In: 2nd International Workshop on Dynamic Networks and Knowledge Discovery (DyNaK II), 15 September 2014, Nancy, France. (ISSN 1613-0073)

Wu, S. J. M. Hofman, W. A. Mason, and D. J. Watts (2011). Who says what to whom on Twitter. In Proceedings of the 20th International Conference on World Wide Web, WWW '11, pages 705–714, New York, NY, USA, 2011. ACM.

Wu Youyou, W., M. Kosinski, and D. Stillwell Computer-based personality judgments are more accurate than those made by humans PNAS 2015 112 (4) 1036-1040;

Zumbühl, Maria & Dohmen, Thomas & Pfann, Gerard A., 2013. "Parental Investment and the Intergenerational Transmission of Economic Preferences and Attitudes," IZA Discussion Papers 7476, Institute for the Study of Labor (IZA).

Appendix

Table a1. Importance of doing well by Age and Gender

	Age						
	10	11	12	13	14	15	Total
Boys (no obs)	*1,278*	*1,379*	*1,384*	*1,458*	*1,423*	*1,362*	*8,284*
very important	68.08	72.44	76.59	78.26	78	75.26	74.9
Important	27.39	23.86	20.38	19.55	19.47	22.47	22.08
not very important	2.74	2.39	1.81	1.58	1.83	1.47	1.96
not at all important	1.8	1.31	1.23	0.62	0.7	0.81	1.06
Girls (no obs)	*1,256*	*1,347*	*1,430*	*1,422*	*1,447*	*1,430*	*8,332*
very important	76.11	80.18	79.58	80.73	79.82	76.15	78.8
Important	20.7	18.86	18.95	18.35	18.45	22.24	19.58
not very important	2.23	0.82	0.98	0.7	1.45	1.26	1.22
not at all important	0.96	0.15	0.49	0.14	0.28	0.35	0.38

What they would Like to Do Age 16

	Age						
	10	11	12	13	14	15	Total
Boys (no obs)	*598*	*640*	*699*	*727*	*781*	*748*	*4,193*
Get a full time job	23.08	19.06	18.17	14.31	11.14	9.09	15.41
Study full time	52.34	61.56	61.8	68.91	71.45	74.33	65.68

Get an apprenticeship/training	13.**88**	12.03	13.16	11.83	14.21	14.44	13.28
Something else	10.7	7.34	6.87	4.95	3.2	2.14	5.63
Girls (no obs)	*595*	*638*	*721*	*742*	*766*	*792*	*4,254*
Get a full time job	14.29	13.48	8.88	6.47	4.31	4.42	8.25
Study full time	72.44	72.26	80.58	81.94	84.6	86.74	80.3
Get an apprenticeship/training	5.88	8.31	7.49	8.76	8.62	7.07	7.73
Something else	7.39	5.96	3.05	2.83	2.48	1.77	3.71

Table a2. Top 10 occupations at 10 and at 15, boys and girls

Boys	10	Boys	15
Sports players	24.81	NCOs and other ranks	6.71
Police officers (sergeant and below)	5.94	Police officers (sergeant and below)	4.15
NCOs and other ranks	3.96	Sports players	3.67
Actors, entertainers and presenters	3.04	Medical practitioners	3.35
Natural and social science professional	2.74	Metal working production and maintenanc	3.35
Animal care services occupations n.e.c.	2.59	Legal professionals n.e.c.	3.04
Product, clothing and related designers	2.28	Secondary education teaching profession	2.88
Aircraft pilots and flight engineers	2.28	Musicians	2.72
Construction and building trades n.e.c.	2.28	Electricians and electrical fitters	2.72
Mechanical engineers	2.13	Programmers and software development pr	2.56

Girls	10	Girls	15
Veterinarians	8.57	Primary and nursery education teaching	6.3
Hairdressers and barbers	8.4	Hairdressers and barbers	5.59
Actors, entertainers and presenters	7.58	Actors, entertainers and presenters	4.01
Primary and nursery education teaching	7.41	Medical practitioners	3.58
Medical practitioners	6.43	Journalists, newspaper and periodical e	3.3
Animal care services occupations n.e.c.	5.11	Product, clothing and related designers	3.15
Product, clothing and related designers	4.61	Veterinarians	2.87
Sports players	4.12	Legal professionals n.e.c.	2.87
Authors, writers and translators	3.29	Beauticians and related occupations	2.87
Beauticians and related occupations	3.29	Secondary education teaching profession	2.72

Table a3. Beliefs about education

	FT Study at 16
Average Probability	
Hours spent on social media (none)	
Less than an hour	-0.155**
	[0.067]
1-3 hours	-0.134*
	[0.081]
4+ hours	-0.091
	[0.117]
Female	0.358***
	[0.058]

White	-0.034
	[0.117]
Age	0.156***
	[0.020]
Religion (ref; none)	
Christian	0.004
	[0.053]
Other	0.142
	[0.121]
Parent and Family Background	
Family situation (both natural parents)	
Step family	0.011
	[0.322]
Single parent	-0.125
	[0.250]
No of older sibling	-0.098
	[0.228]
No of younger siblings	-0.083
	[0.151]
Parents socio-economic class (ref: Routine and manual)	
Managerial and professional	0.048
	[0.136]
Associate professional	0.095
	[0.156]
Never worked/long term unemployed	0.050
	[0.148]
Equivalised monthly HH income ('000)	0.067
	[0.044]
Mother work	-0.024
	[0.100]

Mother's attitude to family life	0.068
	[0.079]
Mother has degree	0.238***
	[0.069]
Mother's age	0.004
	[0.006]
Parent's Investment	
Youth Activities	
Adults takes youth to sporting events (often/sometimes)	0.147
	[0.103]
Adults takes youth to museums/theatre(often/sometimes)	-0.092
	[0.092]
Adults discuss books with youth (often/sometimes)	-0.008
	[0.072]
Youth plays a musical instrument	-0.034
	[0.077]
Number of days eat meal with family	0.066*
	[0.034]
Parents very interested in child's education	-0.033
	[0.117]
Relationship with parents	
Argue with parents	0.109
	[0.074]
Talk to parents	-0.100
	[0.078]
Happiness with family (1 to 7)	-0.062*
	[0.033]
Non-cognitive skills	
SDQ subscales	
Internalising Problems	0.001
	[0.020]

Externalising problems	-0.052*
	[0.028]
Pro-social behaviour	0.010
	[0.026]
Self esteem	-0.009
	[0.012]
Happiness with School work (1 to 7)	0.076***
	[0.025]
Observations	5,076

Standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

Includes controls for wave, missing race and means of time varying variables

Table a4. Beliefs about marriage

	Under 25	25-29	30+	Not marry
Hours spent on social media (none)				
Less than an hour	0.037	0.021	-0.032	-0.026
	[0.031]	[0.033]	[0.029]	[0.020]
1-3 hours	0.048	0.027	-0.033	-0.042*
	[0.036]	[0.038]	[0.034]	[0.022]
4+ hours	0.129**	-0.063	-0.014	-0.052*
	[0.058]	[0.053]	[0.056]	[0.028]
Female	0.020	0.076***	-0.076***	-0.021*
	[0.018]	[0.021]	[0.016]	[0.012]
White	0.046	-0.023	-0.030	0.007
	[0.036]	[0.040]	[0.031]	[0.022]
Age	-0.016**	0.017**	0.002	-0.003
	[0.007]	[0.008]	[0.006]	[0.004]

Religion (ref; none)				
Christian	0.037**	0.014	-0.022	-0.030***
	[0.017]	[0.019]	[0.015]	[0.011]
Other	0.126***	-0.032	-0.087***	-0.008
	[0.042]	[0.044]	[0.027]	[0.025]
Parent and Family Background				
Family situation (both natural parents)				
Step family	0.029	-0.144	0.196	-0.081**
	[0.110]	[0.116]	[0.120]	[0.037]
Single parent	-0.013	-0.084	0.114	-0.017
	[0.079]	[0.094]	[0.083]	[0.051]
No of older sibling	0.001	0.027	-0.041	0.013
	[0.062]	[0.076]	[0.056]	[0.036]
No of younger siblings	-0.017	-0.046	-0.015	0.079***
	[0.048]	[0.053]	[0.040]	[0.028]
Parents socio-economic class (ref: Routine and manual)				
Managerial and professional	0.013	-0.030	-0.009	0.025
	[0.056]	[0.066]	[0.053]	[0.028]
Associate professional	0.027	-0.062	-0.001	0.036
	[0.061]	[0.069]	[0.053]	[0.035]
Never worked/long term unemployed	-0.032	-0.090	-0.022	0.144**
	[0.055]	[0.070]	[0.050]	[0.058]
Equivalised monthly HH income ('000)	-0.006	0.023	-0.019	0.002
	[0.017]	[0.019]	[0.015]	[0.012]
Mother work	-0.014	-0.042	0.010	0.047*
	[0.040]	[0.045]	[0.035]	[0.026]
Mother's attitude to family life	0.030	-0.012	-0.027	0.009
	[0.032]	[0.036]	[0.027]	[0.019]
Mother has degree	0.023	-0.019	0.003	-0.008

	[0.020]	[0.023]	[0.017]	[0.013]
Mother's age	-0.002	-0.003*	0.003*	0.003***
	[0.002]	[0.002]	[0.002]	[0.001]
Parent's Investment				
Youth Activities				
Adults takes youth to sporting events (often/sometimes)	0.011	-0.025	-0.003	0.017
	[0.040]	[0.045]	[0.035]	[0.025]
Adults takes youth to museums/theatre(often/sometimes)	-0.021	0.024	-0.020	0.018
	[0.035]	[0.039]	[0.031]	[0.021]
Adults discuss books with youth (often/sometimes)	-0.084***	-0.001	0.044*	0.041**
	[0.027]	[0.031]	[0.024]	[0.017]
Youth plays a musical instrument	-0.004	0.040	-0.039	0.003
	[0.029]	[0.034]	[0.026]	[0.018]
Number of days eat meal with family	-0.008	0.004	0.003	0.001
	[0.016]	[0.018]	[0.013]	[0.010]
Parents very interested in child's education	0.021	-0.029	0.022	-0.014
	[0.039]	[0.045]	[0.035]	[0.023]
Relationship with parents				
Argue with parents	-0.001	0.033	-0.015	-0.016
	[0.027]	[0.030]	[0.023]	[0.016]
Talk to parents	-0.021	-0.025	0.014	0.032*
	[0.028]	[0.031]	[0.024]	[0.017]
Happiness with family (1 to 7)	-0.008	0.013	0.004	-0.009
	[0.014]	[0.016]	[0.012]	[0.007]
Non-cognitive skills				
SDQ subscales				
Internalising Problems	-0.003	-0.001	0.007	-0.003
	[0.007]	[0.008]	[0.006]	[0.004]
Externalising problems	0.007	0.002	-0.017**	0.008

	[0.009]	[0.010]	[0.008]	[0.006]
Pro-social behaviour	0.005	-0.006	0.009	-0.008
	[0.010]	[0.011]	[0.008]	[0.006]
Self esteem	-0.002	0.000	0.000	0.001
	[0.002]	[0.002]	[0.002]	[0.001]
Happiness with School work (1 to 7)	0.010	0.005	-0.006	-0.009
	[0.011]	[0.013]	[0.010]	[0.007]
Observations	3,099	3,099	3,099	3,099

Standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

Includes controls for wave, missing race and means of the time varying variables

Table a5. Beliefs about parenthood

	Under 25	25-29	30+	No children
Hours spent on social media (none)				
Less than an hour	0.024*	0.050***	-0.014	-0.060***
	[0.013]	[0.018]	[0.016]	[0.012]
1-3 hours	0.046***	0.044**	-0.037**	-0.054***
	[0.015]	[0.020]	[0.019]	[0.014]
4+ hours	0.092***	0.016	-0.057**	-0.051***
	[0.022]	[0.028]	[0.028]	[0.019]
Female	0.036***	0.101***	-0.142***	0.005
	[0.012]	[0.016]	[0.015]	[0.011]
White	0.024	-0.077**	0.016	0.036
	[0.026]	[0.031]	[0.031]	[0.023]
Age	-0.008**	0.032***	-0.017***	-0.006*
	[0.004]	[0.005]	[0.005]	[0.004]
Religion (ref; none)				

Christian	0.001	0.015	0.008	-0.024**
	[0.011]	[0.015]	[0.014]	[0.010]
Other	0.013	0.005	-0.034	0.016
	[0.029]	[0.035]	[0.033]	[0.028]
Parent and Family Background				
Family situation (both natural parents)				
Step family	0.031*	-0.041*	0.009	0.002
	[0.018]	[0.024]	[0.024]	[0.015]
Single parent	0.003	-0.035*	0.021	0.010
	[0.016]	[0.021]	[0.020]	[0.014]
No of older sibling	-0.001	-0.001	0.001	0.002
	[0.007]	[0.010]	[0.009]	[0.006]
No of younger siblings	0.014*	0.023**	-0.032***	-0.005
	[0.008]	[0.010]	[0.009]	[0.007]
Parents socio-economic class (ref: Routine and manual)				
Managerial and professional	-0.018	0.012	0.014	-0.009
	[0.016]	[0.021]	[0.020]	[0.014]
Associate professional	-0.035**	0.007	0.028	0.000
	[0.016]	[0.022]	[0.022]	[0.014]
Never worked/long term unemployed	0.025	-0.074***	0.020	0.029
	[0.019]	[0.024]	[0.025]	[0.018]
Equivalised monthly HH income ('000)	-0.014**	-0.002	0.025***	-0.008
	[0.007]	[0.007]	[0.006]	[0.005]
Mother work	0.011	-0.040**	0.018	0.010
	[0.014]	[0.019]	[0.017]	[0.013]
Mother's attitude to family life	-0.016**	0.012	0.002	0.002
	[0.007]	[0.010]	[0.009]	[0.006]
Mother has degree	-0.020	0.002	0.032**	-0.013

	[0.015]	[0.018]	[0.016]	[0.013]
Mother's age	-0.008***	-0.006***	0.015***	-0.001
	[0.001]	[0.001]	[0.001]	[0.001]
Parent's Investment				
Youth Activities				
Adults takes youth to sporting events (often/sometimes)	0.034**	-0.004	-0.003	-0.028*
	[0.017]	[0.021]	[0.019]	[0.014]
Adults takes youth to museums/theatre(often/sometimes)	-0.019	0.016	0.011	-0.008
	[0.016]	[0.020]	[0.018]	[0.013]
Adults discuss books with youth (often/sometimes)	-0.035***	-0.040***	0.055***	0.020**
	[0.012]	[0.015]	[0.014]	[0.010]
Youth plays a musical instrument	-0.020*	0.013	0.005	0.001
	[0.011]	[0.015]	[0.014]	[0.010]
Number of days eat meal with family	-0.004	-0.005	0.008	0.001
	[0.006]	[0.007]	[0.007]	[0.005]
Parents very interested in child's education	-0.019	0.017	0.017	-0.015
	[0.014]	[0.021]	[0.020]	[0.012]
Relationship with parents				
Argue with parents	-0.018*	-0.004	0.015	0.007
	[0.010]	[0.014]	[0.013]	[0.010]
Talk to parents	0.014	0.001	-0.007	-0.009
	[0.011]	[0.014]	[0.013]	[0.010]
Happiness with family (1 to 7)	0.000	0.005	-0.000	-0.005
	[0.006]	[0.008]	[0.007]	[0.005]
Non-cognitive skills				
SDQ subscales				
Internalising Problems	-0.000	-0.005	0.003	0.003
	[0.002]	[0.003]	[0.003]	[0.002]

Externalising problems	0.005	0.000	-0.006	0.001
	[0.003]	[0.004]	[0.004]	[0.002]
Pro-social behaviour	0.004	0.001	0.005	-0.010***
	[0.003]	[0.004]	[0.004]	[0.003]
Self esteem	-0.003*	0.003	0.001	-0.001
	[0.002]	[0.002]	[0.002]	[0.002]
Happiness with School work (1 to 7)	-0.007*	-0.005	0.018***	-0.005
	[0.004]	[0.007]	[0.006]	[0.004]
Observations	5,082	5,082	5,082	5,082

Standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

Includes controls for wave, missing race

Table a6. Beliefs about Occupation

	Managerial and other professionals	STEM professionals	Health professionals	Education professionals	Associate professionals	Culture, media and sport	Other/none
Average Probability							
Hours spent on social media (none)							
Less than an hour	0.029	-0.021	0.014	0.031	0.010	-0.051	-0.011
	[0.021]	[0.018]	[0.025]	[0.019]	[0.024]	[0.031]	[0.030]
1-3 hours	0.047*	-0.010	-0.005	0.004	-0.004	0.003	-0.034
	[0.026]	[0.023]	[0.028]	[0.018]	[0.025]	[0.038]	[0.033]
4+ hours	-0.011	-0.020	0.028	0.015	-0.025	0.019	-0.006
	[0.029]	[0.032]	[0.048]	[0.030]	[0.036]	[0.059]	[0.049]
Female	-0.015	-0.085***	0.123***	0.074***	-0.147***	0.004	0.046***
	[0.013]	[0.012]	[0.016]	[0.013]	[0.016]	[0.019]	[0.018]
White	-0.036	0.003	-0.053*	0.190***	0.025	-0.068	-0.061
	[0.025]	[0.023]	[0.029]	[0.063]	[0.031]	[0.042]	[0.040]
Age	0.007	0.003	0.015**	0.007	0.007	-0.033***	-0.006
	[0.005]	[0.004]	[0.006]	[0.004]	[0.005]	[0.007]	[0.007]
Religion (ref; none)							
Christian	0.003	0.000	-0.017	0.011	-0.010	0.009	0.005

	[0.013]	[0.010]	[0.015]	[0.010]	[0.013]	[0.019]	[0.017]
Other	0.044	0.008	0.057	0.024	-0.017	-0.049	-0.067*
	[0.034]	[0.027]	[0.039]	[0.037]	[0.029]	[0.040]	[0.035]
Parent and Family Background							
Family situation (both natural parents)							
Step family	0.183	-0.119**	0.073	0.124	-0.045	-0.175**	-0.041
	[0.187]	[0.058]	[0.138]	[0.146]	[0.059]	[0.088]	[0.093]
Single parent	0.048	-0.112**	0.080	0.051	0.009	-0.129	0.053
	[0.087]	[0.055]	[0.099]	[0.077]	[0.066]	[0.084]	[0.100]
No of older sibling	0.053	0.014	0.032	-0.008	-0.043	0.030	-0.078
	[0.053]	[0.043]	[0.056]	[0.034]	[0.041]	[0.070]	[0.055]
No of younger siblings	0.037	-0.047	0.024	0.021	0.060	-0.039	-0.056
	[0.042]	[0.039]	[0.049]	[0.033]	[0.043]	[0.061]	[0.053]
Parents socio-economic class (ref: Routine and manual)							
Managerial and professional	0.030	-0.077	0.036	-0.056	-0.069	0.137**	-0.001
	[0.037]	[0.052]	[0.042]	[0.044]	[0.052]	[0.055]	[0.055]
Associate professional	0.047	-0.038	0.058	-0.063	-0.063	0.035	0.024
	[0.043]	[0.056]	[0.050]	[0.044]	[0.053]	[0.053]	[0.058]
Never worked/long term unemployed	0.061	-0.067	0.033	-0.033	-0.004	0.082	-0.073
	[0.058]	[0.053]	[0.048]	[0.048]	[0.060]	[0.062]	[0.050]

Equivalised monthly HH income ('000)	-0.017	-0.000	0.012	-0.006	0.005	0.016	-0.011
	[0.011]	[0.009]	[0.014]	[0.011]	[0.014]	[0.018]	[0.018]
Mother work	0.014	-0.046*	0.003	-0.008	0.006	0.026	0.005
	[0.031]	[0.026]	[0.035]	[0.023]	[0.031]	[0.044]	[0.039]
Mother's attitude to family life	0.013	-0.002	0.013	-0.010	-0.010	0.011	-0.015
	[0.028]	[0.021]	[0.031]	[0.025]	[0.028]	[0.039]	[0.035]
Mother has degree	0.045***	0.012	0.018	-0.008	-0.001	0.020	-0.088***
	[0.015]	[0.012]	[0.017]	[0.013]	[0.016]	[0.022]	[0.023]
Mother's age	-0.000	-0.001	0.001	0.002*	-0.001	0.000	-0.001
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.002]	[0.002]
Parent's Investment							
Youth Activities							
Adults takes youth to sporting events (often/sometimes)	0.032	-0.051	0.035	-0.009	0.019	0.040	-0.065
	[0.044]	[0.034]	[0.048]	[0.038]	[0.050]	[0.065]	[0.058]
Adults takes youth to museums/theatre(often/ sometimes)	-0.005	0.032	-0.034	-0.029	0.002	0.052	-0.018
	[0.038]	[0.028]	[0.040]	[0.033]	[0.041]	[0.056]	[0.050]
Adults discuss books with youth (often/sometimes)	-0.016	0.026	-0.023	0.027	-0.013	0.014	-0.015
	[0.030]	[0.024]	[0.033]	[0.026]	[0.032]	[0.044]	[0.039]

Youth plays a musical instrument	0.031	0.034	-0.032	-0.008	-0.013	-0.034	0.023
	[0.035]	[0.027]	[0.038]	[0.029]	[0.036]	[0.049]	[0.043]
Number of days eat meal with family	-0.009	-0.011	0.014	-0.002	-0.024**	0.023	0.009
	[0.012]	[0.010]	[0.014]	[0.010]	[0.011]	[0.017]	[0.015]
Parents very interested in child's education	-0.032	-0.023	0.020	0.028	-0.002	-0.013	0.023
	[0.027]	[0.019]	[0.032]	[0.023]	[0.024]	[0.037]	[0.034]
Relationship with parents							
Argue with parents	-0.010	-0.011	-0.005	0.007	0.009	-0.005	0.016
	[0.017]	[0.013]	[0.021]	[0.014]	[0.017]	[0.025]	[0.023]
Talk to parents	-0.010	0.017	0.011	-0.006	-0.013	0.006	-0.006
	[0.017]	[0.014]	[0.021]	[0.015]	[0.017]	[0.025]	[0.023]
Happiness with family (1 to 7)	-0.005	0.011	-0.000	0.003	0.007	-0.021	0.005
	[0.011]	[0.009]	[0.013]	[0.009]	[0.011]	[0.015]	[0.015]
Non-cognitive skills							
SDQ subscales							
Internalising Problems	0.008	-0.001	0.004	-0.003	0.007	-0.006	-0.009
	[0.005]	[0.004]	[0.005]	[0.004]	[0.005]	[0.007]	[0.006]
Externalising problems	-0.004	0.002	0.004	-0.002	0.001	-0.002	0.002
	[0.006]	[0.005]	[0.007]	[0.005]	[0.005]	[0.008]	[0.008]

Pro-social behaviour	-0.002	-0.004	0.001	-0.001	0.012**	0.009	-0.014*
	[0.006]	[0.005]	[0.008]	[0.006]	[0.006]	[0.009]	[0.008]
Self esteem	0.003*	0.000	0.003	0.001	-0.000	-0.002	-0.004*
	[0.002]	[0.001]	[0.002]	[0.001]	[0.002]	[0.002]	[0.002]
Happiness with School work (1 to 7)	0.014	0.000	-0.007	-0.002	-0.003	-0.008	0.005
	[0.010]	[0.007]	[0.011]	[0.007]	[0.008]	[0.012]	[0.011]
Observations	2,622	2,622	2,622	2,622	2,622	2,622	2,622

Standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

Includes controls for wave, missing race and means of time varying variables

Table 15: Monte Carlo MLE results for the 'Maths' network model. Significance codes are 0.001 for * ; 0.01 for **; 0.05 for ***

	Estimate	Std. error	p-value
edges	-10.11456	0.18029	1e-04 ***
mutual	2.04254	0.03878	1e-04 ***
nodematch gen-U	0.40759	0.05142	1e-04 ***
nodematch gen-F	0.42671	0.04207	1e-04 ***
nodematch gen-M	0.17750	0.02528	1e-04 ***
gwesp fixed 0.2	5.32135	0.13947	1e-04 ***

Table 16: Monte Carlo MLE results for the 'English' network model. Significance codes are 0.001 for * ; 0.01 for **; 0.05 for *English:**

	Estimate	Std. error	p-value
Edges	-7.89736	0.02151	1e-04 ***
mutual	-1.72823	0.04503	1e-04 ***
nodematch gen-U	0.89353	0.02859	1e-04 ***
nodematch gen-F	0.14760	0.03372	1e-04 ***
nodematch gen-M	0.05886	0.01468	1e-04 ***
gwesp fixed 0.2	4.31261	0.01533	1e-04 ***

Table 17: Monte Carlo MLE results for the 'Science' network model. Significance codes are 0.001 for * ; 0.01 for **; 0.05 for ***

	Estimate	Std. error	p-value
edges	-8.89681	0.01437	<1e-04 ***
mutual	4.74864	0.39808	<1e-04 ***
nodematch gen-U	0.48054	0.04208	<1e-04 ***
nodematch gen-F	0.29025	0.04250	<1e-04 ***
nodematch gen-M	0.29065	0.02746	<1e-04 ***
gwesp fixed 0.2	5.46952	0.03276	<1e-04 ***

Table 18: Monte Carlo MLE results for the 'GCSE' network model. Significance codes are 0.001 for * ; 0.01 for **; 0.05 for ***

	Estimate	Std. error	p-value
edges	-4.7815	0.1529	1e-04 ***
mutual	1.6136	0.5630	0.00417 **
nodematch gen-U	1.3145	0.3019	0 < 1e-04 ***
nodematch gen-F	0.6685	0.3235	0.03881
nodematch gen-M	0.4443	0.1949	0.02263 *
gwesp fixed 0.2	1.2153	0.2431	0 < 1e-04 ***