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Empathy or science? Empathy explains physical science enrollment for men and women

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ABSTRACT

Those in the physical sciences work to understand relationships among non-social entities and this may come at a cost to their understanding of social relationships. Alternatively, it could be that those in the physical sciences differ in how comfortable they feel in social situations. Prior research had been confined to looking at differences between particular subject majors (e.g., humanities) and physical sciences, leaving open the possibility that people choosing subjects like psychology or biology might differ on empathy. University students ($N = 404$) majoring in humanities, social science, life science, or physical science completed the empathy quotient (EQ). Confirmatory factor analysis showed three-factors of the EQ, and these were used in multinomial logistic regression. Empathy differences made a unique contribution to explaining subject major choice. We found that greater levels of empathy predicted membership in social and life sciences, while lower levels of empathy predicted physical sciences enrollment.

1. Introduction

People who study science have been described as lacking in empathy when compared to people who study humanities, possibly explaining the disparity between men and women's choices in science-related majors at university (Billington, Baron-Cohen, & Wheelwright, 2007; Lai et al., 2012; Wakabayashi, 2013). Early findings suggested that these gender differences were explained by women's academic performance (Cole, 1997; Rossi, 1965). However, more recent evidence from a sample of 127,000 undergraduate students has found that, regardless of performance, women majoring in science have a higher rate of switching their subject major within the first year when compared to men (Dickson, 2010; Seymour & Hewitt, 1997). Thus, we propose that the explanation is incomplete, such that prior research has failed to examine individual difference factors accounting for choice in subject major. For example, those in the physical sciences seek to understand relationships among non-social entities (Feist, 2013) and this may come at a cost to their empathic understanding of social relationships, suggesting an important role of empathy in subject major selection regardless of gender (Manson & Winterbottom, 2012). This begs the question as to whether individual difference factors, which typically differ between men and women (Moriguchi, Touroutoglou, Dickerson, & Barrett, 2014; Rubinstein, 2005; Thakkar et al., 2014; Thomson, 2015), could explain why women are underrepresented in specifically physical science majors? Furthermore, research is lacking in specifying the generalizability to all fields of science (Feist, 2013).

1.1. Gender and science

There is a lack of college enrollment into the sciences by females when compared to males (Beede et al., 2011; Chen & Weko, 2009; Le, Robbins, & Westrick, 2014; Miller, Slawinski Blessing, & Schwartz, 2006; O'Brien, Blodorn, Adams, Garcia, & Hammer, 2014). Gender associated variance in science achievement is what was primarily thought to prevent women from pursuing advanced degrees in the sciences (Katz, Allbritton, Aronis, Wilson, & Soffa, 2006). These differences may be seen as early as 8–9 years of age, subsequently increasing through middle and into high school (Beller & Gafni, 1996; Lindberg, Hyde, Petersen, & Linn, 2010). However, examining college grade point average in science between females and males revealed that performance was equal at the undergraduate level (Dickson, 2010; Glynn, Taasoobshirazi, & Brickman, 2007), which further supports evidence against the notion that women are less competent than men in science (see Brainard & Carlin, 1998; Bridgeman & Lewis, 1996; Gallagher & Kaufman, 2005; Hyde, Lindberg, Linn, Ellis, & Williams, 2008; Stewart, 1998). Arguably, there could be a mismatch between the learning environment women and men prefer and the learning environment associated with particular subject fields (Murphy, Steele, & Gross, 2007); women could then be pushed out of, or feel unwelcome in, the science classroom (Cheryan, Plaut, Davies, & Steele, 2009). Teachers may teach science in the traditional manner of approaching education from a logical perspective that is devoid of considering the

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importance of the socio-emotional climate in the classroom (Arghode, Yalvac, & Liew, 2013). Therefore, less empathic teaching environments may push away females from science subjects (Demetriou, Wilson, & Winterbottom, 2009) yet may facilitate male enrollment. Indeed, men make up the majority of those in the science and engineering profession (National Science Foundation [NSF], 2015). However, gender may not be as important as considering individual differences in empathy, such that those with higher empathy may gravitate toward particular subjects that, in the short-term of a university career, nurture cooperative learning and social interactions in the classroom. In the long-term of career-choice, achievement in particular subjects may rely on high levels of empathic responding (e.g., clinical application of science).

1.2. Empathy and science

Empathizing involves an ability to understand other people's mental states and emotions, and be interested in the social connection with others (Kim & Lee, 2010). The ability to empathize is of particular importance for those successfully pursuing medical and clinical careers (Barak, 1990; Hojat et al., 2002; Hojat et al., 2011;Lambert & Barley, 2001; Rosenfield & Jones, 2004). Furthermore, empathy has been shown to be associated with altruistic ethical decision-making (Brown, Sautter, Littvay, Sautter, & Bearnes, 2010; Schwarz, 2000), which may indeed influence an individual's career choice. While women have been reported to have higher levels of empathy than men (Manson & Winterbottom, 2012; Willer, Wimer, & Owens, 2015), research by Billington et al. (2007) provides strong evidence for a “brain type” (p. 263) in explaining choice in academic career. By classifying 415 undergraduate students by their empathizing and systemizing abilities, Billington et al. (2007) found that those enrolled in physical sciences exhibited low empathizing and high systemizing abilities, while the converse was true for those in humanities. These “brain types” were a stronger predictor than the individual's biological sex as a determinant of subject major enrollment. This may be explained by those majoring in humanities having a “people orientation” due to their higher levels of empathy (Feist, 2013). This “people orientation” stands in contrast to a “thing orientation” (Feist, 2006; Graziano, Habashi, & Woodcock, 2011; Prediger, 1982) characterizing those who study physical sciences (Feist, 2013). That is, those in the physical sciences reclusively work to understand relationships among non-social entities (Feist, 2013). Furthermore, as those studying physical sciences are shown to favor a systemizing thinking style over empathizing (Billington et al., 2007), this may impact the social environment for learners and educators in the physical sciences (Osborne & Dillon, 2008; Vedder-Weiss & Fortus, 2011). Science may be a solitary environment where investigations and writing are done alone and teaching styles are less person-centered (Vedder-Weiss & Fortus, 2011). Scientists have been found to prefer to be left alone (Feist, 2013; Wilson & Jackson, 1994). In fact, people in science related fields were more prone towards introversion rather than extraversion and being generally outgoing (Feist, 1998; Lounsbury et al., 2012). Thus, this focus toward solitary activities may stifle an interest in other people, possibly explaining empathy differences between physical science and other subjects; however, this may generalize to all science-related fields, which encourage similar types of activities.

1.3. Multidimensional structure of empathy

Present methods focusing on dispositional empathy tend to view it as a multidimensional concept made up of both cognition and emotion (Dadds et al., 2009; Davis, 1980). Recent research has shown it to be comprised of three distinct and equally important factors, cognitive, emotional reactivity (affective), and social skills (Allison, Baron-Cohen, Wheelwright, Stone, & Muncer, 2011; Berthoz, Wessa, Kedia, Wicker, & Grezes, 2008; Gronholm, Flynn, Edmonds, & Gardner, 2012; Lawrence, Shaw, Baker, Baron-Cohen, & David, 2004). The cognitive element of empathy has been described as the ability to which a person can identify with and understand another person's point of view (Baron-Cohen, 1995). The affective element has been described as the ability to which a person experiences feelings such as sympathy or concern. Dadds et al. (2009) refer to cognitive empathy as the difference between knowing the ‘how’ and ‘why’ of other people's feelings and affective empathy as ‘feeling’ the emotions of another person. In addition to these elements of understanding others' mental states, social skills relate to an individuals' behavior, in particular, their ability to interact within social situations. Further to the discussion on empathy and science, it could be that those in the physical sciences differ in how comfortable they feel in social situations, implicating the importance of measuring perception of social skills in addition to empathy. Indeed, a focus on solitary activities may limit exposure to social situations in which people learn to engage flexibly with others (see Feist, 2013). Thus, it could be that those in the physical sciences differ in how comfortable they feel in social situations. Yet research is lacking in examining the multidimensional structure of empathy with regard to humanities and the three main branches of science; social sciences, life sciences, and physical sciences (Feist, 2013).

2. Aims

Prior research has been confined to looking at differences between a particular subject area (e.g., humanities) and physical sciences. Thus, prior research neglects the possibility that people choosing subjects like psychology or biology might differ on empathy. For example, many of the social sciences and life sciences (e.g., psychology and biology) draw from a broad range of skills that integrate social studies and math/statistical enquiry, which may be related to a lack of empathy or social skills (Furnham & Crump, 2013). The aim of this study was to determine if empathy was a stronger predictor for subject major (physical science, life sciences, social sciences, and humanities) enrollment when compared to gender. Thus, it may be that women are less represented in the physical sciences, which may be due to their higher levels of empathy. Only by looking at the unique contribution of these factors, can possible explanations emerge. Furthermore, we examined the multidimensional structure of empathy using the empathy quotient (Baron-Cohen & Wheelwright, 2004), and used the resulting factors to statistically predict subject major.

3. Method

3.1. Participants

Students ($N = 404$, 51% male) were recruited from undergraduate prerequisite courses in philosophy, physics, and anthropology. The racial-ethnic identification of the participants were, 28.4% Caucasian, 25.2% Asian American, 22.5% Asian, 10% Pacific Islander/Native Hawaiian, 2.2% European, 2.9% Hispanic-American, 2% African-American, 1.2% Mexican/Central and South American, 0.7%, Middle Eastern, 0.5% Native American/Alaskan, 3.9% indicated more than two ethnicities and 0.5% failed to report. The average age was 22.09 ($SD = 6.14$). Students' year of study ranged from first year to fourth year.

3.2. Instrument

The empathy quotient (EQ) provides a total score from 40 items, which captures cognitive and affective empathy (Baron-Cohen & Wheelwright, 2004). The EQ has been established as the most comprehensible, reliable, and valid empathy scale to date. With a test–retest reliability of $r = .97$, and a Cronbach's alpha measured validity of .92, it scores well, and is ranked highly by other researchers in the field (Baron-Cohen & Wheelwright, 2004). Furthermore, the use of the Rasch model for analysis provides an excellent level of construct, with an item reliability of .99, and person reliability of .92 (Allison et al., 2011). The