## Quality Assurance in Education

A new factor in UK students' university attainment: the relative age effect reversal?

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# A new factor in UK students' university attainment: the relative age effect reversal?

## Introduction

The majority of education systems across the globe adopt age related cut-off points for eligibility. In the United Kingdom (UK) for example, entry to formal school education is compulsory once a child reaches four years of age. The admission date for reception (i.e., the first year of primary school) for most schools in the UK is September 1st (with the exception of Northern Ireland where it is July 1st and Scotland where it is 28th February). Therefore, in England and Wales children are required to have a chronological age of four years, before the September 1st cut-off date, in order to be eligible to begin school in that particular academic year. Consequently, children born in September can be up to twelve months older than peers in the same grade level born in August of the previous year. This variation in birth dates amongst children grouped in the same cohort is commonly referred to as the 'relative age' and its subsequent implications are known as 'relative age effects' (RAEs; Bell & Daniels, 1990; Musch & Grondin, 2001; Cobley, Abraham & Baker, 2008).

A number of possible reasons have been presented for the developmental delay in cognitive achievement amongst relatively younger children. As frontal cortex neurological development is reported to become more efficient with age (Martin, Foels, Clanton & Moon, 2004) one possible hypothesis relates to the standard educational procedure of annually age grouping children, even though neurologically and biologically they may be less developed by up to 9-12 months (Armstrong, 1966; Bell & Daniels, 1990; Bergund, 1967). A second hypothesis posited by Pellegrini (1992) is that children's social behaviour is a strong predictor of school achievement, and therefore the youngest child in a cohort may experience social constraints resulting in lower levels of self-esteem and reduced levels of task involvement. The magnitude of the age range and the observed differences in maturity status at the start of formal schooling has serious consequences for those relatively younger children. Evidence suggests relatively younger children perform less well in standardized tests (i.e. maths, reading, and writing) (Bedard & Dhuey, 2006; Elder & Lubotsky, 2009), are statistically at a greater risk of being referred to psychiatric support services (DiPasquale, Moule, & Flewelling, 1980; Menet, Eakin, Stuart & Rafferty, 2000), demonstrate significantly lower levels of cognitive achievement (Sprietsma, 2010), physical proficiency (McPhillips, Jordan-Black, 2009), are more likely to be diagnosed with moderate learning difficulties (Wilson, 2000), and in the USA there is a greater chance of repeating a year of formal schooling (Elder & Lubotsky, 2009).

Whilst the observed cognitive differences in academic performance between relatively older and relatively younger children is reported to be more pronounced at the primary age range (Bedard & Dhuey, 2006), these effects are reported to dissipate in magnitude upon the onset of puberty (i.e. 0.8 standard deviations to 0.2 standard deviations). If indeed relatively younger children experience discrimination at the primary age range but, as reported previously these inequalities decline over time then one could argue the implications for students in higher education may be minimal. However, if these relative (dis) advantages extend into adulthood there may well be serious implications for higher education and the wider economy (Bedard & Dhuey, 2006). According to Bedard & Dhuey (2006) "…early advantages held by relatively old children persist into adulthood through differences in skill accumulation, college preparation, and the accumulation of softer skills, such as leadership (p.1469

Despite the growing economic and educational literature surrounding RAEs (Bedard & Dhuey, 2006, Fredrikson & Ockert, 2006, Roberts & Fairclough, 2012) there is no conclusive answer as to how absolute age or relative age affects educational performance, presumably because relatively older children are also biologically more advanced when they experience events in the transition into adulthood (Dhuey & Lipscomb, 2010). To date there are only two studies which have examined the relative age phenomenon in a university setting specifically. A study conducted among 6, 237 Italian university students revealed how the relatively younger students performed slightly better than the relatively older students, however, the results were not statistically significant (Pellizzari & Billari, 2008). Billari & Pellizzari, (2008) reported how the relatively younger students appeared to lead less active social lives, and concluded that this afforded the younger students more time to study. More recently Wattie et al., (2012) examined whether RAEs affected the likelihood of enrolment into university sports science and kinesiology programs in Germany and England. The findings from this study revealed that relatively older students in Germany were more likely to enrol on a sports science programme, however, these findings were not replicated in a UK sample.

There is some evidence to suggest that relative age inequalities facilitate increased leadership qualities following graduation from university (Dixon, Horton, & Weir, 2007). Thus, research has also reported evidence that relatively older children are more likely to adopt leadership roles (Dhuey & Lipscomb, 2008), and are approximately 10 per cent more likely to attend a top-ranked university or college (Bedard & Dhuey, 2006).

Although a number of university educational studies already exist (e.g. McNabb, Pal, Sloane, 2002; Smith & Naylor, 2001), very little is known about the influence of RAEs on educational achievement for UK based student populations. Therefore the purpose of this study was to examine from a quantitative perspective the differences between final degree classification, relative age and gender amongst a UK based university population.

## Methodology

*Participants and procedure*

Participants included 460 (287 male, 173 female) students enrolled on a BA Sport Development (*n* =319) and BSc Outdoor Education (*n* =141) undergraduate degree programmes at a university in North West England. Specifically, this included students who enrolled onto the programme in the following academic years: 2006, 2007, 2008, and 2009. The design of the BA Sport Development and BSc Outdoor Education programmes are similar to the one described previously by Stott (2007). For instance the students must study 120 credits at each level (i.e. level 4, 5, and 6) and successfully complete a variety of assessment protocols, which include *inter alia*; written assignments, examinations, oral presentations, electronic portfolios, problem-based learning tasks and research projects.

Following university ethical approval student data from four cohorts were requested and examined (i.e. 2006 to 2009). These records included student date of birth, UCAS entry points, gender, grade point averages and final year degree classification. The data also included those students who withdrew from the programme (*n* =34) or transferred (*n* =5 students) onto different undergraduate courses.

Given the randomness of entry age into university in the UK, and attempts to create a completely homogenous group and reduce the possibility of external validity, the month of birth distribution was restricted to 12 months. Therefore, we did not enter any student into the final analysis who had repeated a year of formal schooling. For example, for the first year of enrolment in 2006 the typical year of birth was 1987/88

(92%), for 2007 it was 1988/9 (95%), for 2008 it was 1989/90 (96%) and for 2009 it was 1990/1991 (95%). This resulted in a number of mature students ($n$=38) and students who originated from Northern Ireland ($n$=18) who were not entered into the final analysis ($n$=56). There were no students who originated from Scotland enrolled on the programmes between the years 2006-2009.

*Statistical Analysis*

Data were separated by gender, undergraduate degree programme and year of entry. Participants were then assigned to one of four quarters on the basis of date of birth and the England and Wales academic age-grouping policy which runs from September 1st to August 31st each year. Relative age (RA) quarter 1 included students born 1$^{st}$ September-30$^{th}$ November, quarter 2 = 1$^{st}$ December – 28(9)$^{th}$ February, quarter 3 = 1$^{st}$ March – 31$^{st}$ May, quarter 4 = 1$^{st}$ June – 31$^{st}$ August, within each cohort year. Data were initially screened for missing or implausible values and assumptions for normality, linearity and homogeneity of variances were conducted. Differences in descriptive characteristics across the four RA groups were examined using a gender x birth quarter two-way analysis of variance (ANOVA). The categorical independent variables included birth date quarter and gender. The student final year degree classification acted as a continuous dependent variable which was coded into a relative scale, which ranged from 7 = first class honours; 6 = upper second class honours; 5 = lower second class honours; 4 = third class honours; 3 = pass degree plus ordinary degree; 2 = fail degree; 1 = withdrawn from degree or non-completion. In addition, the student birth date distributions were compared against the birth dates of the broader UK population provided by the Office for National Statistics (2008) for the period 1987–1991 and chi-square goodness-of-fit tests were conducted. All analyses and effect sizes were conducted using SPSS for Windows version 20 (IBM).

## Results

The main area of interest in this particular study was whether a birth date grouping impacted on final year degree classification in a university in the North-West of England. Table 1 shows the distribution of birth dates by quarter for each of the undergraduate programmes compared with the broader UK birth statistics for the years 1988-1990.

PLEASE INSERT TABLE 1

Table 2 displays the mean plus standard deviation descriptive characteristics of the four RA groups by gender and cohort year. Analysis of the two-way ANOVA revealed a number of significant differences between RA groups for final year degree classification. With the exception of the males in the 2006 cohort RA group 4 performed significantly better than RA group 1 (all $p \leq 0.05$). Unadjusted mean differences: 2006 cohort RA group 4 vs RA group 1 = 24% (8 first class honours v 6 first class honours); 2007 cohort RA group 4 vs RA group 1 = 28% (12 first class honours v 9 first class honours); 2008 cohort RA group 4 vs RA group 1= 47% (11 first class honours v 3 first class honours); 2009 cohort RA group 4 v RA group 1 = 59% (16 first class honours v two first class honours). When examining the, RA group 4 performed significantly better than RA group 1 (all $p \leq 0.05$). Unadjusted mean differences: RA group 4 vs group 1 = 45% (47 first class honours v 20 first class honours). RA group 4 also recorded more upper second class honours than RA group 1 (46 upper second class honours v 42 upper second class honours) however this was not statistically significant ($p \leq .93$). In addition, for the combined female cohort there were also significant differences across the other RA groups i.e. RA group 4 vs 3 ($p \leq 0.01$) and RA group 1 ($p \leq 0.01$). Our analyses also revealed a significant main effect for gender *F (*1, 452) = 3.96, $p \leq 0.04$, eta squared = 0.02). Post-hoc comparisons using the Tukey HSD test revealed that the overall mean score for females (Mean = 5.93, SD = 1.40) was significantly different from the males (Mean = 5.50, SD = 1.32). Moreover, as illustrated in table 3 female students achieved more first-class degree classifications than males (i.e. 32% first class honours v 18% first class honours).

PLEASE INSERT TABLE 3

**Discussion**

The current study indicates the possibility of a statistically significant relevant age effect reversal (RAER; Gibbs, Jarvis & Dufer, 2011) in the final year degree classifications for BA Sport Development and BSc Outdoor Education students enrolled between the years 2006-2009. Specifically, the results revealed a statistically biased distribution of students born in quarter four (Q4), achieving more first-class honours degrees and outperforming those students born in quarter one (Q1). With the exception of the males in the 2006 cohort, the relatively younger students attained significantly higher mean scores than relatively older students enrolled on both degree programmes (all $p \leq 0.05$). There were reported RAEs observed with both males and females, with the female students recording significantly higher mean scores than their male counterparts.

*Relative age effect reversal in university educational attainment*

To our knowledge at least, there has been only one previous UK study which has examined the possibility of RAEs existing in the educational attainment of a university based population. The findings of Wattie et al., (2012) did not provide any conclusive evidence to support age related differences in university course selection or academic achievement. Considering previous studies, albeit in pupil populations, have reported significant RAEs advantaging relatively older students (Cobley, McKenna, Baker &

Wattie, 2009, Roberts & Fairclough, 2012), the observed level of significant over-representation of relatively younger students outperforming relatively older students, is not easily explained. The over-representation of relatively younger students achieving significantly more first-class honours degree classifications, than relatively older students is currently contradictory to previous university attainment studies conducted in England and Wales (e.g. McNabb, Pal, and Sloane, 2002). For instance, the results of McNabb et al., (2002) revealed that more mature students performed better than younger students, however, this performance margin was also reported to decrease for those students aged over 35 years.

However, the findings in the current study were similar to those recently reported in an Italian university education system (Billari & Pellizzari, 2008). Moreover, there is also emerging sports science research, which suggests relatively younger athletes in elite level sport may not be as disadvantaged as previously first thought. For instance Gibbs, Jarvis & Dufur (2011) revealed how strong relative age inequalities in the National Hockey League (NHL) faded and then eventually reversed over time. For example, in their analysis of the NHL All-Star player rosters for 2007-2009 the distribution of players born in the first three months of the year ranged from a low of 13% to a high of 20%. Additionally, members of the 2010 Canadian gold medal winning squad contained a very low distribution of relatively older players (i.e 13% born in the first three months of the year). The authors concluded by claiming "it appears that being born at the start of the year *reduces* (emphasis in the original) the chance of elite play (Gibbs, Jarvis, & Dufer, 2011, p. 647). Furthermore there is emerging economic evidence from German soccer that relatively younger players receive higher annual salaries than relatively older players (Ashworth & Heyndels, 2007).

There are a number of possible reasons to explain our findings; however, we also strike a note of caution here, as they are speculative, and do require further empirical investigation. The most plausible explanation for our RAER is probably the maturity hypothesis (Martin, Foels, Clanton & Moon, 2004). Previous educational research has hypothesized that disparities in academic achievement are strongly correlated with biological age and these influences become less pronounced following the onset of puberty (Sharpe, Hutchinson & Whetton, 1994). However, this supposition is gender specific, as neurological functioning is reported to develop more slowly with boys (Martin, Foels, Clanton & Moon, 2004). It is therefore probable that the early educational disadvantages faced by relatively younger students have dissipated, and the cognitive differences initially encountered by younger students in school have faded. From an educational perspective increases in neurological maturation (Martin, Foels, Clanton & Moon, 2004) are often associated with increased performance in selective attention (Miller, 1991), and metacognition (Garner, 1991). According to Bradshaw (2001) the region of the brain which matures most slowly is located in the frontal cortex. The neurological functioning associated with the frontal cortex includes a number of the antecedent's necessary for effective learning including: independent learning, constructing inferences from complex abstractions, controlling attention, and maintaining effective memory functioning (Bradshaw, 2001).

For a secondary explanation for our findings, we once again turn to elite level sport. Recent commentaries have suggested relatively younger athletes may be challenged by the more mature and older peers (Schorer et al., 2009). It is therefore plausible that during formal schooling relatively younger students develop a more robust coping mechanism for hard work and effort, in an attempt to 'keep up' with older peers. Once the early biological and cognitive advantages are removed, it may lead to relatively younger students being in a stronger psychological position to cope with the extra demands of a university education. This supposition is however, speculative and will be addressed in a follow up study. Alternatively, it is also plausible that the relative younger students devoted more time to their studies. This hypothesis was recently confirmed by Billari & Pellizzari (2008), who concluded that the personality traits often associated with relatively older students include increased levels of self-esteem and leadership. As these traits are reported to continue into adulthood (Dixon, Horton, & Weir, 2011), it is once again probable that the relatively older students are involved in an increased volume of social activity and leadership roles (e.g. student union representative, sports captain/coach, social secretary, university president etc). If indeed, these leadership opportunities, are adopted by relatively older students, it may allow younger students to devote more time to their studies.

*Gender Differences*

Analysis of the two-way ANOVA by university degree programmes revealed a statistical difference, between the academic performance of males and females. The female students achieved more first-class honours degrees (32% v 18%) than the male students and recorded higher overall mean scores. The reported higher number of female students achieving first-class honours final year degree classifications is in contrast to the findings reported in McNabb, Pal and Sloane (2002). These findings may be reflected by the large number of female faculty staff available to support female students. Previous evidence (McNabb, Pal and Sloane, 2002) has suggested female students perform less well in traditionally male dominated subjects (i.e. the sciences and engineering). Based on the relatively low distribution of female students (i.e. 37.6%) enrolled on both programmes in comparison to that of males (i.e. 62.4%) it could be argued that Sport and Outdoor Education courses are also perceived to be male dominated pursuits. It may well be that the assessment protocols for both programmes are more sensitive to the learning needs of the female students. For instance the BA Sport Development programme only contains two formal examinations, which as an assessment method, is reported to advantage male students and disadvantage female students (McNabb, Pal and Sloane, 2002). The differences therefore in academic performance between males and females is interesting and clearly in need of further examination and investigation.

Strengths of this study included the use of a homogeneous group of students to establish whether RAEs persisted through from formal schooling to university level education. Limitations include the following: our sample was modest at best, and restricted to only 460 students located within one of the universities five faculties. Recent RAE studies in education have recruited (000s) of students, therefore our findings may not be totally representative of broader UK university population. Secondly, in order to enter university, students must be above a cut-off level in terms of their cognitive ability. Therefore, it is conceivable that the relatively younger students were already performing at a significantly higher academic level than a 'typical' younger student. The sample in the current study therefore may be biased, as it may include a number of exceptional younger students. Finally, from a methodological perspective any analysis of relative age inequalities from a university perspective is difficult. For instance not all students make the grade to enter university, therefore any appropriate methodology must also estimate the relationship between relative age and being enrolled in a university programme, and hold that relationship constant when analysing RAEs and university outcomes.

**Conclusion**

To our knowledge this is first UK based university study to tentatively suggest a relative age effect reversal; however this is by no means conclusive. In the current study, the relatively younger students, achieved significantly more first-class honours degree classifications than the relatively older students. Whilst these results suggest, in university attainment studies at least, a RAER for the first time, we also strike a note of caution, and recommend further research into this area in order to ratify our claims.

Current research suggest RAEs persist through formal schooling (i.e. from primary age through to secondary), with relatively younger children disadvantaged. However, with the findings of the current study, the recent findings reported by Billari & Pellizzari, (2008) and the evidence emanating from elite level sport, there is a suggestion that these inequalities may reduce in adulthood, and in some instances even reverse. Unfortunately, we can only speculate at the moment, as to why the relatively younger students outperformed the relatively older students in our study. However, this is an interesting and new insight into the relative age effect phenomenon and one that warrants further scientific attention.

**Acknowledgements**

The authors are grateful for the incisive and detailed comments from two anonymous reviewers.

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Table 1. Quarterly distribution by year group and broader UK population for the years 1988-1990

| Group | *n* | Q1 | Q2 | Q3 | Q4 |
|---|---|---|---|---|---|
| Sport Development | 319 | 76(23.8%) | 76(23.8%) | 81(25.3%) | 86(27.5%) |
| Outdoor Education | 141 | 40(28.4%) | 28(19.9%) | 32(22.7%) | 41(29.0%) |
| UK population 1988 | 693.6 | 179.1(25.8%) | 164.6(23.7%) | 173.4(25.0%) | 176.5(25.4%) |
| UK population 1989 | 687.0 | 175.8(25.6%) | 168.2(24.4%) | 167.0(24.3%) | 176.7(25.7%) |
| UK population 1990 | 706.1 | 184.0(26.0%) | 174.5(24.7%) | 168.3(23.8%) | 179.3(25.3%) |

*UK population data numbers (thousands)*

Table 2. Degree classification descriptive characteristics by RA group for the years 2006-2009

| | Males | | | | | Females | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Group 1 | Group 2 | Group 3 | Group 4 | Group Difference | Group 1 | Group 2 | Group 3 | Group 4 | Group Difference |
| | Mean scores | | | | | | | | | |
| 2006 | 5.75 ± 1.13 | 5.10 ± 1.37 | 6.25 ± 0.62 | 5.81 ± 1.32 | G3 > G2, p > 0.01 | 5.66 ± 1.41 | 5.57 ± 1.27 | 6.0 ± 0.89 | 5.70 ± 1.91 | G4 > G2 & G1 p < 0.05, G3 > G2, p < 0.01 |
| 2007 | 5.05 ± 2.33 | 5.85 ± 0.77 | 5.31 ± 1.39 | 5.73 ± 1.36 | G4 > G3 & G1, p < 0.05 | 5.28 ± 0.70 | 5.40 ± 0.69 | 5.75 ± 1.60 | 5.50 ± 2.34 | All p < 0.05 |
| 2008 | 5.00 ± 1.41 | 5.77 ± 0.54 | 5.58 ± 0.88 | 5.90 ± 1.47 | All p < 0.05 | 5.29 ± 1.44 | 5.73 ± 1.53 | 5.83 ± 1.47 | 6.07 ± 1.59 | All p < 0.01 except G4 > G3 p < 0.05 |
| 2009 | 5.00 ± 1.83 | 4.88 ± 1.49 | 5.64 ± 0.84 | 5.77 ± 0.95 | G4 > G 3, p < 0.05, G4 > G2 & G3 p < 0.01 | 5.68 ± 0.60 | 5.56 ± 1.63 | 4.37 ± 2.44 | 6.56 ± 0.72 | All p < 0.01 |
| Overall | 5.58 ± 1.11 | 5.42 ± 1.14 | 5.61 ± 1.04 | 5.72 ± 1.24 | All p < 0.05 | 5.58 ± 1.11 | 5.71 ± 1.35 | 5..54 ± 1.69 | 6.12 ± 1.48 | G4 > G3, & G1 p < 0.01, G4 > G2, p > 0.05 |

Table 3. The distribution of degree classification by gender and percentage 2006-2009

| | Males | Females |
|---|---|---|
| First Class | 51 (18%) | 53 (32%) |
| Upper Second | 129 (46%) | 66 (40%) |
| Lower Second | 75 (27%) | 35 (21%) |
| Third Class | 3 (1%) | 4 (2%) |
| Ordinary Degree | 17 (6%) | 6 (4%) |
| Fail | 5 (2%) | 1 (1%) |