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CAN THE PERFORMANCE EFFECT BE IGNORED IN THE ATTENDANCE POLICY DISCUSSION?

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ABSTRACT

Should universities require students to attend? Academics disagree. One side in the discussion of university attendance policies has tried to dismiss any association between attendance and student performance, insisting that students have a fundamental right to choose what and when to attend. By merging student record data and course attendance data for three cohorts of final-year undergraduate students at a London-based university, we are able to isolate attendance effects for 674 students, giving us a large sample, without the inherent weaknesses of more traditional survey methods. We provide fresh empirical evidence for the positive association between attendance and exam performance, and argue for a more balanced view in the attendance policy discussion. Politicians and higher education policies are increasingly focused on employability, student retention, and completion indicators. Carefully crafted attendance policies can have positive effects on pass and completion rates, primary policy targets of higher education funders and policymakers. Attendance effects therefore cannot be ignored.

Keywords: attendance, performance, completion rates, higher education policy

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INTRODUCTION

Higher education funding mechanisms and policies are increasingly based on performance indicators, such as high retention and completion rates (Dougherty, Jones, Lahr, Natow, Pheatt, & Reddy, 2014). Against this backdrop, a debate about university attendance policies has been slowly unfolding in recent years. Some academics view attendance policies as a symptom of new public managerialism and the marketization of higher education (De Vita & Case, 2016; Tomlinson, 2017). For example, in two recent papers, Macfarlane (2012; 2013) offers an eloquent critique of such policies. He states that attendance policies promote presenteeism and infantilise students - a proposition that he sees as a problem for the modern university. Instead he supports the Humboldtian tradition of academic freedom for both academics and students, noting that "a student's freedom to learn and the choice of when and what to attend [is] a constituent element of student academic freedom" (Macfarlane, 2013, p. 368). Yet, there is mounting evidence that attending classes has positive effects on exam performance (Chen & Lin, 2008; Devadoss & Foltz, 1996; Kirby & McElroy, 2003; Lin & Chen, 2006; Shimoff & Catania, 2001; Teixeira, 2016; van Walbeek, 2004).

In an experimental study of 114 students in two classes within a public finance course in Taiwan, Chen and Lin (2008) find that attendance improved multiple choice exam performance. In earlier survey work the same authors reached a similar conclusion (Lin and Chen, 2006). In

another experimental study of 114 students in an introductory psychology class at the University of Maryland, Shimoff and Catania (2001) find that students who attend classes more often have higher grades on weekly multiple-choice tests, even on questions based on material covered in the text but not in lectures. Survey-based studies report similar findings. In a survey of 400 students on agricultural economics Davadoss and Foltz (1996) find that the more classes a student attends the better that student's grade. In a mixed method study combining archival data and a survey of 368 students in two economics classes at the University of Cork, Kirby and McElroy (2003) find that class attendance (lecture and tutorial), and especially tutorial attendance has a positive effect on multiple choice exam grades. Fewer studies have used archival data. In a study using archival data gathered from 146 students within a macroeconomics class at the University of Porto Teixeira (2016) finds that absenteeism considerably lowers the students' final grade. Finally, in a large archival data study of 1298 students in a microeconomics class at the University of Cape Town, Van Walbeek (2004) finds that students who attend all lectures perform better in both multiple choice and essay questions.

Pointing to such evidence as being "equivocal" (St. Clair, 1999), and to the "possibility of teacher bias in giving students who attend more regularly a higher grade" (Macfarlane, 2013, p. 363), attendance policy sceptics tend to dismiss the academic performance argument. In this paper, we caution against dismissing this argument, offer fresh evidence of the performance effect, and suggest that current higher education policy and funding mechanisms actually make the performance argument more relevant than ever. Studies on attendance effects generally report statistically significant correlations between attendance and academic performance. In fact, the evidence is growing to the point where it cannot be ignored. However, effect sizes do vary by discipline (Newman-Ford, Fitzgibbon, Lloyd, & Thomas, 2008; Ylijoki, 2000).

Furthermore, the link between attendance and student performance has almost exclusively been tested in the context of simple memory recall tests (Romer, 1993; Marburger, 2006). This exam form leaves no room for the teacher bias that Macfarlane (2013) suggests. However, there could remain some uncertainty as to whether the attendance effects apply to other types of exams, such as inductive exams that are common in social sciences, where students are expected to apply theories to novel problems, and criticise the applied theories, often based on case studies (Christensen & Carlile, 2009). There are also inherent issues with survey-based methods concerning both sampling, and misreporting of attendance. Finally, there is evidence that the attendance-performance relationship is moderated by a wide number of factors, such as timetabling and the quality of teaching, but not all studies consider an exhaustive list of such moderators. We here report on a study at a large London based university, using archival data, and introducing a range a moderators, correcting for some of these weaknesses.

We present fresh empirical evidence confirming that attendance has a statistically significant association with student performance. We study several cohorts of students on an undergraduate strategic management course, gathering archival data for almost 700 students, and run a series of models that show clearly that attending classes benefits students, even when controlling for other effects. We do not discount attendance policy sceptics general arguments and opinions *per se*, but suggest that the performance effect simply cannot be dismissed, and encourage universities to consider carefully the question of attendance policies. The Humboldtian ideal of a university where academics and students are free to choose what they want to research, teach, and learn, is a far cry from the realities of modern-day higher education, where funding and policies are built on market logics and discourse (Nixon, Scullion, & Hearn, 2016; Vingaard Johansen, Knudsen, Engelbrecht Kristoffersen, Stellfeld Rasmussen, Saaby

Steffen, & Sund, 2017). These policies increasingly include a requirement for universities to ensure enrolled students have optimal conditions to complete their studies within the designated time. When university funding is dependent on student retention and completion rates, even a small increase in exam performance due to attendance could have a real impact on whether or not a given university lives up to policy expectations. Universities differ widely in location, learning models, and the academic abilities of students that are admitted, all of which matter for attendance and performance. Fitting attendance policies to the specific higher education policy and student context of the university may therefore be wiser than adopting a one size fits all that rejects regulating attendance altogether.

Our paper is organized into four main sections. The first reviews the literature on attendance and student performance. The second presents the method used. The third provides an analysis of results. The final section concludes with a discussion of the findings and their implications for theory and practice.

ATTENDANCE POLICIES AND THE PERFORMANCE ARGUMENT

Absenteeism is by now a recognised and concerning problem in universities around the world (Devadoss & Foltz, 1996; Newman-Ford, Fitzgibbon, Lloyd, & Thomas, 2008; Romer, 1993). Much of what we know about the scale of the problem comes from economics departments, where reported numbers vary from 60-90% average class attendance rates (Lin & Chen, 2006; Marburger, 2006; Romer, 1993). The general conclusion from the field of economics is that there is a positive and statistically significant correlation between attendance

and student performance (Chen & Lin, 2008; Devadoss & Foltz, 1996; Kirby & McElroy, 2003; Lin & Chen, 2006; Shimoff & Catania, 2001; van Walbeek, 2004). From a university practice perspective, such an association raises the question of whether or not to adopt an attendance policy. Of interest to this debate are two recent papers by Macfarlane (2012; 2013), in which he offers an analysis of attendance policy statements from a selection of British universities, from which he concludes that there are three main categories of arguments to justify the monitoring of class attendance. These are (a) *accountability to society* (class attendance is a mark of respect to those who sponsor the education), (b) *student well-being* (absence is bad for students since their academic performance is likely to suffer, and may even indicate that they are experiencing a personal or social problem), and (c) *preparation for the workplace* (students need to attend and be punctual as these are expectations associated with future employment). He then proceeds to dismiss all three arguments. In particular, he states that evidence for a performance effect is insufficient, and what evidence exists may be due to examiners favouring students with higher attendance (Macfarlane, 2013, p. 363). Such a statement is highly speculative, and a careful reading of the literature reveals that much of the research on attendance and student performance is based on an analysis of test scores in objective multiple-choice tests, undermining the teacher bias argument. Furthermore, although reported effect sizes are not always large, the performance effect has been found in numerous studies.

Evidence for a Performance Effect

Many studies have attempted to measure the impact of attendance on student performance, albeit with heterogeneous methods (Romer 1993; Park and Kerr 1990; Durden and Ellis 1995; Schmidt 1983; Marburger 2001). For example, Romer (1993) surveyed attendance at

all undergraduate economics classes during one week at a large public institution, a medium-sized private university, and a small liberal arts college. He concludes that a significant correlation exists between absenteeism and learning. Marburger (2001) investigated the relationship between absenteeism and student performance by surveying a single section of students attending a principles of microeconomics class. He found that daily absenteeism on any given day ranged from 8.5 percent to 44.1 percent. He concludes that students who had a missed a class on a specific day were 7.5 to 14.6 percent more likely to respond incorrectly to a multiple choice question on material covered that day when compared to students who were present. In a follow up study, Marburger (2006) investigated the impact of enforcing an attendance policy on absenteeism and student performance. Once again the context was a microeconomics class but this time split over two fall semesters. Both classes used the same teaching material and teaching staff. In what he set up as an experimental study with a control group, one class had a mandatory attendance policy while the other did not. He concludes that an enforced mandatory attendance policy reduces absenteeism and improves exam performance, and clearly concludes that there is causality, not just correlation. The weakness in this particular study was that the two groups were given different exams (but of the same form).

The general conclusion from these and other studies is that there is a positive and statistically significant association between, and effect of, attendance on student performance (Chen & Lin, 2008; Devadoss & Foltz, 1996; Kirby & McElroy, 2003; Lin & Chen, 2006; Shimoff & Catania, 2001; van Walbeek, 2004). However, reported effect sizes appear to vary, leading to speculation that the effect is neither linear nor automatic (Baldwin 1980; Gatherer & Manning 1998). One explanation for the variance in effect sizes is provided by Westerman et al (2011), who show how weaker students benefit more from attending classes than academically

strong students. This suggests that differences in student population may affect results. Another explanation is methodological differences (Newman-Ford, Fitzgibbon, Lloyd, & Thomas, 2008), and whether or not control variables are included in a study. Whilst a pure experimental setup, using control groups and randomized student assignment into groups, may be the best way to isolate pure attendance effects, in practice this is difficult to conduct on the same course, at the same time, but under different conditions, as it amounts to giving different groups students a different learning experience on the same course. Marburger's (2006) study was a step in this direction, but had its own limitations as the assignment of students was non-random, and the groups were tested a year apart with different exams. In practice therefore, most studies rely on survey or archival data, where control variables play a key role. Such controls are necessary to eliminate alternative explanations for performance differences than the attendance effect.

Theoretical explanations for the observed performance effect vary as well. Lecture attendance may simply be a proxy for student motivation, conscientiousness, and diligence. In this view, non-attendance may be a signal of low motivation. What evidence there is suggests that students who attend lectures and seminars are those who are more likely to be motivated, subscribe to, and understand the benefits of active participation, have strong time management skills, and are likely to conform to the institution's expectations of them (Moore, Armstrong, Pearson, 2008). Another view is that personality may have a role in driving student behaviour. However, a recent study by Woodfield et al. (2006) of the effect of personality and cognitive ability finds that attendance is more significant as a predictor of student performance than personality. Other reasons for non-attendance cited in the literature include the quality of teaching and the scheduling of classroom activities (Westerman, Perez-Batres, Coffey, & Pouder, 2011).

Attendance in the Context of Higher Education Policy

Macfarlane (2012; 2013) offers a range of social and moral arguments against compulsory class attendance. The arguments centre on the premise that compulsory attendance infantilises adult learners. It removes their ability to choose and judge how their time should be spent. It also promotes a culture of presenteeism where one should at least appear to be putting in the hours. Ultimately, compulsory attendance removes student academic freedom, which is defined by Macfarlane (2012; 2013) as the student's freedom to learn and to have the choice of when and what to attend. Macfarlane (2013) espouses the virtues of the Humboldtian tradition, where scholarship is a pursuit of knowledge and understanding as a common goal, necessarily involving both students and teachers (Karran, 2009).

On a personal level we are sympathetic to this view. However, it is necessary to acknowledge the direction of 21st century higher education policies, a point we will return to just below. Furthermore, we must acknowledge the differences between universities and university systems across the world, and even inside countries like the United Kingdom or the United States. Whilst complete academic freedom may still be an achievable ideal in some types of universities, such as the research-intensive "Redbrick" and "Oxbridge" universities in the UK, or "Ivy League" universities in the US, it may be much more difficult to achieve in teaching-intensive universities and colleges that depend on performance-based funding mechanisms, which sometimes directly reward higher retention and completion rates. This is the case for at least two reasons.

Firstly, the context of teaching intensive universities such as the so-called Post-92 Universities in the UK (consisting largely of former polytechnics that were upgraded to full universities) is very different from the reality of the 'Redbrick' or 'Oxbridge' type of university.

The same could be said more universally about high versus low-ranked universities. Post-92 and lower ranked universities are viewed by many student applicants as less attractive. These universities therefore tend to attract more diverse student populations with lower abilities at entry, who cannot gain entry to higher ranked institutions. In these lower ranked universities, retention and progression is a larger problem than in older and higher ranked ones (Breakwell & Tytherleigh, 2010). As previously discussed there is evidence that weaker students benefit more from attendance than stronger ones. If a university attracts mainly weak students, the potential benefits in terms of performance, and ultimately completion, are likely non-negligible, and could make a marked difference to funding.

Secondly, the dominant higher education discourse today focuses not so much on forming the well-informed citizens that preoccupied Humboldt, nor on the role of education in shaping a democratic society, but rather on economic arguments, linking higher education to the needs of the job market, and to macroeconomic growth in general (Vingaard Johansen et al., 2017). As Vingaard Johansen et al. (2017) write, "the general economic mood of the day […] heavily influences higher education policy discourse, regardless of whether the actors within higher education buy into this discourse or not". They suggest that the discourse on higher education policy has changed from a wide focus on citizenship, democracy, and equality of opportunities, to a narrower focus on the role of higher education in supplying knowledge workers to firms. Trowler (2001) makes a similar argument.

Perhaps as a result, some governments around the world have introduced funding mechanisms that directly reward universities on performance parameters (Dougherty, Jones, Lahr, Natow, Pheatt, & Reddy, 2014; Jongbloed & Vossensteyn, 2001). Such mechanisms include financially rewarding universities for publications (cf. Auranen & Nieminen, 2010, for

an international overview), and for producing students. The latter is done either by focusing on input measures (i.e. paying universities based on student recruitment numbers), output measures (such as the number of graduating students), or a mix of both (Jongbloed & Vossensteyn, 2001). Common to output-oriented funding mechanisms, and to associated policy statements, is that they attempt to incentivise universities to improve retention and completion rates, or what is sometimes referred to as degree productivity (Hillman, Tandberg, & Fryar, 2015; Rutherford & Rabovsky, 2014). Universities with large endowments, or those relying heavily on research rather than teaching income, may have the luxury to ignore policymakers' calls for more students to complete their studies successfully and on time. Conversely, ones depending mainly on teaching income, whether directly from governments, or from students themselves, no longer have this freedom today. Even in universities where students pay their own way, such payment often depends on government loan schemes that, again, reward the rapid completion of higher education.

Lower-ranked and post-92 universities, such as the ones examined by Macfarlane (2013) understandably feel compelled to adopt policies that will maximise the chances of academic success of the individual student, regardless of whether such policies in fact interfere with the student's free choice. If attending class raises exam performance, it will also raise the likelihood of successfully completing a degree programme, and therefore of satisfying policymakers' demands on the university. Attendance policies may therefore be a logical choice for some universities in the current policy climate, as long as attendance improves student performance. The evidence base for this performance effect therefore becomes pivotal to the decision of whether or not to impose an attendance policy.

Variables and Gaps in the Performance Effect Literature

What seems clear is that any research attempting to establish a relationship between attendance and performance should go beyond analysing the simple linear relationship between attendance and performance of students in a single class (an obvious limitation in for example Marburger's (2001; 2006) method). Any research on the topic should at the very least take account of (control for) background factors and input factors such as ability at entry, class scheduling, quality of teaching (tutoring), and gender (Moore et al. 2008; Fielding, Charlton, Kounali, & Leckie (2008). Astin's (1993) popular Input-Environment-Output (I-E-O) model provides a framework with which to conceptualize this. Compared to other college impact models, e.g. Pascarella's (1985) model, Astin's I-E-O model is more parsimonious. It avoids multiple levels, multiple phases and multiple concepts and thus it is easier to apply. This model was also developed for use in natural settings. Thus, it avoids artificial conditions such as experiments and makes it possible to study multiple variables (Astin, 1993). Another benefit of the model is that it focuses on the student. In particular, on the learning that has taken place or talents that have developed as a result of participation in the educational programme. According to this model, student outputs (exam scores or course performance) are functions of two major groups of factors, namely inputs (such as student ability, gender, and age), and the environment, (for example course design and teaching style). Inputs "refer to those personal qualities the student brings initially to the education program (including the student's initial level of developed talent at the time of entry)" (Astin, 1993, p. 18). In empirical work, inputs can include gender, age, ethnic background, ability, and socioeconomic level. Environment "refers to the student's actual experiences during the educational program" (Astin, 1993, p. 18). The environment includes everything that might impact the student during the programme, including

the programme itself, personnel, curricula, instructor, facilities, institutional climate, courses, teaching style and organisational affiliation (Astin, 1993). Figure 1 illustrates Astin's I-E-O framework.

Figure 1 about here

For the purposes of this paper we gathered data on three input factors that could accurately and readily be measured: ability at entry, age at entry, and gender. Several large studies (discussed in detail below) have shown that these three factors directly impact student performance (Fielding *et al.*, 2008; Woodfield *et al.*, 2006). Archival data related to these three factors is captured and stored on the university's database when students apply to the university. Other input factors were not included in our research design as the information is not stored within our archive. Alternative research methods such as survey method may capture additional information but this information may not be necessarily be reliable as student knowledge of these other factors, e.g. family income, may not be accurate. Ability at entry refers to a student's general academic ability at the point of university entry. Academic ability at entry is often captured by standardised tests, such as high school grades ('A' level scores in the UK context) and/or university entry scoring (Universities and Colleges Admissions Service, or UCAS, scores, in the UK context). There is a substantial and long standing body of work that has debated the influence of academic (cognitive) ability on student performance (Seth & Pratap, 1971; Heim *et al.*, 1983; Rudd, 1984; Brody, 2000; Mellanby *et al.*, 2000; Woodfield *et al.*, 2006). In one of the larger studies of its kind Woodfield et al. (2006) surveyed 650 undergraduates at the point of

induction at the University of Sussex and tracked them all the way until the end of their degree. They fail to find a positive association between cognitive ability, as measured by the AH5 group test of high intelligence (Heim, 1968) and academic performance. The AH5 comprises two subscales measuring verbal/numerical intelligence and diagrammatic/spatial intelligence, and has been specifically designed to differentiate between 'high intelligence' participants, such as university entrants. Moreover, they find that the effects of attendance on academic performance are independent of dimensions such as openness, sometimes taken as a proxy for intelligence because of its association with educational achievement and measured intelligence results (Costa & McCrae, 1989; Zeidner & Matthews, 2000). However, they do find a significant relationship between 'A' level scores (ability at entry) and degree outcome for female students. Controlling for academic ability at entry may therefore be useful in studies of attendance and student achievement.

Age and gender are other relevant demographic input variables. In what is probably the largest such study, Fielding et al. (2008), commissioned by the Higher Education Academy of the United Kingdom (HEA), and using data from the Higher Education Statistics Agency (HESA) and the National Student Survey (NSS), investigate differences in degree attainment between males and females, as well as different ethnic groups. Their study does not measure attendance. Their initial analysis finds that females generally perform better than males in higher education, echoing results found in a number of other studies (Woodfield, Jessop, and McMillan, 2006). Females are also reported to have an advantage over males in getting "first class" (summa cum laude) degree classifications. However, they do mention that there is evidence that gender differentials in higher education attainment vary significantly according to subject area. In some subjects there seems to be a female advantage, and in other subjects not so. They thus mention

that it is ‘unduly simplistic to take as a stylised fact the net female advantage overall’ (Fielding et al. (2008), pp. 67). Females seem to be more advantaged relative to males among the sciences, engineering and related subjects, and computer science (the reference main effect), and less so or even reversed in subjects such as Social Studies, Law, Business Studies, Languages, Historical and Philosophical Studies, and Creative Arts and Design.

In the context of attendance studies, environmental variables include scheduling of classes, which refers to both the day and time of the learning episode and teaching quality. Archival data related to these two factors is captured and stored in the university’s database. We acknowledge that different types of environmental variables could have an effect on student performance. However, our research design is not survey or experimentally based. We use the data stored within the university’s archive. Marburger (2006) finds that absenteeism is significantly higher on Fridays and the percentage of students absent from class gradually increases as the semester progressed. He concludes that there appears to be a variable opportunity cost to attending classes. Students choose from competing academic (write up assignments on Thursday evening) and non-academic (beer or cinema on a Friday evening) uses of their time (or perhaps they are simply tired due to having to juggle paid work with academic studies), when determining whether to attend class or not. Controlling for scheduling effects may therefore be useful in studies of attendance and student achievement.

Teaching quality is another environmental factor worth considering when analysing the relationship between attendance and performance. Teacher quality refers to the teacher’s ability to engage students in a useful learning episode. As Baldwin (1980) suggested, attendance could be correlated with the perceived value of lectures on the part of students. If this is the case,

students should perceive that the learning episode they are participating in is worthwhile, relevant or useful as an experience (Moore et al. 2008). If lectures are not perceived as worthwhile, relevant, or useful learning experiences, students will be less likely to attend. In their study, Moore et al. (2008) find that some respondents mentioned reasons for absenteeism such as “don’t like lecturer”; “too long’; “too boring”; “Lecturer only reads slides”. Sund (2016) finds similar reasons in a more recent study. This suggests that the inclusion of some sort of control for teacher quality is necessary in studies covering multiple classes with different teachers.

Outputs "refer to the 'talents' we are trying to develop in our educational program" (Astin, 1993, p. 18). Output measures include indicators such as grade point average, exam scores, course performance, degree completion, and overall course satisfaction. For the purposes of our empirical study reported on below, one output factor is considered in separate models: exam score in a final exam.

METHOD

Our intention was to examine the attendance-performance association with a large sample of students, and we adopted a research design based on archival data. Even at a large university, examining the attendance-performance effect with a large sample meant gathering data from several cohorts, and using what data was readily available that would not create ethical problems. In order to test for the attendance-performance association empirically, we collated available student records data pertaining to three consecutive cohorts of students on a final year undergraduate course in strategy, at a large London-based university, giving us an initial total

sample of 756 students. These were three years during which one of the authors was responsible for this course, and therefore had control over exam form and conditions, as well as full access to performance and attendance data. The dataset was collated and analysed only two years later, to allow university records to be updated to reflect final results, including for students with missing credits. Even so, due to incomplete records of timetabling changes, the exact seminar times were missing for some students, bringing the usable sample size for our modelling purposes down to 674. An ANOVA test comparing the mean exam scores of the 674 students with full timetabling data, with the 82 students with incomplete data, revealed that these were not significantly different ($F = 1.870$; $p = .172$). We therefore evaluate the risk of bias due to the non-inclusion of these students in our modelling as low.

With the collated data, we built two regression models to test for an association between student attendance and performance. We did not wish to test attendance policy effects per se (i.e. before – after effects of introducing a policy), as attendance is not mandatory at this university. We included only students who at the time of sampling had a final exam grade on the system. Only 14 students dropped out, so any sample bias due to this limitation would be minimal.

The course involved a weekly plenary lecture taught by the faculty member responsible for the course, and a seminar, taught by a number of different tutors, in smaller groups of between 20 and 30 students. Some seminars were dedicated to coursework, but a majority involved case discussions. Seminar rooms were in two buildings of identical standard. Following the first week or two, students remained in their assigned seminar group for the rest of the course, which spanned two semesters, with 22 weeks of teaching in total.

Assessment on this course consisted of a mix of group coursework, participation, individual assignments, and a final written two-hour exam. The final exam consisted of a case, which students were given to read in advance, and a number of undisclosed questions that students had to respond to in a closed-book exam setting. Assessment elements other than the exam varied somewhat from year to year. Details are provided in Table 1, along with some student demographics. We created a number of different variables for our analysis, the details of which are given below.

Student identifier, age, and gender. We used university student numbers as unique identifiers and consulted the university's student records to record gender (M/F) and age at university entry.

Academic year. We recorded the academic year the student first attended the course, and in the case of re-examination recorded only the results of the first exam sitting. If a student took the entire course a second time, only the first year's records were used. Dummy variables were created for each year. As the exact exam differs every year, we would expect to see a cohort effect in our models.

Exam grade. The exam grade was recorded in percentage terms. The scale is from 0 to 100% and the pass level was 40%.

Ability at entry (UCAS entry score). A commonly used control variable in this type of study is academic ability at entry as previously discussed. In the case of UK universities, this is typically coded as the UCAS (Universities and Colleges Admissions Service) entry, or tariff, score. This score ranges from five to a theoretically maximally achievable 768 points, with higher entry qualifications and grades achieving higher tariff points. The score is not collected for students

entering the university with non-UK qualifications, for mature students, and a range of other entrants. We were thus only able to identify a UCAS entry tariff score for a total of 378 students.

UCAS status. Due to the relatively high number of foreign students attending the university we decided to create a variable dividing students into three categories: home (UK) students, EU students, and overseas students – reflecting their point of origin at university entry.

Tutor. One tutor could teach several seminar groups. We recorded the names of tutors and created dummy variables for these. Although we do not measure the quality of tutoring as such, we can test whether differences related to each tutor can help explain exam scores.

Scheduling day. Scheduling times are sometimes given as reasons for higher or lower attendance rates (Marburger, 2006). We therefore recorded the day seminars were scheduled (Monday to Friday), and again created a series of dummy variables for these.

Scheduling time. Similar to the above, we also recorded the times seminars were scheduled. To simplify the analysis, we chose to code the seminar times as "early AM" (for a class start anywhere between 8 and 10am), "late AM" (for a class start later than 10am but before 12noon), "early PM" (for a class start later than 12noon but earlier than 3pm), and "late PM" (for a class start at 3pm or later). Dummy variables were then created for each. As noted previously, data was missing for some students.

Attendance level. We measured attendance in percentage for three cohorts, based on attendance records kept by seminar tutors. It should be noted, as outlined in Table 1, that for the third cohort the attendance mark was a measure of attendance, but with minor adjustments for preparation and participation in class. The data for this cohort is therefore only a proxy for attendance.

We should emphasize at this stage that we recognize the limitations that our research design imposes and will comment on some of these in the results and conclusion sections. We were, for example, not able to go back in time to conduct psychometric testing of any kind, and did not have the option of setting up an experimental research design.

Tables 1 and 2 about here

RESULTS

Table 2 contains descriptive statistics of exam scores and ability at entry (UCAS entry scores). An initial exploration of the dataset involved visual and statistical inspections of the distributions of the continuous variables attendance and exam grade. A few outliers with very low exam or attendance scores were kept in the sample. There were also a few missing data points. To test the attendance-performance association we constructed linear multiple regression models with exam score as the dependent variable. Table 3 contains the regression model results. The first model excludes ability at entry, with the previously reported sample size of 674 students (r^2 = .23). The second model includes ability at entry, with a resulting sample size of 296 students (r^2 = .27). Residuals were confirmed to be normally distributed for both models through a combination of visual inspections and a Kolmogorov-Smirnov test.

Table 3 about here

As previously discussed, only home (UK) students entering through the university clearing system have a UCAS score. An ANOVA test comparing the mean exam scores of students with a UCAS score (mean of 40.80) and without a UCAS score (mean of 38.35), revealed that these were different (F = 5.259; p = .022). It is therefore necessary to examine the results of these two models separately. We decided to conduct a further analysis, this time comparing the mean exam scores and attendance levels of all home (UK), EU, and overseas students, in our original full data set of 756 students. For this larger dataset an ANOVA test comparing the mean exam scores of home students, EU students, and overseas students, revealed that these were not significantly different (F = 1.826; p = .141). Neither were the attendance levels (F = 1.507; p = .211). In the case of 4 students the student status was missing. The corresponding means and standard deviations are found in Table 4.

Table 4 about here

For both models we see a positive and statistically significant association between attendance and exam score, such that an attendance rate increased by ten percent raises exam score by 1.4% in one model, and by 1.2% in the other. This confirms the existence of the

attendance effect we were looking for. We do not find a gender effect, confirming the finding of Fielding et al. (2008). Interestingly we see some effects on the tutor and scheduling dummy variables. The tutor effect is only present for one tutor, in the model without ability at entry. However, in terms of scheduling we see that early week scheduling, and early afternoon scheduling, appear to be associated with better exam results. Interestingly, ability at entry, as measured by the UCAS entry score, is not a significant predictor of exam performance. Removing the attendance variable changes this model, such that entry score becomes significant, with a one hundred point rise in UCAS score leading to a 1.9% increase in exam score. One interpretation of this could be that attendance allows students with lower ability at entry to catch up with their stronger peers.

An unexpected finding concerns the age at start variable. This variable is statistically significant in both models, such that entering university at a younger age leads to a higher exam score. Attendance behaviour and age at start were uncorrelated in our sample. The same was the case for UCAS entry tariff score and age at entry. A visual inspection of a box plot of the relationship between exam score and age at start (for the original full sample, $N = 738$), suggested that the effect might be U-shaped, such that students reaching their thirties catch up again with direct-entry peers, but the explanatory power is very low ($r^2 < 0.01$). The effect size is also very small, even if statistically significant.

DISCUSSION AND CONCLUSION

The results of the regressions corroborate the studies that have reported associations between attendance and student achievement. Attending classroom sessions appears beneficial to students in our sample, lending new support to the performance argument dismissed by some in the attendance policy discussion. In our study we have used archival data covering a larger sample of students than most previous comparable studies, and incorporating more moderating variables than most previous studies. What our study shows clearly is that once controls for such variables as gender, ability at entry, tutor, or timetabling are taken into account, the statistical association between attendance and academic achievement remains. The effect is not large, but statistically significant. Furthermore, we find that there may be a timetabling effect such that early week and mid-day scheduling has a favourable impact on performance. It should be noted that our results relate to a particular course, in a particular university, as do previous comparable studies mentioned in our review of such studies. However, we add to a growing body of evidence that from a meta-study perspective indicates consistent findings across subject areas.

An unexpected result was a negative student age at entry effect, suggesting that students who have had a break in their studies between school and university subsequently find it harder to perform in their studies. This result contradicts the result of for example Halpern (2007), but who used a simple binary age variable. Our measurement was of actual age, and our result leads us to speculate that there is an erosion of general study skills, difficulties in social integration, increased external obligations, or other effects impacting these students. If true, higher education policies trying to push high school graduates straight into university may have some merit. Furthermore, an attendance policy could perhaps help such students re-engage socially. As the effect appeared to be U-shaped, one might further speculate that mature students (in their thirties) more readily catch up again with direct-entry peers. If this is the case, the policy

implication would be to encourage both direct entry after high school, and options for slightly more mature learners, but this question deserves further study.

Our findings provide some justification for universities reported in Macfarlane (2012; 2013) to have adopted attendance policies. Firstly, once we removed attendance, ability at entry became statistically significant, such that a 100 point increase in UCAS score was associated with a 1.9% higher exam score. This may not seem like much, but the average UCAS score at Oxford University, is almost 400 points higher than that of students in our sample. As elite universities attract students with high ability at entry, they may be less likely to find that attendance policies have an important impact, whereas lower ranked colleges and universities, attracting weaker students, may find that impact to be more critical. Secondly, having an attendance policy is in our view consistent with higher education funding mechanisms and policies that encourage and reward high retention and completion rates. Our results from a teaching intensive university show relatively low mean exam scores. In this context, raising the mean exam score by just a few percentage points has an impact on course and degree pass rates. An attendance policy could therefore conceivable benefit some universities as they try to satisfy the requirements of funders, even if it does take away some of the freedom of students.

Whether or not the performance argument is sufficient to warrant a formal attendance policy is at the end of the day a matter of choice for each institution, but our results should convince the reader that the performance argument cannot simply be dismissed. An alternative to strict compulsory attendance would be a policy that assessment should be closely linked to student learning, as indeed proposed by Macfarlane (2012). Various forms of in-class assessment throughout the semester is one way to achieve this. What is missing in this discussion is not

proof of an attendance effect on student performance, but more detailed studies on the behavioural effects of various types of attendance policy. Given our findings on the effects of age at entry, one might speculate that differentiating attendance policies, or even assessment policies, according to student characteristics could benefit students more than the one-size-fits-all approach taken by most universities today. More experiments along the lines of Marburger's (2006) study could point the way for university teachers and administrators to design effective attendance policies, adapted to their particular student population, programme area, and courses.

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