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MANDATORY ANATOMY DISSECTION; EFFECT ON EXAMINATION PERFORMANCE

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ABSTRACT

Regular class attendance is evidence of professionalism. This has led to mandatory class attendance in many disciplines including anatomy. However, there is paucity of data on the effect of mandatory class attendance on student performance in resource-limited settings. The objective of this study was to determine the effect of mandatory attendance of anatomy dissections on student's practical exams. This was an audit of undergraduate first year health professional students performance on the practical summative Steeplechase exam for the anatomy of limbs in two consecutive academic years at Makerere University. The second lot of first year students in the study had all their scheduled anatomy dissection sessions roll called to confirm their attendance that was the intervention arm in the study. The data was analysed with STATA statistical computing software version 13. Some of the tests run on this data included independent samples t test and Regression analysis. The overall performance of students in the academic year varied with roll call and was significantly lower than that in the previous academic year without roll call (mean difference -8.04 95% CI -10.76 to -5.31). Significant reductions in performance were also observed with type of student sponsorship (P<0.01) and the program they were pursuing (P<0.01). Roll calling had the largest effect on student performance demonstrated by the 0.23 standard deviation reduction in performance of students. This study shows that mandatory attendance of anatomy dissections leads to a reduction in the student's performance on practical anatomy examinations

Key words: Anatomy dissection, class attendance, examination performance

INTRODUCTION

Class attendance has been identified as a key predictor of student performance(Credé et al., 2010). It has been observed that students tend to perform poorly on examination questions set from material covered in lecture sessions they missed(Marburger, 2001). This has been supported by a more recent meta-analysis in favour of the additional use of mandatory class attendance(Credé, Roch and

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Kieszczynka, 2010). There exist differing opinions on use of mandatory class attendance policies in health professional education literature that in some cases discourages(Ahmed et al., 2015; Eisen et al., 2015) and else where encourages the use of such policies(Deane et al., 2013). We must note that one of the major drivers institutional adoption of mandatory class attendance policies has been the need to demonstrate students attainment of necessary levels of competence in the face of increasing student numbers, resource limitations and the requirements of regulatory bodies which consider class attendance as evidence of professionalism(Deane and Murphy, 2013).

The teaching of Anatomy revolves around the dissection of the human cadaver in most health professional training institutions(Korf et al., 2008). The goal of this dissection and other methods of instruction used in the teaching of anatomy are to ensure student engagement with the learning process(Pizzimenti et al., 2015), a core feature of adult learning. Makerere University College of Health Sciences Department of Anatomy has for many years run a cadaver based anatomy-teaching program in a resource-limited environment(Munabi et al., 2008). The need for greater institutional accountability accompanied with the larger class sizes have led to increased calls for mandatory attendance of the gross anatomy dissection session by students. However, there has been no prior assessment on the effect of mandatory class attendance on student performance in these settings. The objective of this study was to determine the effect of mandatory attendance of anatomy dissections on student's practical exam.

Box 1: Characteristics of adult learning

(1) The need to know (Why do I need to know this?)

(2) The learners' self-concept (I am responsible for my own decisions)

(3) The role of the learners' experiences (I have experiences, which I value, and you should respect)

(4) Readiness to learn (I need to learn because my circumstances are changing)

(5) Orientation to learning (Learning will help me deal with the situation in which I find myself)

(6) Motivation (I learn because I want to)

METHODS

This was an evaluation of undergraduate first year health professional students performance on the practical summative Steeplechase exam for the anatomy of limbs in two consecutive academic years at Makerere University College of Health Sciences. A summary of the descriptive statistics of the two first year student populations in the two academic years is provided in Table 1. In this table note that the student population is composed of private sponsored students, government (merit based) sponsored students and international students. Only those students that had sat the exam were included in the study. All the scores or students from previous academic years who were retaking the course were excluded at the time of analysis.

Table 1: Descriptive statistics of the study population

Roll call status	**No**	**Yes**	**Total**
Total number (% of total)	237 (46.02)	278 (53.98)	515
1. Medicine	128	141	269
2. Dental surgery	16	23	39
3. Medical radiology	12	11	23
5. Nursing	17	23	40
6. Pharmacy	27	40	67
7. Biomedical sciences	37	40	77
Proportion of female students	0.34	0.29	0.32
Proportion of international students	0.04	0.05	0.04
Proportion of private sponsored students	0.36	0.42	0.40

The teaching of the practical aspects of human anatomy at Makerere University College of Health Sciences revolves around the dissections of formalin preserved human cadavers, by a multidisciplinary team of 10-20 students. As part of this teaching the students have two to three hour scheduled human cadaver dissection in two sessions each week, with additional opportunities to dissect outside the official class hours. The three volumes of Cunningham's manual of practical anatomy are used to guide the student's work through the various regions of the human body. During the first two years of their respective programs the students work though the human body as follows: Semester 1 limbs; Semester 2 trunk; Semester 3 head neck, the brain and spinal cord. Dissection is augmented by lectures, tutorials and a dissection timetable to ensure that students work through the whole body. Both faculty and graduate students attend these sessions to provide additional support in the form of guidance. In this comparison, the students of the second lot of first year students in the study had all their scheduled anatomy dissection sessions roll called to confirm their attendance. The scores for this academic year with roll call were taken as the intervention arm in the study. With the exception of the roll call and higher number of students, the two lots of first year students received similar levels of anatomy teaching and scheduled instruction experiences in the two years.

In this evaluation we looked at the student's performance on the practical exam. This exam is one of the many exams the students sit as part of their assessment of the anatomy course content. In the exam students are required to identify, describe and or provide a function/application of a marked body structure. A typical exam covers various aspects of the body including: histology, and gross Anatomy of the particular region of the human body under study that semester. This exam contains 35 to 40 one-minute stations that are done by a group of students in shifts under supervision. Table 2 provides a sample of some of the questions used in these exams. The student's responses were captured on a sheet of paper that is later marked by a team of faculty. Efforts were made by the departmental examinations committee to ensure that the content and scope of the exams given to the two groups of students whose scores were included in this evaluation was similar.

Table 2: Sample of questions from the Steeplechase Exams

1 (a) Identify the tied structure (brachial artery) (b) List the fractures that would easily lead to damage of the above structure
2. (a) Identify the tied structure (flexor carpi ulnaris) (b) List the nerves that supply the above structures in the body
3. (a) Identify the painted area (hip joint) (b) What structure contribute to its stability
4. (a) Identify the tied structure (gluteus maximus) (b) Outline how to safely administer a intramuscular injection into the above muscle
5. (a) Identify the tied structure (gastrocanemius) (b) Outline the role of the above muscle in active runner
6. (a) Identify the tied structure (flexor digitorum profundus) (b) List the nerves that supply of the above structure
7. (a) Identify the tied structure (anterior cruciate ligament) (b) Outline a specific task you would ask a patient to perform to test the integrity of the above structure
8. (a) Identify the pinned area of the body (palmar aspect of the hand) (b) List any two potential spaces found in the pinned area

The students summative scores for the limbs course steeplechase exam, were obtained as excel sheets, cleaned and standardised as percentages prior to analysis. The analysis of the student's standardised scores was done in STATA statistical computing software version 13. Some of the tests run on this data included independent samples t test and Regression analysis. The results from the tests in this analysis are further summarised in the various tables in this manuscript with the level of significance set at 0.05. Permission to use the student's scores was obtained from the department of anatomy. No personal identifier information was used during analysis or as part of the final manuscript.

RESULTS

As shown in Table 1, there were slightly more first students in the year with roll call than in the preceding year without roll call. The overall average score for the 515 students across the two years was 66.46% (SD 16.18). Also as summarised in table 1 above, the majority of these students (269/515, 52%) were pursuing the Bachelors of Medicine and Bachelors of Surgery (MBChB) program. In table 3, note that performance on the practical exam was affected by the students': status as an International student ($P<0.01$), being a privately sponsored student ($P<0.01$), taking roll call ($P<0.01$), and the academic program the students was pursuing ($P<0.01$). The only exception to this was with the student's gender where no difference was observed ($P=0.66$).

In figure 1, note that the overall performance of students in the academic year varied with roll call and was significantly lower than that in the previous academic year without roll call (mean difference -8.04 95% CI -10.76 to -5.31, P Value <0.01).

Table 4 provides a summary of the multivariable regression modelling of the student's performance on the steeplechase exams against the intervention (roll call) and the other predictor variables. Gender had no significant effect on the student's performance on the practical examination in this model. Of the remaining variables in the model, roll calling was associated with a 7.48 percentage point significant reduction in performance (p<0.01). Being an international student was associated with a 9.60 percentage point reduction (P<0.01). Significant reductions in performance were also observed with type of student sponsorship (P<0.01) and the program they were pursuing (P<0.01). Of the five predictors of student performance in Table 4, the standardised regression coefficients suggest that roll calling had the largest effect on student performance demonstrated by the 0.23 standard deviation reduction in performance of students.

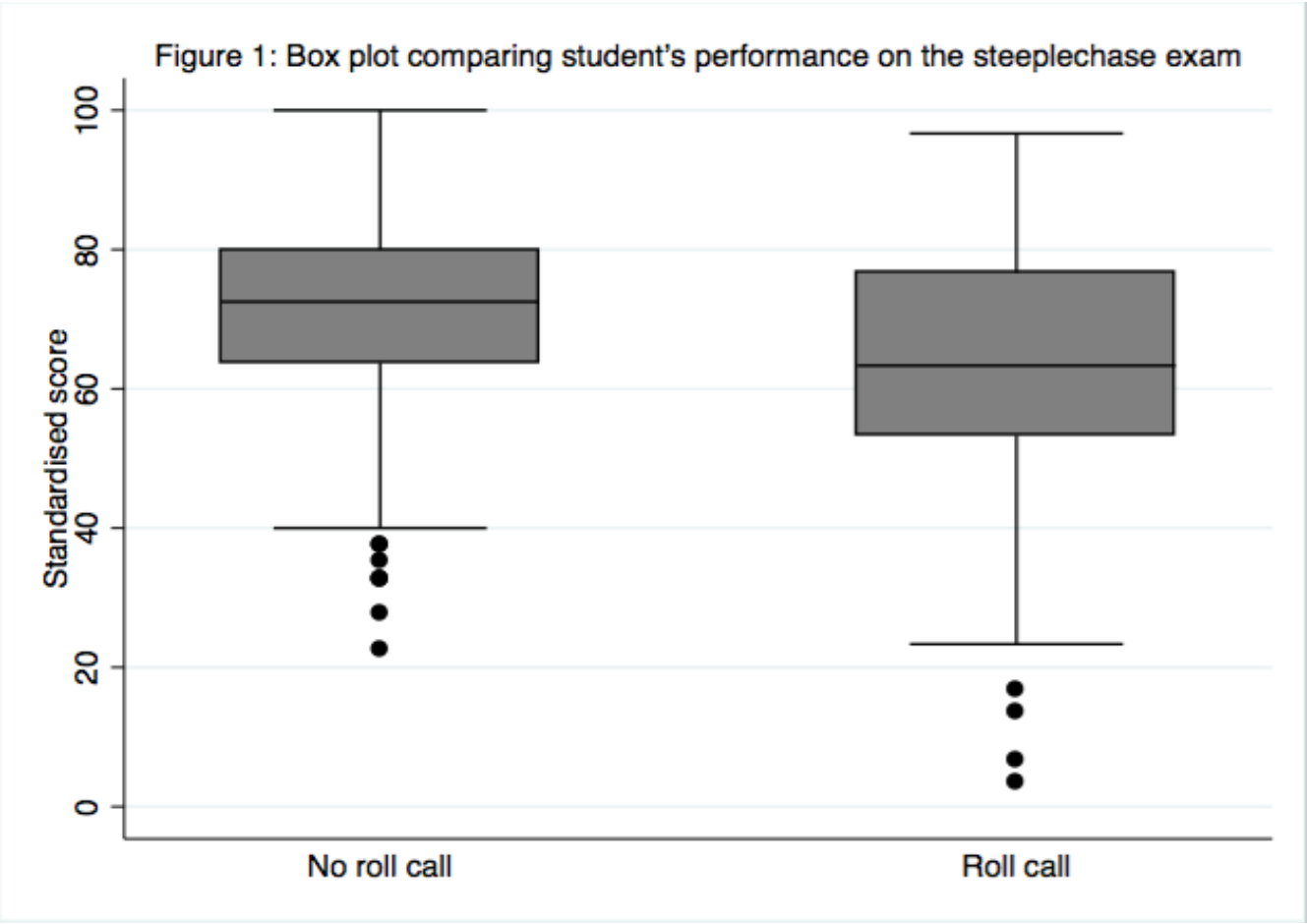

Figure 1: shows a box plot of standardised score against students with no roll call for academic year 2013/201 and roll call 201/2015. The overall performance of students in the academic year varied with roll call and was significantly lower than that in the previous academic year without roll call (mean difference -8.04 95% CI -10.76 to -5.31, P Value <0.01).

Table 3: showing uni-variable Regression analysis student scores

Variable	**Coefficient (95% CI)**	**P value**	**Constant (95% CI)**	**P value**
Gender	-0.68 (-3.70 to 2.33)	0.66	66.67 (64.98 to 68.37)	<0.01
International students	-13.07 (-19.77 to -6.38)	<0.01	67.04 (65.62 to 68.46)	<0.01
Private sponsored students	-9.67 (-12.41 to -6.93)	<0.01	70.29 (68.56 to 72.01)	<0.01
Roll call	-8.04 (-10.76 to -5.31)	<0.01	70.80 (68.79 to 72.80)	<0.01
Program	-2.09 (-2.90 to -1.28)	<0.01	69.36 (67.59 to 71.13)	<0.01
1. Medicine	1			
2. Dental surgery	-6.92 (-12.23 to -1.61)	0.01		
3. Medical radiology	-6.30 (-13.03 to 0.44)	0.07		
5. Nursing	-8.66 (-13.91 to -3.40)	<0.01		
6. Pharmacy	-5.01 (-9.24 to -0.78)	0.02		
7. Biomedical sciences	-9.52 (-13.52 to -5.51)	<0.01		

Table 4: Multivariable regression analysis of student scores and factor variables

Variable	**Coefficient (95% CI)**	**P value**	**Standardised coefficients**
Roll call	-7.48 (-10.06 to -4.91)	<0.01	-0.23
Gender	0.85 (-1.96 to 3.66)	0.55	0.02
International students	-9.60 (-16.10 to -3.10)	<0.01	-0.12
Private sponsored students	-6.73 (-9.58 to -3.89)	<0.01	-0.20
Program	-1.75 (-2.54 to -0.96)	<0.01	-0.18
Constant	75.75 (73.37 to 78.13)	<0.01	

DISCUSSION

We set out to determine the effect of mandatory attendance of gross anatomy dissection on student's summative practical Anatomy exam performance. We found that mandatory attendance of the dissection sessions was associated with a significant reduction in the average students' performance on a summative practical exam. This runs counter to the expected increase in student performance with the institution of measures to ensure mandatory attendance.

There are several possible explanations for this observed reduction in student's performance with the institution of a mandatory attendance

policy for the anatomy dissection sessions. Most of these are derived from the social cognitive theories of learning that categorize this study population as the "generation c" adult learners (Barry et al., 2015; Taylor et al., 2013). The characteristics of this type of learner as summarised in box1, are described in more detail elsewhere (Knowles et al., 2014). Mandatory attendance policies may shift the control of the learning experience away from the learner to the teacher, as the students must come to the dissection room as scheduled as opposed to when they want(Artino et al., 2012). This changes the purpose of being in the dissection room from learning to making sure you are registered as present, which in turn affects the student's motivation to learn, perceived self-respect and self-concept.

In addition, the mandatory attendance policy may also lead to a disruption of the beneficial students centred team based learning efforts(Vasan et al., 2011). This is especially true with the highly controlled crowded conditions, as was typically seen when all the students turn up for the roll call. Also there were slightly more students in the year that had the mandatory attendance policy, which may have worsened the crowding. In a previous study we observed that students when present in the dissection room are doing one of three things: actual dissection, reading or simply observing(Munabi, Ochieng and Ibingira, 2008). In these conditions the dissecting students assume the role of peer demonstrators, a practice that has been observed to lead to poor performance for some students(Pizzimenti, Pantazis, Sandra, Hoffmann, Lenoch and Ferguson, 2015). Overall the observed loss in the quality of learning as evidenced by the lower performance on scores of the practical based examination in these resource-limited settings creates the need to explore alternative forms of evidence to demonstrate that students meet the minimum set of competences as required by the institution and other regulatory agencies(Taylor and Hamdy, 2013). The different perceptions of how learning should occur by the students, teachers, institution, regulatory and funding agencies may serve as a starting point for this exploration(Evans et al., 2011). What is clear is that when left to dissect as and when they please these students performed significantly better on the practical aspect of their exam.

Some of the shortcomings of the study include the retrospective nature of the design that may have limited the documentation of key events that may have adversely affected the study population separated by a whole year. There is also the possibility that certain unique characteristics of the two cohorts like the presence of a lower number of female students in the roll call cohort (see table 1), may have affected the learning experience, comparability of the two cohorts leading to the observed differences in performance. It is important to note that though present these differences are not large, they were retained in the final model (see table 3), which still demonstrated that the roll call was a major predictor of student performance.

Conclusions

This study shows that the introduction of a mandatory dissection policy for the anatomy dissection sessions leads to a reduction in the student's performance on practical anatomy examinations. There is a need to further explore the implications of such policies on the quality of medical education in resource-limited settings.

Competing interests: None to declare

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