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Correlation of Seminar Attendance and Written Examinations in Medical Education

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Abstract

Objectives: The parts of constructive alignment, i.e. learning objectives, activities and assessment are crucial for good learning outcomes. However, they must constantly be evaluated so as to verify the alignment. Our aim was to investigate if attendance to our case-based seminars in family medicine contributed to exam performance and whether gender had any impact for undergraduate students at the medical school of Lund University in Sweden.

Material and methods: Student performances in assessments of eleven consecutive classes (semesters) were studied and the attendance rate was documented as well as gender. These data were then used to analyse the correlation with the results on the written exam with linear regression and multilevel linear regression. Attendance was optional.

Results: The marks on the written exam rose by 0.70 points (95% CI 0.49-0.90) corresponding with every seminar attended, 0.61 (95% CI 0.39-0.84) for men, 0.79 (95% CI 0.55-1.03) for women. Maximum points were 40. There was no detectable influence of teachers.

Conclusions: For the majority of medical students, it is worthwhile to attend case-based seminars in family medicine as much as possible to enhance results in written exams. However, a few can skip seminars altogether and still pass their exams.

Keywords: Attendance; Medical education; Students; Written exam; Gender

Introduction

The intended learning outcomes of teaching and learning activities are assessed by different assessment methods depending on knowledge levels (Bloom, SOLO) and domain (cognitive, affective, psycho-motor) [1]. In the realm of education, learner-centred activities are central. This is partly due to the pursuit to accomplish deep, holistic learning [1]. Different activities and methods are used in order to achieve this level of learning [2]. However, there seems to be no "golden method" that is applicable to all. When resources are limited, the choice of learning activity is crucial in order to reach an optimal result. A major aid in the planning of courses to reach the intended goal is to use constructive alignment (CA) [1]. Biggs' theory describes a model where there is alignment in learning objectives, learning activities and assessment. However, to design courses according to CA does not in itself guarantee alignment; the three different parts in the tripod must continuously be evaluated.

Hammen et al showed a weak positive correlation between lecture attendance and grades in an undergraduate health science introductory physiology class, which suggests that knowledge levels among students only slightly differed according to class attendance [3]. A similar weak correlation was shown by Horton [4]. On the other hand, Chen et al found that classroom attendance/participation was a significant determinant in the exam performance of medical students in first-year basic medical science courses [5]. Khan et al showed similar results in another study [6]. Bamuhair et al. [7] found stronger effect for lecture attendance compared to attendance in other teaching modalities. The correlation between attendance and assessment outcome could therefore be dependent on teaching activity, i.e. different activities have a different correlation [8].

To further complicate matters, the question of gender must also be addressed. Citing various explanations, several authors claim a higher achievement for the female gender [9]. There are also findings that male students have a tendency to overestimate their ability in certain clinical fields [10]. Furthermore, the interaction between same or opposed genders might also influence outcomes [6].

In our setting, we have several different learning activities including lectures, seminars and clinical training. As teachers, we find the face value of these activities equally valuable but the course evaluations do not always confirm this. In particular, we have established and developed the case-based method as a means of teaching important and relevant clinical reasoning [11]. This method is popular with students and teachers but its effect on learning is inconclusive [12].

We do not know whether students' attendance at our case seminars affects their exam performance. On a face level, we have constructed a CA with well-aligned learning outcomes, activities and assessment. Even if we expect that students who miss fewer classes will do better in their exams; we are concerned about the effect of teaching on students' learning. The questions concerning the gender of students and teachers have recently been brought to our attention as well as other factors besides attendance, such as type of studies, age and so forth [13,14].

Aim

Our aim was to investigate case-based seminar attendance effects on exam performance for medical students.

Ethics

According to Swedish law ethical approval is not mandatory for "research which is carried out as part of a program of study at an institute of higher education at a basic or advanced level." Furthermore, the study did not involve sensitive personal data and data were fully anonymised.

Material and Methods

The medical school curriculum of Lund University, Sweden is comprised of five and a half years (11 semesters). The program of Community Medicine runs in the second half of students' eleventh semester for a total of ten weeks. It includes 4 days every second week of clinical practice in a healthcare centre (a total of 16 days) and four days of seminars in different course subjects every other second week (family medicine, geriatrics, forensic medicine and occupational and environmental medicine). There are six case-based seminars in family medicine with an emphasis on clinical reasoning and after each seminar the intended course learning outcomes are distributed to the medical students. These seminars are four lesson-hours long, a total of 24 lesson-hours. The sources for the content are official recommendations from the region of Scania and Läkemedelsboken (ref) Each week there is also one day of lectures in the different subjects. The final exam is a written assessment for all course subjects with key feature problems (KFP) and short questions to answer. An additional examination for the assessment of students' professional development is by examining their portfolio [15].

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Student performances in assessments of eleven consecutive classes (semesters) - a total of 978 students - were studied. A total of 27 students were excluded, due to missing data and/or non-participation in the written exam. The attendance of the remaining 951 students in the six case-based seminars of family medicine was documented. Attendance was not compulsory. The attendance rate was then used to analyze the results on the written exam. Only the results from the family medicine part of the written test were used in data analysis (40 out of a maximum of 90 points). The null hypothesis was that attendance rate should not influence marks on the written exam with the counter hypothesis being that there should be a positive correlation between seminar attendance and results in the written exam. We did not expect any differences according to gender for students or teachers.

Assessment of Variables

Outcome variable

The maximum mark on the written test in family medicine was 40 or normalized to 40 when the maximum mark was 38.The cut-off score for passing was set to 2/3, i.e. 27.

Independent variables

Age: Age in years at the time the course was used.

Gender: Male or female.

Case seminar attendance: The attendance rate was between none and all (0-6).

Teachers: A total of 15 teachers (3 male, 12 female) were involved.

Statistical method

Standard linear regression with Pearson regression coefficient was used for attendance rate and marks. Multilevel linear regression with teachers on the second level was also performed.

Testing of the null-hypothesis was made with Kruskal-Wallis.

Analyses were made with SPSS 22.0 [16], MS Excel 2010 [17]and MlWin 2.2. [18]

Results

Descriptive

The study population consisted of 951 students who participated in the regular written exam. From this group, a total of 468 (49.2%) were women. Mean age was 28.5 years, no gender differences.

Teachers

The mean number of students for every teacher was 63, range 8-111, and the mean number of teaching semesters was seven, range 1-11.

Attendance

The mean attendance rate was 5.5 seminars. The majority (n= 832; 87.4%) attended five to six seminars, 9.6% (n=91) attended 3-4 seminars and only 2.8% (n=27) attended two seminars or less. Five students did not attend at all (Table 1).

Written exam

The mean score on the written exam for all was 35.3 (SD 2.8), range 20.5-40 (Figure 1). For women the mean was35.6 (SD 2.6) (women) and for men 35.0 (SD 2.8) (men).

Relation between attendance and points on written exam

There was a j-shaped relation between number of attended seminars and mean points on the written exam (Table 1, Figure 2).

Table 1: Mean score on written exam for different rates of attendance.

Attendance rate (number of seminars)	Number of students	Mean score (0-40)	SD
0	5	33.6	2.6
1	9	31.9	3.7
2	14	33.0	3.1
3	26	33.3	2.8
4	65	34.1	3.2
5	167	34.8	2.9
6	665	35.7	2.5

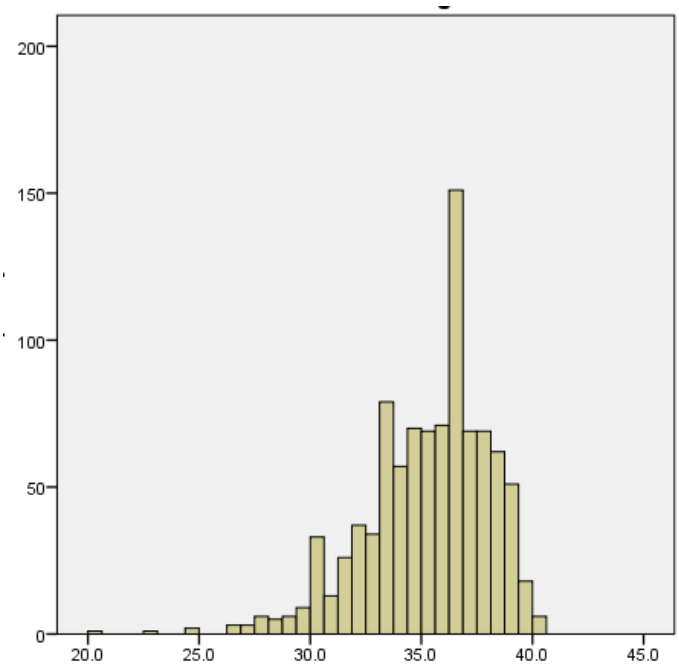

Figure 1: Distribution (frequency=y-axis) of points (x-axis) on the written exam in Family medicine.

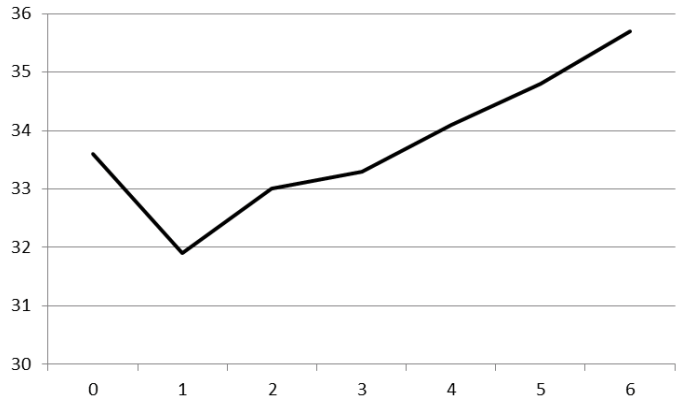

Figure 2: Linear relation between attendance (x-axis) and mean points (y-axis) on written exam in Family Medicine.

Linear regression

The marks on the written exam rose by 0.71 points (95% CI 0.55-0.87) corresponding with every seminar attended. This effect was lower for men, 0.61 (95% CI 0.39-0.84), than for women, 0.79 (95% CI 0.55-1.03). Teacher gender (same as student) did not have any effect on the result, 0.31 (95% CI -0.03-0.65). Each yearly rise in age diminished the marks by 0.1 points (95% CI -0.17 - -0.10) (adjusted for attendance), alike for both men and women.

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Multilevel linear regression

In order to investigate if different teachers (apart from gender) had any influence on the marks on the written exam, we conducted a two-level linear regression with teachers on the second level and students on the first, thus disentangling teacher effect from student. We found no influence of teachers whatsoever, variance on second level 0.

Hypothesis testing

The null hypothesis that there was no difference the attendance groups was rejected (Kruskal-Wallis, P=0.0001) and we found a small gender difference, which favored females.

Discussion

Our results show a small but significant correlation between grouped attendance frequency of case seminars in family medicine and points on a written exam. This effect is more pronounced in women. A j-shaped relation was found when the mean results of students were plotted against each of the seven attendance groups. This implies that there are students with a presumably high capacity that are adept at learning without attending lectures/seminars. To our knowledge, this is possibly a group not previously described.

This is, in some sense, in accordance with the findings of Gal who found that attendance was crucial for learning when "non-traditional methods" were applied [19]. It is implied in our study that one size does not fit all. The concept of individualized learning would perhaps improve the results. This concept is, however, also not without difficulties. Furthermore, it is unclear whether we have the resources and competence to offer individualized teaching.

There could be several reasons for students not attending lectures or seminars, despite the "fact" that their grades outcome is dependent on this. Students may value autonomy and avoid a one-size-fits-all approach to medical education [20]. Kottasz found that major reasons were illness, transport problems and time management issues [21]. In a previous study, when Longhurst surveyed students on both lecture and tutorial attendance, he found various reasons for absence including medical appointments [22]. He also found older students to be absent more often but no gender differences in frequency, whereas Cortright et al found that female gender had a significant positive effect on the correlation between attendance and examination score [23]. This tally with our findings. Added to this are several others factors that likely influence grade outcome; study habits, enthusiasm regarding subject etc [24].

In order to meet different methods of learning, we must emphasize the importance of attendance for most students. However, some students have various reasons for not attending (although it can be mandatory) and for some of these perhaps a supplementary online curriculum should be offered to enhance learning outcomes [4,25]. Finally, a few students seem capable of mastering learning detected in the written exam, without attendance or using an online curriculum.

Limitations of the Study

We have no information about the reasons for low attendance. Social or health issues could affect both attendance rate and the results in written exams.

We measured the results based on one written examination. It would be desirable to evaluate what kind of teaching is best in the long-term perspective; we do not know what kind of teaching will yield the best physicians. Instead of only measuring short-term effects of teaching, it would be preferable to study the effects of performance later on [26,27].

Recommendations for Researchers

There is a need for studies that compare the effects of different kinds of educational activities. There is a need also to study correlation of attendance and other types of students' evaluation such as practical exams and skills evaluation" should be added as another recommendation

Authors' Contributions

AB and PM jointly designed the study, PM collected data and AB performed the data analysis. The two authors discussed the results and cooperatively wrote the manuscript together and approved the final version.

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