“Active Learning” in the time of COVID?

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Abstract. Active learning techniques have been employed in the final year Statistical Physics module since 2009. The introduction of these methods resulted in increased student participation during lectures, and improved student performance in assessments in comparison to the period 2005 – 2008. Student attitudes were probed using a number of surveys, and these were found to be overwhelmingly positive. An increase in student number from 2015 onwards coincided with a drop in student performance and participation in lectures. While active student participation was encouraged during on-line teaching over the last two years, student attendance and performance has been disappointing, particularly in 2021.

1 Introduction

Active learning (AL) strategies have the potential to improve student learning, and hence their performance in assignments, tests and examinations in all spheres of education. They include active engagement, collaborative learning, and problem-based learning, as well as the provision of regular feedback to the student cohort. There have been several reviews of the research on the efficacy of using AL techniques in university teaching. The primary focus of Physics Education Research on the use of AL in physics classrooms has been on the employment of these techniques in introductory courses. However, they have been employed in intermediate and upper-level courses as well. Reports on the introduction of AL techniques in Thermal and Statistical Physics at the University of the Witwatersrand (WITS), and the response of the student cohort, have appeared more recently [1,2]. A review of the literature available at the time is provided in these reports. The results of student surveys have shown that the students have embraced the introduction of these measures, and that an improvement in student performance has resulted from applying these strategies. Comprehensive details of the AL techniques employed at the time are provided in these short papers.

In this presentation the details of the techniques employed previously, together with the adjustments made over the intervening years. It will be shown that the increase in student numbers, particularly since 2015, have had an impact on student performance in summative assessments. It has also become clear that student attendance at face-to-face lectures have declined noticeably over the this same period.

The global COVID-19 pandemic has further complicated the issue. In common with colleagues around the globe, a rapid transition to on-line teaching was made in March 2020. Many of the teaching materials for our 3rd Year Statistical Physics module were (fortunately) in the process of being updated, in particular the lecture slides. The underlying reasons for making the changes to the lecture materials allowed for a reasonably seamless transition to on-line presentations for the instructor. However, some of the AL strategies were severely compromised, in that the students were often engaging asynchronously with the lecture materials. In addition, there were many students who lacked the infrastructure and the financial resources to engage with the teaching material effectively.

2 Student Performance and Student Numbers

Historical data for student numbers and performance are shown in Fig. 1. It can be seen that overall performance in the final examination appears to correlate with class size, although this is clearly not the only factor, as will be discussed in the presentation. The precipitous decline in overall performance in 2021 coincides with the first cohort of students who did not write a face-to-face examination in their 2nd Year.

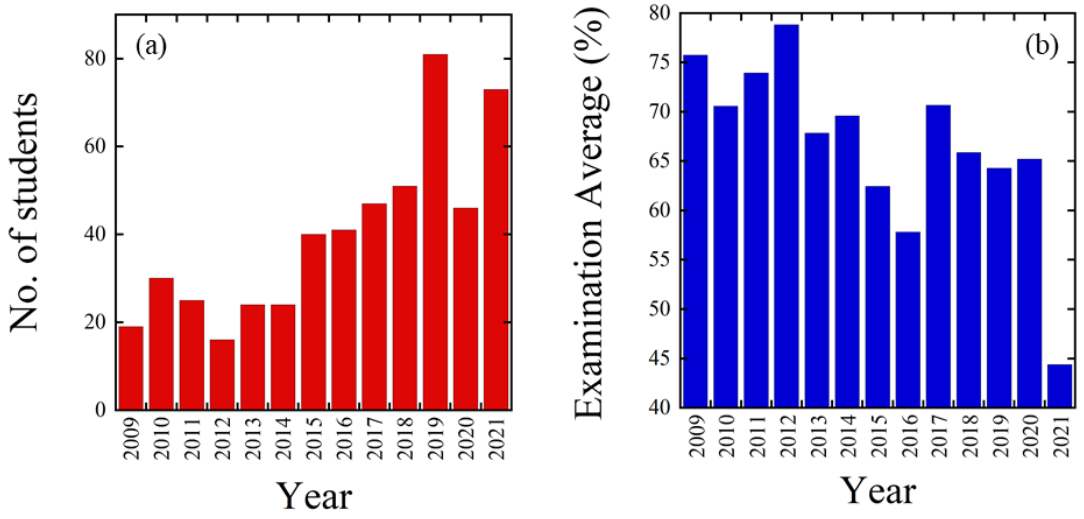

Fig. 1 Student numbers and overall student performance in the final examination for the period over which Active Learning techniqiues have been employed in the Statitical Physics III module. Fig. 1 (a) shows that student numbers rose dramatically in 2015, and the trend is toward larger class sizes (it is not clear whether the large numbers in 2019 and 2021 are anomalous, or whether these represent the new normal). Fig. 1 (b) shows the class average for the final examination for the period of interest. The overall performance of the students in the period 2009-2014 was significantly better than the period 2005-2008, and there appears to be a weak correlation between performance and class size. The reader's attention is drawn to the precipitious decline in the class average for 2021.

3 Summary

AL techniques have been used by the author for over a decade. These techniques have been welcomed by the student cohort, and an increase in student performance has been noted. More rcently an increase in student numbers has highlighte the lack of participation of a significant number of students. The transition to on-line teaching and learning in March 2020 presented issues, particularly for a proportion of the student cohort. However, the final results appeared to hold up. This has not been the case for 2021, where student participation in synchronous sessions has been very low, and the class average has dropped by almost 20%.

References

[1] J. M. Keartland, *Proceedings of SAIP2011: the 56th Annual Conference of the South African Institute of Physics* (2011) 585-590 ISBN 978-1-86888-688-3.

[2] J. M. Keartland, *Proceedings of SAIP2012: the 57th Annual Conference of the South African Institute of Physics* (2014) 412-417 ISBN: 978 1-77592-070-0.