



Motivating Science Undergraduates using pre-lecture preparation

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Abstract: *Almost everyone who has studied Statistical Mechanics remembers it as one of their least inspiring and most difficult subjects, yet it presents an understanding of the physical universe which underpins many important discoveries. Therefore it is important to include it in the curriculum for students taking a major in physics. The difficulties arise because the mathematical detail which is essential for appreciating the subject matter tends to obscure the significance and power of the big ideas.*

A recent change in the teaching and learning method for this subject has resulted in much greater engagement of the students with the subject matter, and a higher success rate.

The teaching method is based on Peer Instruction developed by Crouch and Mazur (2001). Before each lecture, students are required to work through a section of notes and answer some questions to demonstrate their engagement and understanding. They are also asked to specify the aspect which they found most difficult or confusing, or which they found most interesting. These responses are submitted on-line, and read by the lecturer before the lecture. Thus the lecturer is aware of the students' level of understanding, and is able to tailor the lecture content appropriately. Student responses are also used as the basis for questions asked during class, to engage students in discussion.

Direct quotations from student responses demonstrate their engagement with the course and the development of their appreciation of the subject, from week 3 "I would also like to know whether the Boltzmann distribution has any practical use or whether it is solely a tool to theoretically derive the observed behaviour of macroscopic objects." to week 8

In the first half of this course I often found the material to be rather abstract at times, but this is understandable as we were defining fundamental definitions of thermodynamic quantities. Finally we are seeing the true power of all this formalism by using it to show important results such as the Ideal Gas law. In doing so, it makes me realise that the process for another gas model would follow a similar procedure and so the knowledge we have gained so far allows us to do a tremendous amount.

This paper describes some advantages and disadvantages of this mode of teaching, from the perspective of the lecturer and the students.

References

Crouch, C. H. & Mazur, E. (2001). Peer Instruction: ten years of experience and results, *American Journal of Physics* 69 (9), 970-977.