Developing Students’ Questioning Minds by Guiding Them to Critique Published Papers

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When it comes to measuring how successful a scientist can be in research, it is often determined by how sharp his questioning mind is rather than how much knowledge he has. Consequently, to develop questioning minds capable of critical thinking is a major goal of university teaching, especially for students who major in the sciences. The module CM3296 “Molecular Modeling: Theory and Practice” provides some unique opportunities for this, since it is aimed at describing any recent progress made in computational nanoscience, one of the fastest developing fields in science, in which a lot of important problems still remain unsolved.

Designing the Teaching Experiment

In the final homework assignment for CM3296, students were given two papers published in top journals of computational physics, which they had to critique. One paper contained serious errors made through the violation of some basic principles which had been discussed in class. Another paper had some problems in terms of the assumptions it made, but was still an excellent paper which made an important original contribution to theoretical nanoscience. For this assignment, students were divided into several groups. Each group was required to give a presentation in class to comment on these two papers.

Aims of the Experiment

At the end of the experiment, it is hoped that students will be able to:

1. Critically evaluate published papers, even those from top-tiered journals, instead of blindly trusting them. Even papers published in such journals can be wrong. In fact, many important contributions in research were made via a critique of existing and well-accepted theories.

2. Develop an awareness that a researcher should have the courage to make mistakes, especially when he is doing something absolutely new. A paper with some mistakes may still be an excellent paper, and some great discoveries have originated from mistakes.

About the Author

Dr Zhang Chun currently teaches both physics and chemistry modules. He finds that introducing one’s own research into teaching is very helpful in stimulating students’ interest in the subject. In the context of current research, he feels that using such an approach also makes it easier for students to understand some abstract concepts.
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Implementation of the Experiment & Problems Encountered

Students were given two weeks to read the papers and prepare their presentations. Each group was given 15 minutes to present, and their presentations were graded immediately after that. Since the other groups were listening while one group made their presentation, I only gave comments after all the groups have made their presentations.

I noticed some problems when it came to the implementation. First, one or two groups modified their PowerPoint slides after listening to their classmates’ presentations. Second, there was no question-and-answer session to discuss the presentations, since I only gave comments at the end. The implementation can be improved in future by letting other groups wait outside the classroom when one group is presenting. Of course, the current implementation is only applicable to small classes. For large classes, writing reports may be more effective as assignments instead of presentations, especially when it comes to grading.

Student Feedback for the Experiment

Clearly, students liked the experiment. Some of them were really surprised by the mistakes they found in the published papers. One student commented that the current publishing system must have severe problems for such mistakes to occur. Some others expressed their interest in working in computational nanoscience in future as they found this field interesting, and they gained more confidence after finding out that even papers from top-tiered journals are not immune to making ‘silly’ mistakes.

In summary, based on the feedback from students, giving students the opportunity to critique published papers through this exercise seems to encourage them to develop questioning minds, foster an interest in the subject, and gain more confidence in research.

Recommended Citation