Topic 1

Lecturing

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In universities lecturing is the primary method of student tuition, and no doubt will remain so for the foreseeable future. Therefore, to maximise their effectiveness, it is important to understand the dynamics of the lecturing process. The follow papers address such issues as: attention span in lectures, effectiveness of note taking styles and pre–lecture material.

1.1 General papers on Lecturing

[Johnstone and Parcival 1976] Johnstone, A. H. and Parcival, F., *Attention Breaks in Lectures*. Education in chemistry, **13**(2), 48 – 50, 1976.

In a study of first year chemistry students it was found that a lapse in attention occurred some 10 – 18 minutes after the lecture had started: with the period between subsequent lapses decreasing. The important factors effecting the rate of decline were attributed to: difficulty of subject, delivery rate, legibility of blackboard work and lecturer personality. By introducing variation and/or deliberate breaks it was found that the lapses in attention could be postponed or even eliminated.

[Johnstone and Su 1994] Johnstone, A. H and Su, W. Y., *Lectures – A Learning Experience*. Education in chemistry, **31**(5), 75 – 79, 1994.

During a lecture approximately 5000 words are delivered by the lecturer but, only some 500 are recorded by the students!. How students select these words and determine which information is important, worthy of a note, is investigated in this paper. The authors identify four note taking styles and the main characteristics of a poor lecturer, concluding that “at best, lectures are overviews or outlines of what has to be learnt rather than learning experiences in themselves”.

[Holme 1998] Holme, T., *Using Interactive Anonymous Quizzes in Large General Chemistry Lecture Courses*. Journal of Chemistry Education, **75**(5), 574 – 576, 1998.

In this paper Holme discusses the use of short (five minutes) multiple choice quizzes administered at the start of a lecture. These are designed to test students' understanding of the key concepts presented in earlier lectures. The format of the quizzes permit student – student interaction and rapid feedback of weaknesses in student understanding.

1.2 Peer Instruction

[Mazur 1997] Mazur, E., *Peer Instruction: A User's Manual*. Prentice Hall, Upper Saddle River, NJ, 1997.

In this book Mazur details the Peer Instruction (PI) pedagogy. Here lectures are interspersed with short concept tests designed to reveal common misunderstandings and actively engage students in lecture courses. A web site providing further information on PI can be found here.

[Crouch and Mazur 2001] Crouch, C. H. and Mazur, E., *Peer Instruction: Ten Years of Experience and Results*. American Journal of Physics, **69**(9), 970 – 977, 2001.

In this article the authors report on data relating to ten years of peer instruction and discuss changes they have made so as to improve PI instruction.

[Fagen et. al. 2002] Fagen, A. P., Crouch, C. H. and Mazur, E., *Peer Instruction: Results From a Range of Classrooms*. The Physics Teacher, **40**(4), 206 – 207, 2002.

This paper presents a survey of Peer Instruction implementation, instructor evaluation, course assessment and effectiveness.

[Meltzer and Manivannan 2002] Meltzer, D. E. and Manivannan, K., *Transforming the Lecture Hall Environment: The Fully Interactive Physics Lecture*. American Journal of Physics, **70**(6), 639 – 654, 1996.

In this article the authors describe how they have attempted to convert the large formal lecture into a more interactive seminar come tutorial format. The methodology that they present here is a variant of Muzar's Peer Instruction [Mazur 1997].

1.3 Pre–lectures

[Sirhan et. al. 1999] Sirhan, G., Gray, C., Johnstone, A. H. and Reid, N., *Preparing the Mind of the Learner*. University Chemistry Education, **3**(2), 43 – 46, 1999.

Before the start of their first year chemistry lecture course students were given a multiple-choice test to identify gaps in background knowledge. After self assessing their performance those students who felt they understood a given concept taught, using a series of short exercises, those that didn't. The authors report that this process improved the performance, in subsequent course examinations, of those students with lower entry qualifications.

[Sirhan and Reid 2001] Sirhan, G. and Reid, N., *Preparing the Mind of Learner – Part 2*. University Chemistry Education, **5**(1), 52 – 58, 2001.

In this paper pre–lecture "Chemorganisers" are presented. These are self contained units, each presented on a single side of A4 paper, covering concepts in chemistry and mathematics. The broad aims of the chemorganisers are:

1. To enhance the preparation of the mind for new learning.
2. To ease the load on working memory
3. To change attitudes towards learning.

For two consecutive years pre–lecture chemorganisers were given to first year chemistry students, were then withdrawn for one year and finally re-administered for a further year. The authors found that, when chemorganisers were used, students, who had entered the course with lower qualifications, showed an improvement in exam performance over those years when chemorganisers were not provided. An example of a chemorganiser, "The Mole and Solutions", can be viewed here, and a large collection of chemorganisers can be found here

[Sirhan and Reid 2002] Sirhan, G. and Reid, N, *An Approach in Supporting University Chemistry Teaching*. Chemistry Education: Research and Practice in Europe, **3**(1), 65 – 75, 2002.

A paper which discusses the use of "Chemorganisers", is available online here

[Kristine 1985] Kristine, F. J., *Developing Study Skills In The Context Of The General Chemistry Course: The Prelecture Assignment*. Journal of Chemistry Education, **82**(6), 509 – 510, 1985.

In this paper the author discuses his use of prelecture assignments, designed to introduce students to studying strategies. These assignments review prerequisite material and preview the upcoming lecture material (including parts of mathematical calculations). Examples of review and preview questions are presented and positive outcomes are discussed.

[Allen 1981] Allen, P. S., *Some Development in the Promotion of Individual Study in Physics*. European Journal of Physics, **2**(1), 58 – 62, 1981.

In this paper the author discusses his eight year study into various ways in which to promote individual student study. He reports that the most effective strategy appears to be one in which students are encouraged to learn from study units *before* the lecture, coupled with tests and discussions in lectures.

[Van Heuvelen 1991] Van Heuvelen, A, *Learning to Think Like a Physicist: A Review of Research–Based Instructional Strategies*. American Journal of Physics, **59**(10), 891 – 896, 1991.

To help students with the acquisition, and long-term retention, of concepts and skills they should be exposed to a technique or concept over an extended time interval, in a variety of contexts, and instruction should provide opportunities for students,

- whilst in lectures, to actively participate in the construction of concepts, reason qualitatively and solve problems,

- to evaluate their own and fellow students thinking,
- to make, whilst getting immediate lecturer feedback, unpenalised mistakes.

1.4 Courses Without Lectures

For an example of an introductory physics course without lectures see [Laws 1991].

1.5 Field Dependency and Lectures

A paper exploring the role of field dependence/independence and learning from lectures can be found in Topic 9, (Field Dependency, [Frank 1984]).