Long Questionnaire

1. Age:

2. Sex: male/female

3. School background:
   a. SPM Year:
   b. Bahasa Inggeris Grade:
   c. English 1119 Grade:
   d. TOEFL Score:

4. What language do you speak at home?

5. What language(s) do you speak with your friends? (Begin with the one you speak the most frequently)

6. How do you rate yourself in English?

<table>
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<tr>
<th>Skill</th>
<th>very good</th>
<th>good</th>
<th>average</th>
<th>poor</th>
<th>very poor</th>
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<td>listening</td>
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7. Do you enjoy reading in English? Yes/No
   Reason:

8. The following is a list of reading materials. Rate them according to your interest in reading them in either English or in Bahasa Malaysia.

   1. not interested at all
   2. not very interested
   3. moderately interested
   4. very interested

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<td>a</td>
<td>newspapers</td>
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<td>b</td>
<td>novels – war, romance, etc.</td>
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<td>c</td>
<td>non-fiction – narratives, biographies, war, etc.</td>
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<td>d</td>
<td>general knowledge, e.g. computers, engineering, etc.</td>
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<td>e</td>
<td>light entertainment, e.g. movie magazines, humour magazines, etc.</td>
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<td>f</td>
<td>poetry</td>
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9. Why do you read in English?

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<td>because the lecturer asked me to read</td>
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<td>to know more about the topic taught in class</td>
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<td>to update my knowledge – e.g. world news</td>
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<td>to look for information for a homework assignment</td>
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<tr>
<td>to prepare for a test/quiz</td>
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10. Roughly estimate the percentage of what you read in B.M. and in English now.
   B.M. ____%  
   English ____%  

11. The following are two courses that you are taking/have taken. For each of the courses, indicate the importance of reading in English by ticking (✓) the appropriate box below.

   **Physics 152**
   
   [ ] Very important – I must read in English for the course.
   [ ] Recommended but not really necessary – I can get by even if I only read some of the recommended material.
   [ ] No reading is required – I can get through the course without reading anything at all.

   **Chemistry 112**
   
   [ ] Very important – I cannot avoid reading in English for the course.
   [ ] Recommended but not really necessary – I can get by even if I only read some of the recommended material.
   [ ] No reading is required – I can get through the course without reading anything at all.

12. How often do you read (textbook, lecture notes, other reference books)

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<tbody>
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<td>a.</td>
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<td>b.</td>
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<td>c.</td>
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<td>g.</td>
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<td>h.</td>
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13. Which of the following do your lecturers do when they give out an assignment?

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<th>always</th>
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<tbody>
<tr>
<td>a.</td>
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<td>b.</td>
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<td>c.</td>
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<tr>
<td>d.</td>
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The following questions have been designed to find out about how you read. Please include other details that are relevant in the spaces provided.

14 a. Do you practice a particular reading strategy?
   Yes/No

   b. Very briefly, state how you go about reading something in your content area:

15 When you need to read your text, or other material, what do you do?

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<tbody>
<tr>
<td>a</td>
<td>start reading at once</td>
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<td>b</td>
<td>get an idea of the topic by looking at the title, diagrams, pictures, etc.</td>
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<tr>
<td>c</td>
<td>look through the ‘Contents’ page/Index to decide on what to read</td>
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<tr>
<td>d</td>
<td>estimate how much I have to read to see how long it will take</td>
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<td>e</td>
<td>anything else?</td>
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</table>

16 While you are reading, what do you do?

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<th>always</th>
<th>frequently</th>
<th>sometimes</th>
<th>never</th>
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<tbody>
<tr>
<td>a</td>
<td>highlight/mark all the parts I think are important</td>
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<tr>
<td>b</td>
<td>make notes in the margin or on a piece of paper</td>
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<tr>
<td>c</td>
<td>take down only those parts that are relevant</td>
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<tr>
<td>d</td>
<td>try to understand every word I read</td>
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<tr>
<td>e</td>
<td>use a bilingual dictionary to check all the words I don’t know</td>
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<tr>
<td>f</td>
<td>ignore difficult words or phrases, only looking up the meaning of really important ones</td>
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<tr>
<td>g</td>
<td>try to get the main idea of each paragraph</td>
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<tr>
<td>h</td>
<td>write comments in the margin: good point, confusing, etc.</td>
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<tr>
<td>i</td>
<td>keep on reading even though I find it very confusing – hoping it will get clearer as I go on</td>
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<tr>
<td>j</td>
<td>keep in mind the purpose of reading</td>
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<tr>
<td>k</td>
<td>anything else?</td>
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17 Do you use a dictionary to help you with your reading? Yes/No

If ‘yes’, when do you use a dictionary?

☐ whenever I come across a difficult word
☐ at the end of my reading
☐ during my free time
☐ other response?

18 How often do you use a dictionary? (Please tick (✓) one)

☐ always
☐ most of the time
☐ sometimes
☐ once in a while
☐ never
☐ other response:

19 Do you have any problems when reading in English? Yes/No
If ‘yes’, what problem(s) do you have?

20 When you have problems with your reading, what do you do?

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<thead>
<tr>
<th></th>
<th>always</th>
<th>often</th>
<th>sometimes</th>
<th>never</th>
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</thead>
<tbody>
<tr>
<td>a. give up reading</td>
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<tr>
<td>b. ask friends who have read it to tell me what it is about</td>
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<tr>
<td>c. get notes from ‘seniors’</td>
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<tr>
<td>g. discuss the topic with friends and hope I’ll then understanding it better</td>
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<tr>
<td>h. see the subject lecturer for help</td>
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<tr>
<td>i. see an English lecturer for help</td>
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<tr>
<td>j. anything else?</td>
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21 Which of these do you consider to be the main reason for some of your problems in reading in English in your content area? (please tick (✓) one)

☐ difficult to get at the concept – too abstract
☐ the subject matter is new
☐ the text is boring
☐ there are too many difficult words
☐ the style of the writing is too complex – many long sentences
☐ difficult to follow the author’s train of thought
22 If all the reading materials were available in Bahasa Malaysia, which of these would still be reasons for some of your problems in reading? (Please tick \(\checkmark\) those that are relevant.)

- difficult to get at the concept – too abstract
- the subject matter is new
- the text is boring
- there are too many difficult words
- the style of the writing is too complex – many long sentences
- difficult to follow the author’s train of thought
- too many ideas in the text
- other reason:

23 Do you think your subject lecturer can help you to better understand your reading?
   Yes/No
   Reason:

24 Do you feel that you can pass the exams/quizzes/assignments, etc. without reading your text book at all?
   Yes/No
   Reason:

25 Do you think it is necessary/important to read the text and other reference materials?
   Yes/No
   Reason:

26 Besides the text, do you read any other reading material (other than your lecture notes)?
   Yes/No
   Reason:

27 How do you prepare for a writing assignment?

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<tbody>
<tr>
<td>a. read through the question first to see what is required</td>
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<td>b. read the relevant chapter/section of the text, reference book, lecture notes, etc.</td>
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<td>c. focus on what is asked in the question, and begin writing out the answer at once</td>
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<tr>
<td>d. make an outline of the main points</td>
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<tr>
<td>e. discuss the question with friends and work out the answer together</td>
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<tr>
<td>f. discuss the question with friends and then work out my own answer</td>
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<tr>
<td>g. copy one of my friend’s answer</td>
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<tr>
<td>anything else?</td>
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</table>
28 Do you edit your work? (Do you make 2nd/3rd drafts, look through for errors, spelling mistakes, logic, etc.?)
   Yes/No
   Reason:

29 Do you ask anyone else to read through your answer to see if it is OK?
   Yes/No
   Reason:

30 Do you find questions with 'EXPLAIN' (i.e. say in your own words) difficult to do?
   Yes/No
   Reason:

31 Do you feel that your ESL course has helped in your coping with this course?
   Yes/No
   Reason:
Short Questionnaire

Appendix 2

Below is a short questionnaire to find out how you have been handling this class so far, and how you prepare for it.

1. Did you read up before today's class? Yes/No
   a. i. If yes, what did you read?
      textbook ✓
      lecture notes
      other material (please say what it is)
   ii. Why?

   b. If no, why not? (please state your reason(s))

2. Do you think your textbook is difficult to read? Yes/No
   a. If yes, what makes it difficult?

   b. If no, why do you think so?

3. Do you participate actively (ask questions when you are unsure; share information; point out something that is not understood, etc) in class? Yes/No
   a. If yes, why?

   b. If no, why?
Appendix 3

The following is an example of a student’s answer in a written examination in the Chemistry class. It received full marks (10 out of 10) from the examiner, and is included below as an example of what is deemed ‘good’ writing in the content-area classroom.

Examination Question:

3) Write a short essay, explaining to a non scientist, the principles and uses of ONE of these topics.

a) desalination    b) high temperature super conductors    c) radio-carbon dating
d) enzyme catalysis    e) the manufacturing of ammonia

Student answer:

e) The manufacturing of ammonia

Ammonia has many usage in every day life, from industrial needs to daily gardening. Therefore, the demand for ammonia production is very high. Plants naturally sintezise (sic) or manufacture ammonia by taking Nitrogen gas and Hydrogen gas from the air and convert by means of complicated reaction.

Humans have been wise to create a method of manufacturing ammonia in large scale & quantity. The process of manufacturing ammonia is the Haber cycle.

We must understand that Nitrogen & Hydrogen gases are very stable gases. They exist as diatomic molecule. When these two gases meet each other at normal conditions, they will not react with each other. Therefore Mr Haber, an intelligent scientist has devised a way in which Nitrogen & Hydrogen gasses can react with each other and thus creating ammonia.

The Nitrogen & Hydrogen gas is first compressed to a very high pressure state because this will help in getting a bigger yield. Then the pressurized gases is made to flow and get in contact with a metal oxide catalyst. The catalyst will help speed up and split the gas molecules into their respective ions. However the catalyst will not be consumed by the reaction.

When the pressurized gases come in contact with the surface of the catalyst, hydrogen molecules will break into their ions. Much energy is required to break the stable bonds of the gases. Therefore for this reason also that this gas is conducted under high pressure & temp of about 500 C.

The gases ions are very reactive & will come & combine with one other to form ammonia molecules.

The is a sight variation in the theory & industrial application of Haber’s Law. According to theory, in order to get more yield the temperature should be lowered because formation of ammonia is an exothermic process. However if we increase the temperature the reaction will generally take place at a higher rate. However we must note that at high temp ammonia will tend to break up into its constituents, thus getting a smaller yield.
Appendix 4

OBSERVATION NOTES

(Note: Interview/triangulation of data appear in italics)

Observation #1
Physics 152
19 May 1997
8.20 – 10.00

This is the first day of the semester. At 8:00, there is no one about. It is a large classroom – there are five horizontal rows of tables and chairs arranged together, with a centre aisle: five tables on each side of the aisle. Everything looks new. The class has the capacity for fifty students. It is well lighted, air-conditioned, and there is a clean whiteboard behind the lecturer’s table at the top of the room. The researcher has taken the first seat to the right of the aisle, in the last row. It affords a clear view of the class and the lecturer.

At about 8:10, one student comes into class and places his bag at a table and then leaves. Some voices outside the room. Slowly, they come in and settle at places in the classroom. Four girls sit right up front on the left – two in front, in row one; two behind them in row two. The rest of the students, all boys fill up the rows on the right, starting with the first row. Three boys sit behind the girls in row three, on the left. There are a total of 19 boys and 4 girls in the class – with a grand total of 23 students.

[The researcher has set up her cassette recorder on the table in front of her, just next to the centre aisle. Given the size of the room and the number of students in the class, she is afraid that the quality of the recording will not be very good – too much echo; or the words spoken may not be clear.

At the end of the tape, i.e. after the first half-hour, the recorder noisily shuts itself off. The researcher had to apologize to Specialist Informant 1 (SI1) and the class and proceed to flip the tape over, and begin recording again. This process was repeated at the end of the next half-hour, after which the researcher just sat quietly and smiled when the recorder shut itself off.

As she feared, the recording made of the first observation session was a poor one. The acoustics of the room were just not suitable for a clear recording. There were long moments of scratchy silences, punctuated by the voice of SI1. However, what he was saying was not clear – more muffled, with the odd word, here and there audible and discernable. Student responses and questions did not come through at all, except for the occasional hiss of a voice speaking very faintly.

After this one attempt at recording, the researcher decided to dispense with this tool for two reasons: one, the quality of the recording was not good enough for a transcript to be made from it; two, it was too disruptive to re-load and as it shut off.)

Most students seem to have a huge text with them – it probably is the required textbook for Physics.
(Triangulation: After class, the researcher asks the students what the book is, and confirms that it is the required text for the course. They had found out about it beforehand, and had acquired a copy to be ready for the class.) It is taken out of bags and lies unopened on the table. Pens/pencils are out. Some students have a lecture pad opened in front of them – but not all.

The students talk quietly with each other. Two students who have previously been in the researcher’s ESL class come up and ask her why she is there. The researcher briefly explains that she is conducting a study on their use of English after the ESL programme.
The Physics Lecturer (S11) enters, and the room becomes silent. He introduces himself to the class and lets them know that he will post his 'office hours' on his door this afternoon. (From past experience at this institution, the researcher is aware, as are the students, that this means that these 'office hours' will indicate the times at which the lecturer will be in his office to see those students who wish to meet him).

S11 tells the students that he specialized in Aerospace Engineering, and that he has a background in both Engineering and Physics. Throughout this course he will attempt to apply Physics with an Engineering perspective – i.e. doing more Applied Physics.

S11 walks to the top of the room and begins to tell them about the syllabus they will cover in this summer semester. He says that it is a short semester, only 8 weeks long, and that there will be a considerable amount of stuff for them to cover. He indicates the chapters in the text that he will cover, and those that he will not. And, he explains that they will be covering about two chapters a week, and that at that rate it would be impossible for him to go into any one topic in any depth. This will therefore be a surface approach – a background to Physics in Engineering and that students will have to read up on their own as this same material will be covered in Engineering classes later.

S11 says that understanding would be better with the help of demonstrations and videos, but that these are not yet available.

S11 goes on to explain to the students about how he will run the course – the percentage awarded to exams, quizzes, daily group-work, and individual solving of assigned problems. He reminds students that there is a lot of material that needs to be covered, and in a very short time – they cannot afford to miss class, and must therefore be in class for every lesson. And that they must read two chapters a week, to keep up with the pace of the classes.

S11 : What is science? Somebody give me a definition of science.
Student 1 : A study of a field.
S11 : Why are we studying it?
Student 2 : To study about everything around us.
Student 3 : To study about the laws of nature.
S11 : What do you mean by 'law'?
Student 3 : The phenomena that occurs in the world.
S11 : We need to be very specific about the words we use. Everybody has a different background – so it could mean different things to different people.
I'm going to put this down. (He writes 'THE FINDING (SEARCH) OF NEW OR BETTER MODELS OF NATURE')
I'm going to use 'models' instead of 'laws'.

S11 then goes on to provide some history of the development of science from the time of the Greeks. Initially the students are writing. Then as he goes into the historical aspect of science, slowly the students' heads are raised, and they listen to him.

S11 : Nature has to be allowed to speak for itself. Is science the search for the truth? No. What do you as an engineer do?
Student 4 : Apply the models.
S11 : That's good ... (Students able to follow S11's train of thought – as 'applying the models' attests to. S11 said later that he could feel that the students could understand what he was saying and that he was confident that they could follow what he was trying to get at.)

S11 : Does anybody know the breakdown of the sciences?
(Students) (I think the students do not understand the question – they do not understand what S11 wants from them. I think they know the answer, but cannot follow his train of thought.)
S11: (Rephrases the question) What are the natural sciences? *(Triangulation: When asked later, S11 admitted that he felt that the students did not understand what he wanted them to tell him. They could not follow where he was leading, and that is why there was not response.)*


S11: Good. Very good.

S11 announces that he is going to give them a quiz – to test their background knowledge. He asks them to take out a sheet of paper and write their names and i/d numbers on the top. S11 begins to read out a question. Students begin writing. Some laughter in the class.

S11 begins writing four questions on the board for the students to do. They are on ‘vectors’. More laughter from the students. *(Are they laughing because the questions are too easy, or too difficult? I don’t think they are too easy. They must be challenging at the least. Students seem to stop and think as they write – indicating that the answers are not straight forward. But I also don’t think that they can be too difficult – as every student is writing something.)* *(Triangulation with S11: These are not difficult questions. Students can use their Math background to answer these. However, they need to recall, call up this knowledge and keep it ready for what’s ahead in the course.)*

*(In science, knowledge is cumulative – and this must be brought to the class to enable the students to follow what is going on. As an outsider, the researcher is not privy to this knowledge, and needs to be told when it is called into play.)*

Many students have their textbooks opened in front of them. Yet, not one is looking for the answers in the text. Could it be that the answers are not found there, even though there is a chapter on ‘vectors’ in the book? *(Triangulation with S11 and students: yes, answers were not to be found in the text. They had to think up the answers. But it was information that they possessed – they had to try to recall it.)*

While students are working, S11 reads from a list – finding out who is in class. He then asks students to hand in their answers. After they have handed in their papers, students discuss with each other how to answer the questions.

S11 puts the papers on his desk and walks to the board. He points to question 1, and asks students the various ways to answer the question. S11 says that he is assuming that students have the background to answer the questions in the quiz. There is no objection from the students. Do they agree that they should already possess this knowledge? *(Triangulation: When asked later, students said that they had covered this in their previous math classes. However, the knowledge does come to mind easily. They have had a break, and although the last math class was only a week or so ago, trying to think back about it is difficult.)*

S11: What is the X component?

Students: 8 N

S11: (S11 works out some math on the board) Somebody multiply that for me.

Students: (call out some numbers)

S11: Any questions on this at this point?

One student asks S11 how to ‘subtract’, since he only showed how to ‘add’ on the board. S11 says that that is a good question and then goes on to show how it is done, and to show the problem at work in nature. *(S11 says that the student’s question here and later showed that they were not only following what was going on, but that they were also thinking.)*

S11 goes on through the problem. Students seem to be able to follow. S11 intersperses explanation with questions and students are able to answer – indicating that students can follow the explanation. Confirmed by students later.

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S11 asks students to turn to page 24 of their text and assigns questions 1 and 14 for homework. "Hand in written answers at the end of the class." He also gives them an another assignment that will be due at the end of the following week. Students begin to work on the assigned problems. They work in pairs or in groups of three. There is much discussion – mostly in English. There is one group working in Malay.

(S11 says that students will not really need to read up on Chapter 1 to follow what is going to happen in class tomorrow. However, material in the chapters are cumulative, so references in Chapter 2 will refer to material covered in Chapter 1 or encountered earlier.)

However, S11 says that it will be very necessary for the students to read the chapters in the text in order to keep up with his lectures. To help them in this area, he assigns them questions every other day. To work through these problems, they have to know what is said in the chapter. So in this way, S11 helps them to keep current.)

S11 reiterates to the class that it is very important that they read. He says that it would be better if they read beforehand so that they can bring the knowledge gleaned to class.

S11 says that those who have finished can hand in their papers and leave. Students begin standing up and handing in their work. Then, they leave. When all the papers have been handed in S11 also leaves the room.

(Interview with students: the questions at the end of the end of the session were not difficult but they required some discussion and thinking, on their part, about the concepts involved. They were not difficult because their knowledge from last semester’s Calculus course could be used to answer the questions.)

(Triangulation: S11 has used the above strategy to get students to access the relevant schema so that they can follow the lesson. After this point, they will need to read in order to keep abreast with what he says in class.

S11 has incorporated a style that will ‘force’ students to read or find out more about what he is saying in class. The bi-weekly exams, assignments and quizzes, are built-in devices to make them read and keep up with the class. Marks assigned to every bit of work done by the students. This system should work well with Malaysian students, as they are very concerned with their grades.)

[Notes: this is not a formal lecture-type of class. This is more like the classroom-type that students were used to in school – some instruction, some board work, some questions to the students which they attempt to answer, some assigned problems to solve during class time. While the students work, the lecturer either walks around, stopping now and again to talk to a student, or, sits at his desk and sometimes a student goes up to ask a question.]

Observation #2
Physics 152
20 May 1997
8:20 – 10:00

One student in class – it is about 8:10. Slowly other students walk in. Many greet the researcher as a familiar face. One student asks how her research is getting along. The researcher replies that it is doing fine.

S11 walks in and wishes the students good morning. Some murmur from the students as they get ready for the class, taking out their texts and writing instruments; some take out their notes.

S11: Chapter 2 is fairly important, so I’ll give you a few problems here (he proceeds to write up the numbers of the problems he wishes them to work on.
I suppose you’re all done with the problems in Chapter 1, right? (smiles)
(I feel that SI1 thinks that this is an important area and he wants the students to be sure of it before he moves on to new material. Triangulation: Later, SI1 confirms my feelings – he says that they need more work in this area, as they are quite weak in it, with some of them not very clear of the important concepts in this important area.

Also, SI1 tells the researcher that almost 2/3 of the class were not able to do the problems assigned at the end of the last lesson. SI1 says that he is very disappointed – he thought that they had understood.

Triangulation: when asked if the problems were difficult, and whether they could do it, students had said that they were difficult and that they had struggled to do it. This could either mean that students did not know how to do the problems or that they did not understand all that was explained in class. Either way, they had not spoken up and asked SI1 for help – in that way letting him know that he was going too fast, or needed to explain something again.)

SI1 goes on to do a problem on the board and students reach for calculators and writing pads. Textbooks are open on the tables. Students seem to work with SI1 on the problems. Most seem able to follow. SI1 is currently going over the work that he assigned yesterday – to make sure that students understand what that was all about before he introduces new material.

SI1 demonstrates the addition of vectors on the board. One student asks how to do the subtraction of vectors (a similar question was asked in the last class) SI1 goes on to explain how this is done. (SI1 says later that the question the student asked proved to him that they did not fully grasp all that was taught at the last lesson.)

SI1 says that they are now going to move on to Chapter 2. “It’s on Mechanics,” he says. He goes on to explain the main terms that will be encountered in the chapter: displacement, time, average velocity.

SI1: OK. What is average velocity?
Students: (murmur; some look into the textbook)
Student 1: (calls out an answer – indecipherable to the researcher)

(Student interview: When asked, students said that much of the material found in their textbook was ‘old’ material – in that they had already learned it in Form 5 Physics. The only difference was that they need to go into it in greater depth at this level. So they were able to answer the simple basic questions posed by the lecturer at the start – it simply meant recalling what they had already learnt.

SI1 has confirmed that he asks the simple questions that he does at the start of the class to enable students to activate this schema that they have, and to enable them to use it to deal with the new material they are then going on to learn. He tries to enable the students to gather the knowledge they already possess, and then help them refocus it and take it deeper into the concepts that they need to learn.)

SI1 often elicits information from the students as he goes along. (to make sure that they are keeping up with him and are able to follow. He says that when they cannot answer, he will backtrack to find out where he lost them.)

SI1: When I write this on the board ... does everybody know what I'm doing here?
Students: (nod)

(Triangulation: S1 later confirms that he asks this to confirm that students are able to follow the calculations he is doing on the board.)

S11 assigns a problem for the students to do. Students work on it. There is some discussion. Some students are working independently.

S11 then calls for answers to the question. There is a chorus of answers – students were able to work it out. S11 works out the calculations on the board – but he keeps forgetting to put in the minus signs in the calculations. “You guys keep me honest. I’m pretty lax with my minus signs.” Students laugh.

(Triangulation: The researcher feels that students are able to follow what S11 is doing on the board and are thus able to remind him to put in those minus signs. If they could not follow – they would not realize that there was a mistake. S11 agrees with the researcher.)

S11 assigns another problem. Students work on it alone. Then S11 does on the board. Students are able to work through it with him. (Students understand what is going on.)

S11 asks a question on ‘acceleration’. Silence. Two of the senior students are able to answer. (Could it be that students had not read up on the topic before class? S11 thinks they did not read. Students confirm this – they had no time.)

Lesson ends with S11 asking them to do their problems, and leaving the class.

Observation #3
Physics 152
22 May 1997
8:20 - 10:00

[Interview notes: S1 feels that this course is not difficult because much of the material has already been covered in Form 5 work. However, he still needs to go over the material assigned in the homework e.g. that relating to vectors. Comment: I feel that it cannot be as easy as the students’ say because they still need to ask S11’s help - evidenced by visits to his room or asking him after class.]

Usual pattern in the class. A few at their places, some waiting outside. As it nears the time for the class, more and more stream into class. S11 enters - "Good Morning"; to a murmured response.

Without preamble, S11 puts a problem on the board and proceeds to work through it. Most of the class have their eyes on the board - except two students at the back on the researcher’s left. Why are they not paying attention? (Interview note: When asked later, they admitted that they were talking about something unrelated to the lesson. When asked S11 about it, he said that he feels that these boys, plus the other one in that back row, consistently hand in less than perfect work. He says that he has talked to them, and feels that they are capable of better, but they just do not seem to try hard enough. When double checked with the students about their work and how they were doing, they said they were doing fine but that there was a lot of material to cover and so they were struggling with it. These students were either satisfied with their grades or were being less than candid with the researcher.)

One student draws S11’s attention to the signs (+/-) in the calculations - they are not consistent. He is obviously paying attention to have noticed this. S11 tells him that he is “totally correct” and asks the others if they had noticed it too. Some general murmur from the class. S11 tells them that it is important that they follow this closely because this is an important area and the knowledge learnt here will be called upon again/used in the next chapter. (Triangulation: S11 if he said that because he felt that the students were not paying attention to what was happening on the board. He agreed. He felt that since it was the first thing in
the morning, perhaps the students had not warmed up to the pace yet - except for that one student. When asked on the next day, the students agreed that they were very sleepy that morning because they had been up late the previous night finishing up the problems that needed to be handed in today.)

After Tuesday’s class, many students had come up and asked SII questions on ‘direction’ and which signs (+/-) to assign to such values. (SII was therefore not very clear in class and will need to go over the topic during the next lesson. This feedback from the students is very valuable to SII as it helps him gauge how well each topic/lesson is received and whether he should backtrack or carry on.)

SII goes over the topic which was unclear in Tuesday’s class. He then asks the students to work out a problem. Students get down to work – just a few murmurs here and there. Most students are working on their own – only two groups are working in pairs.

SII moves to the board when he feels that students are finished and begins to work through the problem. Most seem to be working with it with him.

<table>
<thead>
<tr>
<th>Student 1</th>
<th>SII</th>
<th>Student 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I’m not sure what a negative sign shows.</td>
<td>Sir, it also shows deceleration, no?</td>
</tr>
<tr>
<td>SII</td>
<td>(SII moves to another part of the board and begins to explain this with the aid of diagrams.) Let’s do some more problems. I want to do some free-fall ones too.</td>
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(SII says that the students have been taught that the minus sign only means deceleration. It also shows direction. Students need to add this to the stock of information under this topic, and ‘unlearn’ that the minus equals deceleration. That is why he gives them more problems – so that they can fix this new concept in their minds.)

SII moves to the board again and calls for answers to the problems. He puts down three sets of answers. He then works through the problem with the students. Only one set of answers is correct.

SII asks them to read their textbooks on ‘intervals’ – this has not been covered by the problems he has given them, but they need to know this. He then tells them that that is the end of Chapter 2, and that they will be moving on to Chapter 3 on the next day. He also reminds them that there will be a quiz on the next day, and that it will be based on material from Chapters 1 and 2.

The students smile at SII and at each other. (Do they feel that this is going very fast? That is the impression I get. Triangulation: When asked the students confirm this. They feel that SII is going very fast and that they barely have time to catch up with him – what with keeping up with the reading, the homework and studying for the quiz. One student says that that is why he dreaded this summer semester – the pace is too fast for him.)

SII assigns 3 questions for the students to work on in groups. They get down to work. Most of the students work in English, except for a few of the Malay students who work in Bahasa Malaysia.

I feel that these problems are not simple. The students cannot simply work out the answers – there is the need for discussion and a lot of ‘chin wiping’. There is a lot of thinking involved too. Students need to figure out the various directions, and whether it is acceleration or deceleration that is involved. Sometimes there seem to be arguments. (Triangulation: Both the students and SII confirm that these are not simple problems. There is a need to critically look at the question and figure out what exactly is being asked before the actual calculation per se can be done.)
The researcher is as usual the first ‘student’ to report for class and she takes her usual place at the back of the room. Slowly the students come in. She is quite a familiar face now and many stop to say ‘good morning’ or to smile as they make their way to their tables. The researcher has used this period in the morning to ask students about the previous class – their responses to SI1, their reaction to the problems he set, etc. This information is then added to the stock of data on this class that is slowly being built up.

SI1 enters and after ‘good morning’, asks, “First of all – are the any questions of the homework?” The students remain silent. Many are taking out the things they will need for the class and then putting their bags away. There is general ‘fidgeting’ but no response to his question. “Have you done any of the homework?” he then asks. Many students shake their heads; others simply stare at him. So SI1 reminds them. “Homework is due on the same day you take the exam … Thursday next week … OK? … remember that.”

Some students nod, others still stare ahead.

SI1 turns to the board and writes a long list of problems he is assigning for the next chapter. (Triangulation: SI1 admits that he is worried that the students are not working. He assigns a lot of problems to ‘force’ students to get out their books and read, and thus keep abreast of what he is teaching in class.)

SI1 : So … I’m assuming that you guys know everything about Chapter 2, OK? And … I’ll find out today, eh? … eh? (SI1 is jokingly referring to the quiz that the students will take later on in the lesson.)

(Interview note: SI1 says that he would like students to talk or ask questions during class so that he would not have to talk for the whole 1 hour and 40 minutes. But he says that the students don’t share anything. So he is forced into giving them the things to work through so that they assimilate some of the material he is introducing in the course of the lesson.

SI1 says that the students can do most of the problems assigned, but that they do not really understand the concepts behind them. He uses the example of the ‘falling stone’: while students are able to do the math associated with that phenomenon, they did not get the sign (+-) right. Why? Because they did not understand the concept behind the use of the signs and that the signs can mean either deceleration or direction. They could not decide which.

(The students tell the researcher later that they were silent in class because they were ‘concerned’ (worried) about the quiz that they had to take later. That is why the class was very quiet at the start, with barely any responses from them. Some said that instead of working with SI1 on the problems he was handling on the board, they were actually looking at earlier chapters to try and ‘cram up’ on material for the quiz.)

SI1 then introduces a new idea – a diagrammatic problem on the board. He gets students to say in which direction they think the elephant is walking (with reference to the diagram/values on the board). SI1 goes over the same idea many times. (Triangulation: SI1 would say later that he intuitively felt that the students were unable to get the idea. His intuition is based on the soft, hesitant murmur from the students. He says that from past experience, students think that they understand when they work through the problem with him on the board. But when he introduces a new problem, they are unable to figure it out. So, SI1 says he takes it very slow, giving many examples on the board to clear it in their minds.)

At 9:15, it is time for the quiz. SI1 asks the students to spread out around the class. He hands out the question paper. Students get their papers and begin working – reading mostly. After a few seconds, students are busy writing.

Slowly, student behaviour changes – most of them have stopped writing. They are reading again. Drawing diagrams. Looking up at the ceiling. Looking ahead. Occasionally they write – but it is not as furiously as with the first question.
(Triangulation: A glance at the question paper reveals that the first question requires them to calculate something. That is why everyone is busy writing almost from the start. The second problem is in text form and will require the students to read it and then figure out what is required of them. That is why, after the first spate of writing, students’ behaviour exhibited the fact that they need to think.

When asked how the quiz was afterwards, many students said that it was ‘all right’. The questions asked for things that they were familiar with. One student volunteered that although the questions were simple, he had problems working out the answers. The second question, especially, required that they think – the answer was not as straightforward as they would have liked.

(Note: The researcher has been very lucky thus far in her research. S11 often stops by her desk when the students are working on a problem, and they have a chance to discuss what has just been happening in class. This has afforded the researcher the opportunity to triangulate data when it is fresh – both in her and S11’s minds. Thus, information/phenomena perceived could be quickly triangulated against the participants’ ideas, and a conclusion can be arrived at. It also helps to shape the researcher’s thoughts on what is going on, with a clearer understanding of what S11 hopes to achieve with the students.)

Observation #5
Physics 152
2 June 1997
8:20 – 10:00

The usual pattern at the start of this observation session occurs. The researcher is as usual the first to arrive and take her place. Slowly students trickle in – all smiling or saying ‘good morning’ as they pass by the researcher. They head to their usual places and either just sit there talking, or take out the paraphernalia they will need for the course of the lesson.

(Note: Prior to attending this class, the researcher had met up with S11 and they looked over how the students had done on the quiz given in the previous week. Most students got Question 1 correct. Many got Question 2 wrong, or did not finish the problem correctly. Question 1 involved a diagrammatic problem – it contained a graph, with angles and distances marked out. Question 2 was expressed in words – there was no diagram given. Students needed to read and understand the information given in the question, and from this information construct their own diagram, put in the angles and distances in the correct places and then proceed to solve the problem, using the appropriate formulas and calculations.

(The researcher asks S11 if students could have not performed as well in Question 2 as they did in Question 1 because they had a problem understanding the language – since it was not a diagram, but that the problem was expressed in words. S11 agrees that, sometimes, students do not understand the language in the problem. He suspects that this is the case with Question 2. He says that he will ask the students if indeed they had a problem with the language of the question.)

S11 walks in. And, after a brief ‘good morning’ and a smile all round, he says that he is going to go over the answers to the quiz that they had last week. He says that he thinks that the quiz was fairly easy.

S11 proceeds to Question 1. He mentions that he recalls that everyone in the class got this question right. S11 says that it was fairly straightforward, and that everyone could handle it.

S11 then goes on to Question 2. Many students had problems with this question. He tells them that for this question, they would need to conceptualize the problem before they can work it out. S11 explains what is required, working out a diagram on the board as he speaks. He then proceeds to solve the problem – this involves many lines of calculation. The students look at the board as he explains: glancing at their papers and then back at the board. When he begins to work on the calculations, many students begin writing – they appear to be copying what is on the board onto their papers/writing pads. S11 remarks that this problem too
is 'pretty straightforward', and that all they need to do is apply one of the many formulas they are familiar with and proceed.

S11: How many of you had a problem with how this question was phrased? Did you have a problem understanding what you needed to do?

Students: (no vocal response from the students, but many are nodding their heads)

S11: Well ... if you do not understand the phrasing of a problem ... I can understand that ... with your background and problems with English ... you can come up and ask me about it.

Students: (many are smiling. One girl, right up front, looks at him incredulously.)

S11: (addressing her, and then the others) You don’t think so? It’s OK ... even though it is an exam or quiz ... you can come up.

S11 then goes on to talk about the test that was given the previous week. Again, he says that the first two questions were fairly easy and straightforward. The then says that he thinks that Question 3 was a ‘tough’ question. “And it was,” he says, referring to the number of students who had difficulty with it. As with Question 2 of the quiz, this question too needed for the students to ‘sit and think about it for a bit’ before they could attempt to solve it. There was no formula that would apply automatically; no straightforward answer.

S11 draws a diagram to represent the ideas in Question 3 and then proceeds with the calculation for the problem. Students are writing again – heads bobbing as they copy from the board.

S11 goes on to do the same for Question 4 of the test. One student waves his hand at S11 and questions him on the calculations on the board. S11 pauses to go back over the question, explaining what is required of the student. He says that they need to get the concept of what is being implied in the question before they can work. He explains what needs to be done again, and the student nods. S11 then finishes up the calculation.

S11 tells the students that the questions for the test are pitched at average difficulty. He reminds them that there will be many tests before the final exam, and that this will help the students achieve a good grade.

Putting the sheet of the test paper aside, S11 reaches for his notes and says that he would then like to start on Chapter 6. He begins introducing the main concepts in the chapter. Students look up towards him. Books are open on the table. A few students occasionally make a note in the text or on their writing pads.

Towards the end of the lesson, S11 looks straight at the students and speaks to them in a serious tone. “I feel that some of you have not been doing your homework. Some others have copied your homework,” he says. He then goes on to warn the students that the tests and quizzes he sets are very similar to what is given as homework. “Therefore ... homework is very important,” he says. He tells students to know what they are doing, and to know what is going on. He tells them that he doesn’t mind if they work together on the problems,”...but is very important that you understand the concepts, and what is going on ... so that you do not do the wrong stuff,” he ends.

To help students work towards a better grade, S11 decides that he will assign them an ‘extra credit’ question. They are required to design an instrument to measure acceleration. They must also design a piece of equipment that measures mass in outer space, where there is no gravity. He explains that this was a problem for NASA in the sixties. He assigns 3½ marks per question and tells them that these are two sides to the same problem. They will need to think about it for a while before they can come up with a solution.

S11 then gives the students a couple of problems that deal with the concepts he has just taught in class. Students work alone, some in groups. After a few minutes have lapsed, S11 calls for answers. He puts down the different answers that they call out on the board. No two answers called out are the same.

S11 proceeds to work out the problem on the board. He arrives at a totally different answer from those on the board. *(Triangulation: Could it be that the students did not really understand what he had been saying*
earlier? 'Yes', says S11 when asked later. They had not fully grasped the concepts and this is why their answers were erroneous. That is why he went on to explain part of it again.)

S11 explains again about 'fluid resistance' and 'terminal speed'. Then he asks students to read up the relevant parts of the chapter on these areas if they are still not clear on them. He asks students to let him know on the next day if they still do not understand – even after reading. He'll explain again.

With that he signals the end of the lesson, collects his things and walks out of the room.

Observation #6
Physics 152
16 June 1997
8:20 – 10:00

Students come in and sit in the same places everyday. Everyone has his/her textbook with him/her, and it is opened. Most have note books/pads also open on the table. They wait, some talking quietly, for S11 to arrive.

S11 arrives, and after a brief 'good morning', tells them about the test they have just taken. The scores range from very high to low, and that he will go over the paper with them on the next day. He looks at his notes, and tells them that he will finish up with Chapter 8, and then move on to Chapter 9, today. Students flick through the pages of their texts.

S11: First of all ... any questions on the homework?
Students: (no response – all heads down in the texts before them)

S11: Well ... this either means two things – you’ve no problems or you’ve not started on it yet.
Students: (laugh)
Student 1: Yes. Question 8-23.

S11: OK. (S11 turns the pages of the textbook and briefly reads through the problem)
Is the problem with the fact that you don’t know what a hockey puck is? Do you know what it is? (This observation on the part of S11, shows that he is really sensitive to the language problems of his students. He at once focuses on what may be a difficult item of vocabulary, rather than on the Math part of the problem.)

Students: Yes.
S11: OK. Let’s see what we have here ... (he reads out the problem. Then he turns to the board and begins drawing out diagram)
I’m just putting down the ideas in the question. (He then writes out a formula on momentum)
Now ... let’s do this ... (he proceeds to substitute values for different parts of the formula)
What does this equal to?

Students: Zero (They are able to follow what is going on. Triangulation: Later S11 will explain that the problem, per se, is not difficult. What seems to be difficult for the students is to conceptualize what it is. When asked after the class, many students concur with what S11 says. They too feel that their main problem is to figure out how to conceptualize what is being referred to in the question.)

S11: (writes in ‘zero’ in the equation building up on the board. It is many lines long, but the students do not seem to have difficulty following what is going on.)
Students: (Call out values as S11 reaches various points in the equation.)
S11: We have two unknowns, right? What are we gonna do?
Students: (some murmurs)
S11: Let’s find out some value for one of them. (Another equation/formula goes up on the board)
Student 2: (calls out a mistake in the equation on the board)
SI1: You're right. Very good. (SI1 changes something in the equation and continues with the calculation)
Check that out. What do you get?
Students: (Work on their calculators – they are punching in information. They begin calling out answers.)
SI1: (continues working with the equation. He then stops. Something seems to be wrong.)
Can that be? (He looks at the material on the board)
Oh, here we are. Why did I do this? It's wrong isn't it?
Student 3: (inaudible – but apparently offering a reason for the error)
SI1: He says that this is not tepat.
Students: Kinetic energy.
SI1: That's right (and goes on to explain why the equation is right so far)
Students: (begin calling out answers again.)
29.3
SI1: OK. Now for the second part of the equation.
Student 4: Sir, what happened to 'cos 30'?
SI1: Did I do something wrong? (He looks at what is on the board)
You caught me. I apologize. I think I did something wrong. (He goes back to the numbers on the board and works through a section again. Students call out numbers, and 'plus' and 'minus' to indicate what signs to use.)
OK guys. Way to go. Every Monday morning ... I'm like this. (He laughs.) I don't know how this came out the same. Ha! Ha!
Students: (Laugh)
SI1: Let's get back to the second part ... (he begins to explain something, using the diagram to help)
Is this an elastic equation or not?
Students: Not
Student 5: What about ... (asks about some values)
SI1: (puts in the values in the equation he is writing.)
Students straighten up. (Is this the end of the calculation on the board?) SI1 begins to erase everything on the board. (Because they were following the calculations carefully, the students' body language informed the researcher that the problem was over – it had been solved. SI1 confirmed this by wiping the board clean, signaling that it was over.)
SI1: I'm going to conceptually finish up Chapter 8. (He walks up to the board and writes 'centre of mass'.)
SI1 goes on to explain some concepts of Newton. Students appear to be paying attention – they look up at him. No fidgeting. Quiet. No one is taking notes. (Could the material that SI1 is covering be in the textbook?)
SI1: I'm going to write something on the board. You'll not use this that much. But you'll need to understand this now because it'll turn up later.
(SI1 proceeds to write out three levels of equations on the board.)
SI1: Somebody explain to me what this means.
Students: (some are smiling. Others just look up. Silence)
(SI1 proceeds to draw what appears to be the sun, and some planets in orbit around it.)
SI1: I'm Captain Kirk of the USS Enterprise. How do I find the centre of mass of this?
(As the students are silent, SI1 goes on to explain the concept of the centre of mass. The students nod. SI1 throws his pen across the room. Everybody follows it with their eyes.)
SII: See how it rotates? Somewhere along the pen is the centre of mass ... which moves in a straight line. (SII continues explaining the concept.)

Any questions on this?

Student 6: (inaudible)

SII: (walks to the equations on the board) What is it that you don’t understand?

Student 6: (pauses to think) Never mind. Let’s do some examples ... maybe then I’ll know better.

Student 7: Does high centre/ low centre of gravity mean the same as centre of mass?

SII: (Triangulation: SII appears confused by the term ‘centre of gravity’. Later, he will tell the researcher that this term is not used in America, and that he feels that it is an inaccurate term to use. Students on the other hand say that this is the term that they have used in Forms 4 and 5, and that they have never come across ‘centre of mass’. He then realizes that both terms are referring to the same thing and he then explains the concept to the students.)

Student 8: (inaudible – but apparently asks about another part of the equation)

SII: Let’s do some examples. Let me make sure that I’m doing this precisely right. You guys give me a hand here. Let’s do it. (SII writes out part of an equation on the board.) You guys read this to me.

Students: (read out values from the textbook.)

SII: (writes them out on the board)

Student 9: (asks a question about some values)

SII: (explains) Oops, I’m sorry – we are given these values. I apologize. We’ll do ‘x’ first. So, ‘x’ equals ... ?

Students: (murmur – some call out some numbers)

Student 10: So what does centre of mass co-ordinates mean, sir?

SII: Actually, that’s a good question. I should have explained it first.

SII proceeds to show the co-ordinate system on the board. A student asks another question about it. SII explains.

SII: I didn’t think I’d spend so long here ... but I’m glad you’re asking these questions.

SII goes back to explaining the concept. He uses his marker pen to help explain. Students are all paying attention. All eyes are on him.

SII: We’ll go back to working out more examples. I can still see that there’s some confusion. Give me a day for that and I’ll come up with some examples. (He walks back to his table, and turns back to the text.) Look at ‘rocket propulsion’. Can somebody tell me here how a rocket works?

(SII sits on his table and talks about how rockets work. He suggests a reason for how they work)

Right? I see some nods, and I see some ‘no’s’.

Students: Newton’s third law.

SII: But what does that mean? (goes on to explain how a rocket really works. He writes an equation on the board. Students write this down.)

What does this part of the equation mean? What does it stand for?

Student 11: (calls out an answer)

SII: OK. Let’s do a problem. Let’s do the problem I assigned you. 8-47. SII reads the problem.

Students: (flip the pages of the textbook and follow)

SII: (works values into the equation on the board.)

What do we want to find?

Students: Delta ‘m’.

SII: Right. (He continues working on the equation.)

Is that right? (he asks this at different points of the equation.)

Students: (They are copying from the board.)
Student 12 : Are the units correct?

S11 : (looks at the equation) I told you guys that you need to keep me honest. (He changes some areas on the equation.) OK ... that’s it for Chapter 8. Let’s go on to Chapter 9. Most of it is easy — you have done this before, so you guys should be all right. So, Chapter 9 should be relatively easy. When I talk about ‘radians’, do you guys know what I mean?

Students : Yes.
S11 : (goes on to explain the introduction to the chapter on the board.)
Students : (all looking up)
S11 : I think your book uses ‘alpha’
Students : Yes (shows that they are following his explanation)
S11 : I’m going to get some papers. Do page 257, questions 4 and 5. Discuss them and explain the answer to me — in writing.

S11 leaves the class. Most of the students seem to be doing the problem on their own. One group of boys are discussing something.

S11 returns and hands out graded work to the students. He asks students if they are ready to discuss their answers. Students ask for more time to workout their answers.

(Triangulation: S11 comes to the back of the class to talk to the researcher. Yes, there seems to be some confusion with the close of Chapter 8 he responds when asked. Apparently, the students have a problem with the concept of ‘centre of mass’. S11 feels that he will need to do more work on this with them.
S11 says that today’s class has not gone well. Students did not know as much as S11 thought they would. Finishing up the chapter therefore took much longer than he had planned and delayed the moving into Chapter 9.

The researcher tells S11 that some students have said in the ‘Short Questionnaire’ that they find the text very confusing. S11 says that this is a standard Physics textbook — and that most textbooks are like that.)

S11 walks up to the board and draws a diagram on it. He writes an equation under it. Students walk up and leave their papers on S11’s table. S11 explains ‘centre of mass’ with the diagram and the equation. Students have no questions.

S11 asks them to finish reading up Chapter 8 and to ask him any questions they may have on it tomorrow. He also asks them to read up on Chapter 9. No reaction from the students — they are packing up their things and getting ready to leave the class.

S11 says indicates that the class is over. Many students go up to his table. They have questions on the ‘centre of mass’. S11 says that this is a major design problem in Engineering and that it is crucial that the students understand it clearly. He tells them that he will bring in more problems on the next day as students cannot afford to be confused in this area. He says that they will need to work out problems in this area when they are engineers.

Students return to their desks, pick up their things and leave. S11 leaves the room.

Observation #7
Physics 152
17 June 1997
8:20 – 10:00

Students enter the class as usual. All with textbooks. No one is reading. A lot of talking — not about Physics. S11 enters with a stack of exam papers. Class gets quiet. He begins giving them out. He calls name after name (he says later that he this is how he remembers names).
Overall, the class average for the test is 74%. S11 says he is not satisfied with this, he would like it to be 85% ‘this is what it should be’.

S11: Let’s go through it very quickly. OK. No.1 should have been drawn like this. (He proceeds to draw a diagram on the board) This is frictionless, right?

Student I: Yes
S11: OK. So what is M1, and M2?

Students: (call out values)

S11: Remember, every time you get a question like this, you’ve got to draw a three-bodied diagram.

Three boys come in. They are late. ‘You want your test?’ S11 asks. ‘Come on up.’

S11 then goes on to explain to the class how the diagram should be drawn, and why it should be drawn that way. Students have their test papers before them. No one is writing.

S11 writes an equation on the board to solve the problem. He says that almost everyone got the full 20 points on this question.

He then goes on to No.2. The main mistake here was a wrong assumption for the values of T1 and T2. Students assumed that they were the same when they were different. ‘Again, you need a three-bodied diagram.’ He draws the diagram on the board. ‘Just looking at this, do the values look the same?’ he asks the class. An unconvincing ‘no’ from the students. S11 explains why the students should have known they were different by just looking.

‘Be careful making assumptions. A lot of the time, people make assumptions that are not true. So be very careful when you make assumptions.’

S11 explains what the question is asking for. He begins to work it out on the board, calling for values from the students. He writes out the equations on the board. 5 students are taking down material from the board.

S11 goes on to solve the equations on the board – explaining what he is doing as he goes along. ‘Are there any questions? Shall I carry on? Most of you had the idea – but jumped to the assumption that they were the same.’

S11 goes on to No.3. He reads out the question and says that he thinks most of them got that right. He begins drawing out the diagram on the board. He writes out a formula under the diagram. S11 speaks to the students as he draws and writes so that the students can follow what he is doing. He explains how he is formulating the equation that is taking shape on the board. There are no interruptions from the students. All seem to be paying attention. (Triangulation: S11 confirms that by looking at them he can tell that they are all paying attention. This again correlates with what the students have said in the short questionnaire – that they pay attention to him in class so that they are better able to follow in class and later with their reading)

‘I make the test fairly straight-forward and relatively easy. But I always put one in there that’s quite hard. This (no.4) is the one. Did anyone get the full 20 points?’ One hand goes up – a girl in the second row. ‘Good. And you came up and asked me to clarify something in the question during the test, right?’ She nods.

S11 proceeds to draw out the diagram on the board, talking his way through it. He says that students have made mistakes in the naming of the units on the diagram – and that this is how lots of students lost points. ‘Please be careful with your units. I took off points for that.’

S11 writes out an equation on the board and he asks the students to say if it is correct. There is a murmur from the students. S11 explains how to go about working on this problem. (Triangulation: S11 later tells
the researcher that this is a difficult question. Students needed to think it out carefully before actually doing anything. It is not a straightforward question. There is one of this type of question in every test as it tests their ability to think and reason things out.

'Everybody follow this? I'm gonna spend some time on this so that everybody understands this one. This problem.'

Students look up at the board. Most are taking notes. S11 asks questions as he goes along, and students call out values for the equation.

S11 explains that there are various ways of doing the problem. He explains one way. "I can choose to do it this way" — writing another equation on the board. Students are very quiet — all eyes on the board. "Is that a 2 or a 7 I've written here? (students say '7') It's really bad when you can't understand your own writing." Students smile.

S11 writes another equation on the board. "What kind of equation is this called?" A murmur from the students. "This is a quadratic equation," he tells them and proceeds to solve it.

A student asks S11 to explain part 'e' again. "The force technique?" he asks. The students nod. "OK. Let me see if I can explain it better." He clears off part of the board and proceeds to work through another equation, explaining as he goes along. "Is that better?" Students nod. "I did jump around for that question." S11 says.

S11 goes on to the next part of the question. "This no. 4 was a do-able question if you really took it and analysed it," he says. He cleans the board — signaling the end of the test questions.

S11 goes to his desk and opens up his textbook. "What I want to do today is finish Chapter 8, and then go on to finish Chapter 9." He then goes on to do an example from the textbook. He draws a diagram on the board. He then writes out two equations to explain how to solve the problem.

S11: Is this right?
Students: Yes.
S11: No. This is wrong. Why did you say it was right? I'm testing you guys — you're all asleep! (S11 laughs.) I just made a mistake in the equation. Where should we put out reference points?
Students: (call out answer)
S11: OK. Let's see what this works out. See. So it doesn't matter where you choose to put it. It always comes out the same. Let's look at some problems. These are all things that you'll run into when you're engineers.

(S11 draws a diagram on the board)
S11: Where's the simplest point to put the 'x'-axis.
Students: (call out answer)
S11: OK. But let's choose the simplest place.
(He writes out a formula on the board, and proceeds to work on it, talking through it step by step. Students work with him, there is a murmur from them as they follow.)

S11 tells them that they will get a lot of problems like this one when they go on to do statics and dynamics. He then talks about how to build a wind turbine. Students seem to be listening. He talks about the difference between static balance and dynamic balance.

S11 says that they are now going on to Chapter 9. 'Chapter 9 is a very simple one.' He draws a diagram on the board. "Yesterday we talked about this" and goes on to put and equation on the board, and proceeds to work through it. Students are writing down things from the board. "Your book calls it 'tangential acceleration'. What does this mean?" There is a murmur from the students. S11 proceeds to explain.
SII goes on to look at the kinetic energy of a rotating mass. He draws a diagram on the board and writes out a formula for the diagram. And he goes on to explain when and how to use the formula to find the 'moment of inertia'. He goes on to explain what this term means.

'Where do we use this? A fly wheel.' A student asks what this is. SII draws it out on the board. 'We need a class on practical experience!' he jokes. The students laugh. SII tells them that there is a picture of one on p.270 of their text. Students turn to the page.

SII says that they have come to the end of the chapter, and puts down the numbers of the questions he wants the class to do as homework.

A student asks SII to explain 'moment of inertia'. 'OK. Let's look at a problem and see if we can explain it.' He explains on the board.

SII uses the last few minutes of the class to go through the students' answers to the true/false section of the test. He explains how he allots marks (2 points for yes/no, 2 points for the explanation.) He goes through the questions.

'Ok? That's all for today.'

3 students go up to SII with their test papers. Most of the students leave. 4 stay behind and read the student's answer to the difficult question.

Observation #8
Physics 152
23 June 1997
8:20 – 10:00

As usual, the class slowly fills up just prior to 8:20. Noisy – seem to be catching up on weekend news. Textbooks taken out, and notes (asked students what was in their notes – and looked – mostly calculations of what was done on the board. No text.)

SII comes in. Silence. All have books open. He hands out the assignment (group work) from last week. It has been graded. Students look at their work.

SII: 'I spent quite a bit of time on these. It's worth about 5 points somewhere or other. Let me go over these now.' He then proceeds to read the question. 'I'm just going to show you how this one is conceptually – it's not going to take a lot of time. We've got a lot to go through today.'

SII begins to explain the question. He draws a diagram on the board. Students follow attentively. He asks students to provide the values as the calculation progresses. A couple of students comply. They work it through to the answer.

SII: 'Left you guys working on Chapter 10. Left you totally confused with the problem we did on the board. I'm sorry. You mentioned something and I didn't listen. So I'm gonna do that again now. Problem 10-17. I'm gonna set it up on the board. I'm not gonna do the math.'

SII then begins to explain the problem. Students rifle through their notes to get at the relevant ones. Most are looking up and paying attention. (SII agrees that the students pay close attention most of the time.)

Some students are taking down stuff from the board. Every time SII writes an equation/formula on the board, the students take it down. SII explains where he made the mistake in the previous explanation. SII: 'Let's do a few more.'

SII works through another problem. One student does not understand something in the calculation/how it is worked out. SII explains.
S1I works out another problem on the board. This time the students tell him that his answer is wrong – it is different from their answer manual. S1I: 'The book is wrong.' (laughs) 'I never make mistakes.' (laughs) Students laugh too. 'I'll just go over this and let you know for sure tomorrow. But the book is wrong. I know it is inconceivable that I could be wrong. But it can happen (smiling). But I'll let you know either way tomorrow.'

S1I goes on to work more problems on the board.

S1I: 'How many have started with the problems of Chapter 10? This week is your third exam? Chapters 8 through 11? Are you getting tired of this? (Students laugh and nod) Only 3 weeks left of school guys. Let me ask you this – how many of you are finding this stuff easy?' Students laugh.

S1I: 'Kinematics and dynamics – how many understand that? (no response from students) How many understand that very well? (no hands go up, some shaking of heads) OK. Just do the problems and it'll get clear.'

S1I moves on to the next chapter – on equilibrium and elasticity. 'I'm doing something different from your book. I hope it will be simpler. Does that scare you? When I do something different than your book?' Students laugh. S1I maintains eye contact with the students – his eyes scan the room from right to left before he goes on. He puts a diagram on the board. 'Can somebody explain this to me conceptually?'

A student answers. S1I goes on posing questions and students answer. (Interview note: Students later say that they were able to follow the lesson. And that they could understand what was going on quite well.)

S1I works out a few problems from the textbook. As he works through the problems he'll stop to ask students the values for various components of the equations being worked. Students call out answers. All look up and seem to be following the lesson. Now and then, S1I will stop to explain how the problem will work in real life. (Interview note: Later students will say that they like that – it helps make the problem 'real' not just an academic exercise.)

Lesson ends.

Observation #9
Physics 152
24 June 1997
8:20 – 10:00

Class fills slowly. Students take out their texts. Many are discussing the problems assigned for homework. They never seem to be discussing concepts – on the mathematical calculations of the problem – numbers/values, which value to put where.

S1I: 'OK. Any questions on the homework? The question I did on the board yesterday – the answer in the book is wrong.'

One student asks S1I to do/explain no.10-36. S1I reads out the question, and proceeds to draw a diagram on the board. He begins explaining, and adds values to the diagram developing on the board. Students all looking up.

Another student asks S1I about a formula in the text. S1I explains how it works. Another student asks S1I about the force in a pulley. S1I explains. Other students ask questions on the direction of force and other questions. S1I explains.

S1I: 'How many did no.10-11? How many finished it?' A show of 5 hands. 'Did you get it right?' One student shakes his head – 'no'. S1I laughs. 'Let's do it very quickly up here.'
Building a diagram on the board, S11 explains the different concepts involved. Students all looking up and also taking down notes from the board. (S11 tells me that this is a difficult question and the students know this. His eye contact with the students tells him a that they are all paying close attention.)

S11: ‘Is everyone OK with this?’ Silence. S11 looks at the class and decides that they are not OK. ‘Let’s do this one more time. Slowly.’ He goes back to the diagram. ‘I hope I’m not making this more difficult. I see a lot of confusion in your eyes. Is it OK?’ Some nods from the students. ‘Can I go on?’ Students murmur – some nod. S11 cleans the board – signaling that that problem is over.

S11 tells the students that that is the end of Chapter 10 and that they are now going on to Chapter 11. He turns to write the homework problems (question numbers) on the board. Students groan, but mark the questions in their textbooks.

S11 begins to talk about the concepts found in Chapter 11. He introduces two new terms: compressive load, tensile load. He explains what they mean. He then proceeds to work on problems from the textbook. He goes on to introduce other new terms and what they mean. All are followed with formulae to calculate the values of various components. Many students are taking notes. All are looking up.

(Triangulation: S11 says that whenever he introduces a new concept, he tries to relate the concept to the real-life experiences of his students. That way, they can relate to it and it makes sense to them so that they understand it quicker, and remember it better. Students say that S11's explanations help them to conceptualize the problem better because they include real-life examples.)

Observation #10
Chemistry 112
22 May 1997
10:30 – 11:45

Most of the students have their Chemistry textbooks on the table. S12 enters the class, and after the ‘good morning’, he draws a diagram on the board. S12: ‘What is wrong with this picture?’ One student, up front volunteers that the signs are wrong. S12 proceeds to change them.

All the students are looking up at the board. No one is taking any notes. (This is a big class, rather packed to capacity. There will always be at least one student absent – so I will always find a seat at the back. If they all decide to show up – I will be without a seat.)

Specialist Informant 2 (S12), the Chemistry lecturer proceeds to introduce various terms: london forces, dispersion forces; induced dipoles. There is a lot of board work. No questions to the class – lecture type of lesson. Notice that one student is sleeping.

After 45 minutes of lecture, S12 suggests a 10 minute break. Students voice their assent. Class resumes. There are a lot of stifled yawns. Books are open. No questions from the students. Eyes seem to be on S12. Lecture continues.

(Triangulation: After class, some students say that S12 is different from their previous Chemistry lecturer. She would follow the organization of topics in the book. S12 does not – he jumps from topic to topic. Difficult to follow him. They are very scared of him. They have looked at the past year/semester questions and they feel that he sets very difficult questions.

Students say that they don't take notes when S12 is teaching because he goes very fast. If they write, they will miss something. So they just try to pay attention in class. “Everything is in the textbook” – so there is no need to take notes in class.)
Observation #11
Chemistry 112
23 May 1997
10:30 – 11.45

S12: ‘Put all your books away. Have on your desk just one piece of paper. It’s not me reading it – it’s your grandmother who doesn’t understand Chemistry. Explain all the terms, because she doesn’t know anything, in clear and simple English sentences. Ten minutes.’

S12 writes the question on the board. They are to explain one of the following terms: polarizing power, polarizability, dipole-dipole interactions. All the topics were discussed during the last two days’ lectures.

Students begin writing. A lot of them seem to be thinking. The student next to the researcher has an empty sheet before him.

After 10 minutes, S12 collects the papers. He talks about the importance of English – English communication. He gives the example of a factory in which there was a problem. But the problem could not be resolved because the workers could not communicate to each other what the problem was.

S12 begins the lecture for the day.

(Triangulation: S12 says that he gave them the short quiz because he wants to see what they have understood over the last two days. Have they read up? Also, can they express what they know in clear and simple English. He says that over the years of teaching in Malaysia, he has come to the realization that students can do the calculations, but cannot handle any question that requires an explanation.)

Observation #12
Chemistry 112
16 June 1997
10:30 – 11.45

The room is empty. There are bags and books on some of the tables but the students are not around. They are all waiting outside. They will only enter when they see S12 appear at the top of the stairs.

S12 enters and writes ‘Equilibrium’ on the board. He proceeds to give a definition of the term and writes out an equation on the board. He goes on lecturing. Students seem to be fidgeting, flicking through the pages of the textbook, looking up at the board. S12 continues without interrupting his pace. He cleans the board and puts up the chemical name of sodium chloride on the board. The class is silent. Students are looking at the board.

S12 asks the students to work out a problem. They begin work. S12 walks around and stops now and then to peer over a student’s shoulder. ‘Wrong!’ he calls out and walks on. ‘Have you thought about that?’ ‘Do you think that can be right?’ he asks others. ‘It’s amazing what people use a calculator for these days.’

S12 writes the answer on the board. ‘Remember, no equilibrium can be negative.’ He goes on to explain why. He then goes on to ‘successive equilibrium’, and writes out the equation for phosphoric acid on the board. ‘Is this OK? Shout soon, before I get into a mess!’ Students say it is all right, so S12 proceeds with the explanation.

S12 explains line after line of the equation on the board. Some students are writing in the margins of their textbooks, others in a note book. S12 reaches the end – ‘Is that right?’ he asks. Some students point that something is not right. S12 corrects it. (Students are obviously following what is going on in class.)
SI2: ‘I want you to work out the equilibrium constant for this reaction.’ He puts something on the board. ‘Work it out symbolically.’ One student says that he doesn’t understand. SI2 explains. The other students go ‘Oh.’ and then begin to work.

SI2 walks around the class. ‘I’ll give you a hint – look at the earlier example. Use that explanation to do this.’ A student asks a question. Obviously they have not understood him. SI2 explains again. ‘Now do you see?’ Students are quiet. They are writing. ‘The more you do this, the more you’ll see that it is quite simple,’ SI2 says.

SI2: ‘I’m not going to follow the text now. Those of you with itchy fingers can use their calculators.’ He writes an equation on the board. The students punch at their calculators, working out what is needed.

SI2 gives them another problem. Then SI2 says that they will break for a few minutes and he leaves the class.

(3 students near by talk about the lesson. One says that this is a very interesting part of the chapter – playing around with numbers. Two other students continue working on the problem given earlier. One student is explaining to another a problem that was done in class earlier. Other students join them and there is some discussion.

Note: Today’s class is a class about numbers. Line after line of numbers that students need to see relationships about. They also need to do a lot of calculations. Students say that on the whole they did not have any problem following the lesson.)

SI2 returns and tells them that this is a crucial chapter. He puts more problems on the board. The students work. (SI2 says that if the students can work out these problems it will tell him that they have understood the lesson.)

SI2: ‘I urge you do as many examples as possible, to make sure you understand the concept. Remember, you need to look at your answers and decide if they are logical or not. OK. That’s it.’

SI2 turns and begins cleaning the board. Students pack up and leave.

Observation #13
Chemistry 112
17 June 1997
10:30 — 11:45

As usual, students come to class just before SI2 does. SI2 refers to the Short Questionnaire that the researcher had administered to the students a few days earlier – how they ‘lied’ in their answers to the last question (on their participation in class). The analysis showed that 35% participate in class. ‘You blatantly lied,’ he says. The students laugh.

SI2 goes through the register of names. Students raise their hands when their names are called. There is a lot of laughter at the way SI2 pronounces the Malaysian names. The list is put away.

SI2 turns to the board and writes ‘HETEROGENOUS EQUILIBRIUM’. He explains about the concentration of liquids. After the explanation, he asks, ‘Does that make sense?’ A few students nod – the rest just look at him. (Triangulation: When asked, students said that they generally nod briefly when asked a yes/no question in class. They say that they are paying attention but don’t feel the need to shout out answers to questions asked. Some say that they are shy. Could this be natural Malaysian reserve?)

SI2 writes an equation on the board. SI2: ‘Is that all right? What’s the matter with that?’ Students stare at the board. SI2 explains the equation. 2 students take down notes. The rest seem to be listening. One student asks a question about something in the equation. SI2 explains.
SI2 turns away from the board and looks at the class. His eyes sweep from left to right. The students stare at him or the board. (Triangulation: Later SI2 says that he was scanning their faces for comprehension. ‘Sometimes I have no idea at all whether they understand what I’ve said or not. They are not about to tell me if they don’t understand. A few will come up after class and ask a couple of questions, then I know that there was a gap. Most don’t say or do a thing. It is so frustrating. I sometimes don’t know whether to go on or not. They just sit there and stare – I’m not even sure if they are awake!’)

SI2 turns to the board and writes: ‘EFFLORESCENCE’. He then writes out an equation on the board. He has made a mistake. A student calls out the correct figure for the equation. ‘That’s 3.137% of a response,’ SI2 says – a reference to the researcher’s questionnaire data.

The lesson goes on. There is a lot of calculation that needs to be done. The students work with their calculators. Some note their answers on scraps of paper or their textbook. Some only work with the calculator, nothing is written down.

SI2 moves through the topics – the students follow the lecture by flipping to the relevant page in the textbook as he moves to a new area in the chapter. Only a few students have some sort of notepad before them. Of these, a few take notes.

(Note: This is a very crowded classroom – filled to capacity. Oftentimes, it is impossible for the researcher to see every student, and what he or she is doing. A glance into the books/writing pads of the students shows that they are not taking down any of the ideas being talked about by SI2. They take down numbers, equations, formulas. The notes are all in numbers. When asked, they say that it is not necessary to take down what he says – ‘It’s all in the book already.’)

SI2 puts a problem on the board, and asks students to work out what would happen to a gas if the volume was decreased. A student is talking. SI2 turns to him and offers him the board marker, ‘Do you want to do this?’ he asks. The students shakes his head. SI2: ‘Then shut up!’ The class laughs. The students smiles and turns red.

SI2 puts up various examples of substances on the board and asks the students to explain the ‘direction of reaction’. (Triangulation: SI2 says that this helps him determine if the students have been able to keep up with him and can understand what is going on. SI2: ‘Generally that is how I tell if they understand. Most of the time I just bash on. I know I should stop and give them time to assimilate what I’m saying. I know I should ask questions. But they take 20 years to give me an answer. I’d waste so much time!’)

SI2 goes on to give the student more problems to solve. He works some of them out on the board. Students seem able to follow, for they prompt him with values, etc. as he works on the board. Many of the answers to the problems in this chapter have two answers – ‘two roots’. SI2: ‘The answer will have two roots. You have to decide on which one is the real answer and which one is a mathematical impossibility.’

(Triangulation: Students would need to think and decide on the right answer. So it is not enough to just know the calculation – they must understand the physical realities of the process involved. They must be able to read the numbers and make sense of them in the real world. They must look at the answers and decide if it is a reasonable number. SI2)

SI2: ‘OK. That’s it.’ He turns to clean the board as students pack up and leave.

Observation #14
Chemistry 112
23 June 1997
10:30 – 11:45

As usual, the class is empty. Students come in just moments before SI2. SI2: ‘It helps to write English if you read English.’ Students laugh. ‘I’m going to give out the papers of the test we had on Friday.’ Students
look up. ‘You can look at them and the marks – that should put you out of your agony. I will then take them back and grade the last bit – the essay question.’

After handing out the papers, S12 leaves the class. The is a lot of murmuring in the class as students look at their work. There is a lot of groaning, some rude remarks, some laughing. Students compare answers, look at each other’s work. There is a general feeling that S12 has been very strict with the marking. Many look very disappointed with their papers.

S12 returns and collects the papers. S12: ‘Right. While my mind gets back into action, work out the ph of these solutions.’

Students begin to take out their textbooks, and turn to the relevant pages. Others take out their calculators. Students begin to work on their calculators.

(The class is very restless. There is a lot of fidgeting, murmuring.)

S12 work out an equation on the board. It is hard to tell if the students are paying attention. Most seem to be simply staring at the board. S12 carries on with the lesson. (Interview note: Later, students say that it was very difficult to concentrate on the day’s lesson. They kept thinking of the exam papers that they had just seen. Many were disappointed with their marks. Others were trying to figure out why they got some answers wrong. Generally, their minds were on the exam paper, and wouldn’t focus on the lesson.)

S12 writes an equation on the board. They are still on equilibrium. S12: ‘You’d know instinctively where the equilibrium is. Don’t you? Who says that way? Hands. Who says that way?’ A few hands go up. ‘Who says “I don’t know”?’ Many hands go up. The students laugh. S12 then has to explain.

S12: ‘You’re looking very blank today.’

(Triangulation: Another reason for the change in the class today, according to S12 is the fact that the lesson was based on theory and not on calculations. When asked students agreed. They prefer to have calculations – ‘it is more interesting’. They find theory very boring, and therefore it is hard to pay attention.)

S12 asks a question. He walks to the middle of the room and asks a particular student to answer. The student looks stunned. The other students laugh. (S12 says that he did this to wake up the students. They seemed very quiet, he says.) S12 calls out some numbers and walks back to the board to write them down. The student visibly relaxes.

S12 asks another question, and some students call out answers. S12 seems satisfied: ‘OK. You got that, eh?’ S12: ‘I’m just gonna finish up this chapter. (groans from the students which S12 ignores) You can read up this stuff in your book. (more groans) You know how to read? (Students chorus: ‘yes’) Sometimes I wonder. I’m going on to the end of the chapter.’ S12 goes on with the lesson.

Students are looking at S12. Some are stretched out over the desk, a couple at the back are stretching, one is cupping his head in his hands. A couple of students in the middle of the class (two girls) take notes.

The lesson ends.

Observation #15
Chemistry 112
24 June 1997
10:30 – 11.45
SI2 comes in the class and immediately writes out some homework problems on the board. Some students groan. SI2 turns to look at them, and then continues writing. SI2: 'Your assignments are due Friday.'

SI2 says that he will begin a new chapter today and writes 'IONIZATION CONSTANTS' on the board. There is a lot of moaning and mumbling from the class. It is still settling down. SI2 carries on talking, and then turns and writes an equation on the board. The class is at last quiet. SI2 asks students to turn to page 633 to look at an equation that is too long to write on the board. Despite the rumblings earlier, students seem to be already on the right page.

SI2 proceeds with the lesson. There are a lot of problems in today lesson. Lots of opportunities for the students to use their calculators. Today the students are working—taking notes, looking at the text and at the board, writing notes, answers. Many students take down stuff in the margins of their textbook. SI2 notices this as he walks around—'Would you like me to bring in some paper for you to write on?' Other students laugh. SI2 smiles. He asks for answers, and a couple of students call out their answers. The lesson goes on.

(Interview note: Many students come to class with only their textbook in hand. Any information that they want, is taken down into the margins. When asked they say that this is deliberate. It will be easier later when they look at their books, the extra information will be right where they want it—no need for them to look through a pile of notes to find it.)

SI2 carries on with the working out of problems and calling for answers from the students. There is a lot of mumbling from the class. SI2: 'Goodbye?' A student has indicated that their time is up. SI2 looks at his watch. 'Oh, OK then.' Students pack up and leave.