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AUTHOR Linacre, E. T.
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ABSTRACT

In view of the well-known disadvantages of lecturing, and the practicability of teaching without them, why does lecturing remain the standard method in universities? To increase the chances of lectures being good, they should be fewer, and to offset their deficiencies they should be regarded as only one component of a combination of methods used in teaching a particular course. The displacement of lecturing from its central position in teaching makes time available for more dialogue with students in tutorials, for more student initiative in the library, the laboratory, and the field, and for improving the whole package of teaching methods used in the course. In what follows is an account of the way in which the transition was made in the teaching of one particular course, Climatology, starting from lectures to become something quite different using extempore lecturing, prepared lecturing, notes for the student, readings, illustrations, tapes, free choice assignments, assessment of the student, and the student's assessment of the course. Appendices include the final evaluation of the course by the students, comparison of the different kinds of students and their course marks compared with other courses they have taken, and the ABCDE method of marking essays. (Author/PG)

CENTRE FOR ADVANCEMENT OF TEACHING

EDUCATION MONOGRAPH SERIES

No. 2 Lessons Not Lectures

by

Associate Professor E.T. Linacre,
School of Earth Sciences
Macquarie University

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Lessons Not Lectures

Contents

1. Lectures

Anyone who has taught a class of over 30, say, by the traditional method of lecturing, is aware of the educational difficulties. Lectures are teacher-oriented, allow passivity in the student, and convey only a certain kind of information, suited to a certain kind of student. In this transfer, the pace is set by the teacher, irrespective of the needs of an individual students. Also, the speaker's lectern and student's desk are barriers, and real discussion is impossible. For such reasons, the energetic lecturer supplements his lectures by slides and films, tutorials, practical work, and the rest. But then the question arises whether or not an integration of such alternatives could not replace lectures as the core of one's teaching?

The answer to that question is well-known. Lectures can be dispensed with, as in Macquarie's School of Chemistry, at Britain's Open University, and in America the Postlethwait method of multi-media self-tuition. The reasons for abandoning lectures in these examples are not necessarily those mentioned earlier: in the case of the Open University and Macquarie University's external teaching, for instance, it is plainly impossible to teach students by lecturing because they live at great distances. However, the point is that one can indeed teach without lectures.

In view of the well-known disadvantages of lecturing, and the practicability of teaching without them, why does lecturing remain the standard method in universities and elsewhere? A cynic would say that the reasons include the attachment of academics to hallowed ritual, perhaps coming from the historical association of universities with the Church, and its tradition of preaching. We all enjoy the pulpit, the pleasures of pontificating, and the straightforward simplicity of entering a room, giving a monologue, and then walking out. Also the system looks like a direct carry-over from customary secondary-school teaching. But there are also good reasons for lectures, when adequately prepared and delivered. They permit students to enjoy a shared experience of the lecturer's personality, to see him in the flesh, to see demonstrated in actuality the way in which a trained mind handles ideas. In a radio broadcast by Dr. Bill Williams (ABC *Insight*, February 11, 1973), a lecture is likened to a musical recital. This can be, and should be, an exciting occasion. In fact, of course, it seldom is like that, because

exciting lecturers are rare and their performance varies. So even the good reasons for lecturing are valid only occasionally.

It is not the purpose of this essay to argue for the total abandonment of lecturing. If lecturing is practicable, as in teaching students on campus, it will always be worthwhile, to an extent which depends on the ability of the lecturer and the kind of subject being taught. Poetry may perhaps be more suited than mathematics, though even with the explicit subjects a good lecture is valuable. It motivates the listener, and eases the assimilation of ideas. However, to increase the chances of lectures being good, they should be fewer, and to offset their deficiencies they should be regarded as only one component of a combination of methods used in teaching a particular course. That is the basis of what follows.

2. Teaching by a combination of methods

The displacement of lecturing from its central position in teaching makes time available for more dialogue with students in tutorials, for more student initiative in the library, the laboratory, and the field, and for improving the whole package of teaching methods used in the course. Detailed lesson notes can be written, to save the student the mindless drudgery of the usual dictation, and such notes can be criticised and amended more effectively than can a lecture, so that a gradual improvement occurs.

Time can still be allocated to occasional lectures, from specialist practitioners, whose active involvement in a subject makes such lectures valuable. But replacing most lectures by tutorials and tests, films and practicals, etc., leads to the occasional lectures being different in one significant respect. Whereas the traditional lecture carries almost the whole burden of the teaching, and has therefore to provide both instruction and motivation, i.e. facts with guidance, a combination of methods of teaching, on the other hand, can treat these two aspects separately. In other words, the factual content of the teaching can be left to extensive lesson notes, which can be read in advance and which remain available for reference, leaving the occasional lectures free to serve as illumination, explanation, enrichment. Thus the

lecture component is not for information, but for subsequent understanding.

What is advocated is replacing the units of tuition, with the lesson instead of the lecture as the basic unit of teaching. A lesson is the combination of notes, class discussion, practical work etc., on one topic.

Reducing the emphasis on lectures can offer several advantages. For a start, there may be economic advantages in having to build fewer lecture theatres, to offset increased costs for printing, film-hire and so on. Secondly a method of teaching on-campus students with little emphasis on lectures is readily adapted to teaching distant students by correspondence. Also, using a combination of methods of teaching necessitates planning, and a critical consideration of the comparative effectiveness of various methods, and both steps lead to better teaching. Replacing a dependence on the performance of a lecturer by a package of prepared notes, tapes, films, experiments, tests and assignments, leads to the creation of a valuable asset in the form of material which can be continually improved and is immune to the boredom of repetition and the risks of illness or staff changes.

So much for generalizations about traditional lecturing and the alternative of multi-faceted teaching. In what follows is an account of the way in which the transition was made in the teaching of one particular course, starting from lectures, to become something quite different.

3. Development of a particular course

The course happens to be 04213 Climatology, and the nature of the topic and level of the teaching are relevant to what follows. The course is an introductory one, serving to make students aware of two things - the nature of the physical processes underlying the weather and climate, and, secondly, the relevance of climate to man's experience. The aim is to cover a wide range of ideas, even if profundity is reduced, to stimulate rather than to create experts.

The topic lies at the interface of the two cultures, being science, yet related to man, notably his environment.

The subject is based on visible, everyday realities, but connects with ideas of elegant scientific abstraction or immense significance, like man's future. The topic involves such a range of aspects - concrete and abstruse, local and geographical, scientific and subjective - that a single method of teaching like lecturing is inadequate. In any case, there is something odd about staying indoors in the lecture theatre to learn about the sky, the winds, and the weather.

Now the writer is not a trained educationist, but an amateur, like most University faculty. I came to Macquarie in 1969 after some decades in research, and had to start giving lectures within a few days of arrival here. Thereafter the course has been given several times, and on each occasion attempts were made to remedy deficiencies discovered in the previous offering. The replies given by students to questionnaires were a great help.

The way in which the course presentation has developed, and several features of the outcome, resemble what has resulted from parallel experiments in teaching elsewhere (e.g., J.R. Hanscomb and P.S. Arbib, An audio-tutorial project in physics, *The Australian Physicist*, 8:173-7, 1971, and see AVCC Education Newsletter 1/71). However what will be described differs in the range of teaching means which are employed, and in comparative cheapness. For instance, the emphasis in what follows is not restricted to any particular method of teaching, nor to reliance on mechanical aids, as in tape/slide self-tuition (see AVCC Education Newsletter 3/72). Again, the teaching to be discussed differs from that devised by the British Open University, which needs an enormous investment of time. What will be described here has been developed by evolution during the course of teaching, without several man-years of untrammelled prior preparation.

Stage I - extempore lecturing

Initially it seemed straightforward to talk extempore on each lecture's topic, drawing on past reading and experience. The lectures were undoubtedly spontaneous, fresh and apparently enjoyable. But they wandered, were uncertain in coverage, and formless.

Stage II - prepared lecturing

This involved writing out verbatim notes on what was to be said. The lectures were then better organized, but dull. In any case, dictating from a text seemed a waste of time: the students could read for themselves, faster and more conveniently.

Stage III - notes for the students

Macquarie's excellent printery was used to reproduce the lecture notes and these were handed to the students. A sample is given in Example I, being the first page of 9 pages of text, comprising the content of lesson 12, in the 1973 version.

These notes were unanimously appreciated by the students, as shown by question 5 of Table 1. That questionnaire was administered just after the results of a test were returned to the students, and students who had scored well in the test particularly appreciated the notes (mean grade of 4.7, instead of 4.5 for the whole class).

A striking feature of the replies in Table 1 is the variety of response. To most statements about the course there are students who strongly agree and strongly disagree. In other words, the class is not homogeneous, but consists of individuals who need different kinds of teaching. This range is better provided by multi-faceted teaching than by lecture alone.

The notes for each lesson contain references to textbooks offering complementary ideas, and to literature quoted in the notes (Example II). These were appreciated by most students (Question 7 of Table 1), and matching numbers of students in consequence used the library (question 11 of Table 1), and textbook (question 13).

As a result of removing fact-transfer from the classtime, the occasions of face-to-face contact could now be spent discussing colour slides, for instance.

This sytem of teaching internal classes was readily transferable to external teaching, as the printed course material

EXAMPLE I

MACQUARIE UNIVERSITY
SCHOOL OF EARTH SCIENCES

12. SURFACE WINDS

1. Wind measurement
2. Surface winds & turbulence
3. Mountain winds
4. Sea and land breezes
5. Pressure differences
6. Wind direction and strength

---

1. Wind measurement

1.1 There is a confusion in the customary nomenclature on direction. An East wind blows from the East. Thus the Bellman was wrong to expect anything different -
But the principal failing occurred in the sailing,
And the Bellman, perplexed and distressed,
Said he had hoped at least, when the wind blew due East,
That the ship would not travel due West.
(*Hunting of the Snark* - Lewis Carroll)

VEERING AND BACKING

1.2 The wind is said to 'veer' when facing it involves turning to the right (i.e. clockwise). Contrarily the wind is said to 'back'.

FIG 1

Most wind vanes do not respond to changes of wind direction when the speed is below 3 knots. Then use drift of smoke, or pennant. Eddies from nearby buildings spoil wind direction measurement.

1.3 By international agreement (1956) the knot is the meteorological unit of wind speed (but I prefer consistent metric units).
1 knot = 0.515 m/sec = 1.15 m.p.h. = 1.85 km/hr

WIND METERS

1.4 Methods of measuring winds described by Pedgeley (p.26): (i) rotating cups (Robinson 1846), (ii) pressure-tube (pitot), (iii) pressure-plate (invented by Hooke 17thC) (iv) hot-wire type.

FIG 2

Pitot tube-water pushed down by force of moving air into one limb of U tube holding the water.
Various types of instrument for measuring wind are discussed in detail by Meteorological Office (p.187-257, 1956), Donn (p.166-181).
A home-made anemograph is described by Hatch (1973 Weather, 28, p.26)

1.5 Beaufort scale devised by Admiral Beaufort 1806 with 12 steps e.g., 0 is flat calm, force 9 is strong gale of 22 m/s which damages houses, causes waves of 10 metres.

* at 10 m height

Beaufort Scale No.	Metre/Sec*	Appearance
0 calm	0	calm, smoke vertical
1 light air	1	drifting smoke
2 light breeze	3	slight breeze, leaves rustle
4 moderate breeze	7	moderate breeze, small branches move
6 strong breeze	12	strong breeze, larger branches sway
8 gale	19	gale, twigs break off
10 storm	26	trees blown down
12 hurricane over	33	hurricane, extreme damage

For details see World Meteor. Organization Guide to Meteor. Instrument and Observing Practices, 1969, Chapter VI.

(continued from Page 5)

can be posted off. But a tape recording of the discussion in class was meaningless without the illustrations, which necessitate the next development.

Table 1

Replies to questionnaires to students taking the daytime class, on 10/4/73 and 17/4/73

	strongly agree		neutral	strongly disagree		mean grade
1. Assessment grade	5	4	3	2	1	-3
A. Lectures						
2. Replacing traditional lectures is good	10	11	23	10	4	+0.2
3. Guest lecturers are worthwhile	18	25	14	2	0	+1.0
4. Weekly class-discussions are useful	7	17	23	12	1	+0.3
4a Slides in class-discussions are useful	13	23	3	3	1	+1.0
4b Answering submitted questions is useful	9	15	13	6	0	+0.6
4c Explanations are not clear	3	5	10	21	3	-0.4
B. Notes						
5. The notes are useful	35	21	4	0	0	+1.5
6. Self-assessment tests are useful	11	22	14	10	3	+0.5
7. References given are helpful	15	15	21	8	1	+0.6
8. Revision-summary pages are useful	37	10	4	4	0	+1.4
C. Other Aids						
9. Tapes are useful	2	14	23	15	6	-0.1
10. Films are useful	16	22	17	3	1	+0.8
11. Library Special Reserve collection is useful.	16	10	22	8	1	+0.6

Table 1 (continued)

12. Practicals are useful.	10	23	22	6	0	+0.6
13. Recommended textbook is useful	13	21	18	5	4	+0.5
14. Tutorials are unnecessary	3	9	7	13	9	-0.4
15. The lecturer and tutor are accessible and helpful	15	19	17	3	0	+0.9
D. Assessment of students						
16. Weekly assignments promote understanding and keeping up-to-date with the work	21	22	8	7	1	+0.9
17. Marked tests are useful	19	21	10	1	3	+1.0
18. The marking is fair	24	23	8	4	0	+1.1
19. Reasons for losing marks are made clear	10	10	20	12	3	+0.2
E. Rating of the course						
20. The course demands hard work	26	20	11	1	1	+1.2
21. The workload is reasonable	4	9	21	12	12	-0.3
22. I feel I am learning a lot	9	26	22	1	1	+0.6
23. The course is intellectually stimulating	6	22	24	6	1	+0.4
24. The course meets my needs	9	27	16	6	0	+0.7
25. The course is to be recommended to other students.	13	21	21	2	1	+0.7

EXAMPLE II

Readings

1. Background

Valuable sections are in Strahler (1969, p. 151-68, p. 199-212), Petterssen (p. 148-175), Hare (p. 45-57), Barry & Chorley, Munn (p. 179-188). The student is recommended especially to read Cole (p. 167-90, 243-7) and Manual of Meteorology (Bureau of Met., 1966, p. 33-41), but note Coriolis misprinted. Chapter IV of B & C's book is too advanced for this course.

2. References

F.W. Cole (1970) *Introduction to Meteorology* (Wiley)
J.L.B. Cooper (1969) *Coriolis force* Physics Education, 4:155-156
W.L. Donn (1965) *Meteorology* ( )
J.G. Dunn (1970) *Australian Weather Manual* (McGraw-Hill)
E.L. Fisher (1960) *An observational study of the sea breeze* J. Meteor., 17:650
H. Flohn (1969) *Climate & Weather* (World Univ. Library)
R. Geiger (1966) *Climate Near the Ground* (Harvard Univ. Press)
J. Gentilli (1968) *Sun, Climate and Life* (Jacaranda)
F.K. Hare (1966) *The Restless Atmosphere* (Hutchinson)
A. Holmes (1965) *Principles of Physical Geology* (Nelson)
H.H. Lamb (1966) *The Changing Climate* (Methuen)
R.J. List (1949) *Smithsonian Meteorological Tables*
R.W. Longley (1970) *Elements of Meteorology* (Wiley)
Manual of Meteorology (1966) published by Aust. Commonwealth Bureau of Meteorology.
Meteorological Office (1956) *Handbook of Meteorological Instruments.* (HMSO, London)
R.E. Munn (1966) *Descriptive Micrometeorology* (Academic)
D.E. Pedgley (1962) *Elementary Meteorology* (HMSO)
S. Petterssen (1969) *Introduction to Meteorology* (Hutchinson)
H. Riehl (1965) *Introduction to the Atmosphere* (McGraw Hill)
A.N. Strahler (1963) *The Earth Sciences* (Harper)
A.N. Strahler (1969) *Physical Geography* (Wiley)
O.G. Sutton (1964) *Understanding Weather* (Penguin)
J. van Eimern (1968) *Protection of soils, plants and animals against wind* Proc. WMO Seminar on Agric. Meteorology, Melbourne, 1966 (Bureau of Meteorology), 2:621-638
P.G. Wickham (1970) *The Practice of Weather Forecasting* (HMSO)

Stage IV - illustrations

The literature was ransacked for illustrations and Macquarie's photographers provided standard-format prints which were reproduced by the printery and issued to the students, with each set of lesson notes. Trial and error revealed that the best size for prints is 3" x 4". In each lesson there were about 20 such pictures.

The factual content of the course was made explicit in the notes, for digestion by the student in his own time, at his own speed. So how best to use the available classroom time? The answer was, do the things which cannot be done elsewhere - demonstrate equipment, discuss points raised by the students, see films, have tests, tutorials and practicals, and listen to guest lecturers. (External students did all these things too, but crammed into two weekends).

Stage V - taped commentaries

Tape recordings made in the classroom are full of tedious silences and repetitions. So they were remade in the studio, with the expert co-operation of the Centre for Advancement of Teaching. The new tapes were quite different from the recitation of written texts or recordings of classroom activity. The former are inevitably stilted and take one back to Stage II. If the text is already written down, why not issue the text for the student to read? As regards recording a classroom lecture, such a canned lecture lacks even the virtues of freshness of a real lecture, whilst retaining all the disadvantages.

By contrast, the kind of tape made for this course consists of an extempore commentary on the notes and illustrations, based on a rough script of headings and timings (Example III) enlivened by snatches of music. The tape encourages a student to read the notes with care, and the spoken voice helps comprehension, with the insinuating impact which headphones provide. At intervals the student is asked to switch off and write down the answer to some question, the answer to which is given when he switches on again.

4. Tapes

These tapes differ from those used in the Postlethwait method of teaching where the tape is the thread connecting all the teaching of a course. In that system, a student's use of notes, experimental material and illustrations is linked by the tape. In the present method, the tape is not so central: the lesson notes are the basic feature, and the tape simply an optional commentary on them.

The tapes were made primarily for part-time students. (Evening students borrow them for use at home.) But sets are kept in the library along with sets of the notes, and are available for use by anyone, including full-time students.

In transition presentation of the course to Evening students in 1970, half the lessons were presented by notes and conventional lectures and half by notes and tapes instead, and the latter were preferred by 16 out of the 19 students in the class. In 1971, only 44% of full-time students faced with the replacement of lectures were initially in favour, but by the end of the course the number was 64%. The following year, all students were asked to say how many of the 22 lesson tapes they had used, with the following results:

Table 2

Number of tapes used in 1971

	all 22	15-21	10-14	less than 10
Day	13%	15%	20%	50% of the class
Evening	14%	17%	20%	48%
External	52%	22%	28%	8%

It will be seen that students attending on campus make much less use of the tapes than do External students. This may be expected, because the tapes do not convey the factual content of the course, and are not essential. The commentary on the notes which the tapes contain is available elsewhere to on-campus students, in class-discussion periods each week, whereas the taped commentary is all that External students can hear, until they come to campus.

EXAMPLE III

Script for Lesson 12. Surface Winds

Minutes to go

40 Music — Linacre/title/first lesson in a group of 4 on wind and weather

read paragraphs 1.1 - 1.8 on ways of measuring winds

38 Music — note Easterly is FROM the East

'backing' wind shown FIG 1/examples are

(i) Sydney seabreeze, i.e. direction of origin moves anticlockwise
(ii) passage of cold front over Australia (i.e. in South hemisphere)

Methods of measuring winds -

(i) pressure-plate shown in FIG. 1
(ii) Dines instrument on E7, based on Pitot tube
(iii) hot-wire anemometer due to cooling of wire by wind, so electrical resistance altered.
(iv) Beaufort scale, paragraph 1.5 (initially based on ocean-wave shape). Note drawbacks listed on page 2.

Nomenclature for telegraph, wind direction and speed in 4 digits:

last 2 are speed in knots
first 2 are direction, e.g. 23 = SW because 18(0°) = S, 27(0°) = W
etc.

Even for full-time daytime students, the tapes are appreciated by a worthwhile number, as shown by question 9 in Table 1, i.e. at least 16 out of 60 students valued the availability of the tapes. The students who had done well in the test which was marked just before the questionnaire was administered particularly appreciated the tapes (mean grade 3.3, in place of 2.9 for the whole class). The fact that 21 of the class did not find the tapes useful is unimportant, as there was no compulsion to use them. Individual students can choose what best suits them.

The median time for working through each of the two weekly sets of notes with the help of a tape was about two hours in 1972. This figure is affected by the overconscientious students who take far too long, by replaying the tape. Also, the 1972 tapes included some which were too lengthy: they too were all remade in 1973 and now do not exceed a convenient 40 minutes' playing time.

A disadvantage of the tapes is that they do not guarantee careful attention to the notes, nor do the 'enriching' components of the course (films, guest lecturers, tutorials, and practicals) necessarily bring the student to grapple with the course content. To a large extent these problems were overcome by several tests during the semester. These act as pacemaker, promoting steady application to the work involved in the course. They also indicate to both student and teacher where better learning and better teaching are needed. Model answers are given to the students immediately after each test, since the students are then uniquely interested in learning. The tests were valued by at least 40 out of 54 students (question 17 of Table 1).

Stage VI - other aids to learning

Other learning aids were developed to assist further in creating habits of regular study. There were (a) a question sheet, (b) a self-assessment test, (c) a summary sheet, and (d) minor assignments. These are discussed below in turn. In addition, something must be said about (e) the films and (f) practicals.

EXAMPLE IV

12. Surface Winds

Questions Day / Evening / External

date .....

Question for the lecturer:

Paragraph(s) in lesson notes that are not clear:

Please hand this in at the lesson of 17 April

5. Other aids

The question sheet is an almost blank paper attached to the notes, as shown in Example IV. The student writes on it his questions on the notes, and also indicates which paragraphs are not clear. These sheets are handed in weekly, anonymously, and the 'lecturer' devotes time to a classroom discussion of the points raised. Thus classroom time is spent on the points which need attention, and the feedback facilitates later improvements to the notes.

The self-assessment test consists of multi-choice questions on the 20-30 concepts introduced in the lesson, as shown in Example V. These questions are not easy to frame, if one wants to avoid alternatives which are merely facetious fill-ups or obviously impossible. It is more searching to state that more than one of the alternatives may be correct, so that each has to be assessed independently. Students finding an inconsistency between the answers and the lesson notes are awarded a half-mark; and it is chastening how many ambiguities this reveals.

Initially, I did not include the answers in the lesson notes, so that the answers could be worked out in small-group, tutorial sessions. But I now think that this introduces an undesirable degree of programming into tutorials, which should be free discussions. So, currently, the lesson notes include answers to the self-assessment tests for most lessons, on another page. Matching the questions and answers is another means of learning. These tests are presumably used, as they are popular with at least half the students (question 6 in Table 1).

Concepts introduced in a lesson are signalled in the margin of the notes (see Example I), and also listed on a summary sheet attached to them (Example VI). The student enters a brief statement beside each word or phrase of the list, being his summary of the notes on this topic. Normally, he would write this statement at the same time as he reads through the notes and hears the taped commentary. The effort of formulating his own statement, and writing it down, is another aid to learning. Also, the summary sheet is useful for revision before tests. All the concepts to be explained in the tests and final examination are taken soley

EXAMPLE V

12. Surface Winds

Optional self-assessment test. At least one answer is correct for each question:

1. Wind strength is measured by (A) a theodolite (B) an aerometer (C) an anemometer (D) a wind vane
2. Balloons can be used to measure windspeeds up to (A) 5 km (B) 1 km (C) cloud base (D) tropopause (E) 30 km
3. A rawinsonde apparatus is the measuring (A) wind profile by radar (B) raw data on Rossby waves (C) insolation radiation (D) other
4. Beaufort scale 12 corresponds to (A) dead calm (B) squalls (C) hurricane (D) totally overcast (E) 75 mph
5. One full barb on wind rose symbol means (A) 10 knots (B) 10 mph (C) 10 m/s (D) 5
6. The length of the shaft on a wind rose means (A) Beaufort scale (B) percentage of time wind from that direction (C) mean relative humidity (D) wind speed mph
7. On the coast the seabreeze blows landwards (A) in day (B) at night (C) all the time (D) varies
8. Seabreeze typically influences inland for (A) 100 km (B) 10 km (C) 1 km (D) 100 m
9. Mountain breeze is due to (A) heating air in compression (B) diversion of upper winds (C) heating of mountain side facing sun (D) effect of snow on summit
10. The pressure of the atmosphere results from (A) weight of gas above (B) altitude (C) tendency of heavy fluids to sink to the bottom (D) reduced temperature (E) increased density
11. The pressure at the top of Mt. Everest is (A) 99% (B) 90% (C) 50% (D) 30% (E) 3% of that at sealevel
12. Which of these create wind movement? (A) Coriolis effect (B) centrifugal force (C) friction (D) pressure gradient
13. Which of those govern wind direction?
14. In southern hemisphere, Coriolis effect leads to a deflection (A) to left (B) to right (C) varying with latitude (D) otherwise

EXAMPLE V (continued)

15. Wind above zone of frictional forces moves parallel to isobars because (A) this reduces centrifugal effect (B) otherwise the air converges (C) then the pressure-gradient force matches Coriolis plus or minus centrifugal force (D) this is average of movements across isobars

16. The geostrophic wind is (A) at midlatitudes (B) wind in absence of frictional forces (C) wind in absence of centrifugal forces (D) typically above 1 km

17. Coriolis effect depends on (A) latitude (B) wind speed (C) altitude (D) wind direction (E) square of wind speed

18. Centrifugal force depends on (A) latitude (B) wind speed (C) square of wind speed (D) curvature of isobars (E) wind direction.

(continued from Page 16)

from such lists, which define explicitly the scope of the course. The summary sheets are welcomed by 47 out of 55 students (question 8 of Table 1).

Tests and examinations each consist of two parts - the explaining of concepts and the writing of essays. Three or four titles of essays are given in connection with each lesson, and all test and examination essay questions are taken from those given. Minor assignments also consist of writing essays under titles from these lists. The annotated marking of the minor assignments gives the students fair warning of what is expected in test and examination.

Minor assignments are initially required each week, in order to ensure that students did in fact keep up to date in reading the lesson notes. (In traditional teaching the lectures provide an automatic pacemaking, whereas students collecting lesson notes could let them accumulate unread until the next test.) So each week's essay or numerical exercises depended on a grasp of the notes issued the week before. The essays of about 300 words required the student to demonstrate an ability to relate together the various concepts introduced in the course,

EXAMPLE V'. 12. Surface Winds

Revision summary

1. Veering and backing .....
2. Wind meters .....
3. Beaufort scale .....
4. Wind plot symbol .....
5. Planetary boundary layer .....
6. Effect of stability on surface wind .....
7. Gustiness .....
8. Squall .....
9. Causes of turbulence .....
10. Katabatic wind .....
11. Characteristics of valley winds .....
12. Lee waves .....
13. Seabreeze .....
14. Land breeze .....
15. Monsoon .....

and in addition necessitate some reading of the literature, outside the lesson notes. However, the work load involved in such weekly assignments, in addition to class attendance, tape-work, reading, and major assignments, was too much (see questions 2 and 21 of Table 1). Therefore the number of such minor assignments was reduced, despite their popularity (question 16 of Table 1).

Films are popular (question 10 in Table 1), and effective. However, it is necessary to search widely and select carefully to provide useful films.

Practicals also are valued (question 12 in Table 1), but they are difficult with a large class. Many maps and instruments are needed, and experience shows that at least one member of staff should be present for each 15 or so of students.

Stage VII - free choice assignments

The chief snag about so explicit and planned a form of teaching is that it is limited, essentially uncreative on the part of the student. It is necessary to add an element of open-endedness, and this has been provided by two major assignments. The student himself chooses these and carries them out alone, albeit with several pages of advice in the study guide.

The first assignment consists of a literature review of about 2500 words on any topic proposed by the student, though the teacher has to agree in writing that the topic is relevant to the course. In addition, no more than two or three are permitted to do the same topic, to reduce the pressure on the same books in the library, and to encourage originality. Two lectures are given on the library by staff there, on how to search the recent climatology literature for material. The essays are marked in terms of breadth, depth, clarity, originality, and numeracy. In marking both the major assignments, there is fairly detailed annotation, because this is a useful teaching device. Xerox copies are made of the best and added to a collection of examples held in the Special Reserve section of the Library, for the benefit of subsequent students.

The second assignment is the writing of a report of an experimental investigation, suggested and carried out by the

student. Many students boggle at this assignment initially, since they are thrown so much on their own resources. Nevertheless creditable reports are produced, and the major assignments were reckoned to provide an instructive experience by 72% of Day students, 72% of Evening students, and 60% of External students in 1972.

6. Assessment of the student

The efforts of the student are guided by the allocation of marks. In view of their significance, the major assignments are each allotted 15%. Five minor assignments are each worth 2%, and day students also take four tests worth 5% each.

Attendance and effective contribution to each of 5 tutorials earns 1%, leaving 35% for the final examination. This amount for the examination avoids a do-or-die tension, but allows remedying poor marks earned previously.

This pattern as a whole was reckoned 'good' by 42 out of 68 students in 1973, and 'reasonable' by the rest.

7. Assessment of the course

Let us now discuss the repercussions of such a method of teaching. The course as it is presently offered comprises the elements shown in Table 3.

An aspect of importance is the great amount of preparation involved in such a course. There is planning (guest lectures, tutoring, various kinds of accommodation, films, posting dates, studio bookings and so on) and the notes need writing, typing, making of illustrations. Also, considerable demands are made on various University facilities - photography, tape recording and reproduction, film borrowing and projection. The printery has to provide about 400 pages of notes for each student, apart from a 25-page study guide (which explains how to earn good marks in the course). Tape players, tapes and booths are needed in the library for internal students. Accommodation is needed for practicals and tutorials, but lecture-theatres are required only for class discussions (1 hour weekly), and for occasional films or guest lectures.

TABLE 3

Time allocations in the 1973 presentation of 04213 Climatology

A. Classtime: hours/semester

	Day class	Evening	External
Class discussions	12	12	8
Films	4	4	4
Tests	5ϕ	4	3
Tutorials	5	3	3
Lectures	7*	6**	4***
Practicals	6	4	4
Total	39	33	26

B. Student's timetable: hours/week

	Day	Evening	External
Classtime	3	2½	2
Notes (and tape)	4	4	4
Minor assignment or test preparation	1	1	1
Major assignment	2	2	2
Reading generally	2	2½	3
Total	12	12	12

ϕ including one two hour test

* 3 guest lectures
2 lectures by librarian
1 lecture by teacher of the course
1 lecture by teacher of allied course

** 1 guest lecture
1 lecture by librarian
4 lectures by teacher of the course

*** 4 lectures by teacher of the course

The course represents a staff work load which is steady. The weekly class discussions are essentially informal and require little preparation. The marking of exercises, tests, major assignment and final examination is spread over the entire course. Once it is prepared, the course can be taught with only a modest demand on staff numbers. In 1972, one lecturer and half the time of one tutor coped with 150 students, including full-time, evening, and external people. The only addition was about 50 manhours of part-time tutoring. It would have been better to have doubled the last number for better practicals, but the increase might be avoided by at least partial replacement of the practical session, currently with say, 80 students in a noisy single laboratory, by tape/slide self-instruction à la Postlethwait.

One criticism levelled against those seeking alternatives to lectures is that human contact is being reduced. However, it should be clear that what has been described here allows for more interaction than is practical in lecturing to classes of over, say 30 students. Apart from the feedback in the weekly class-discussions based on students' questions (Example IV), there are tutorials, and the major assignments lead to considerable one-to-one discussions with the teacher (see question 15 of Table 1). A good part of the practicals is also spent in talking with individual students.

Nevertheless, the point is taken. The system of teaching described here may not be suited to courses where particular emphasis is needed on personal interaction, as in all final-year courses, in my opinion. For such courses, classes must be kept small. The best system for those courses needs to be evolved in the reiterative, trial-and-error manner illustrated by the present case.

Another criticism is that organized teaching does not need a teacher, but could be done by a technician, who issues lesson notes, supplies tapes, rolls the films, and shows the slides and equipment. Indeed it is a good thing to relieve the teacher of these tasks. But he is still required for the contact mentioned above, for setting and marking tests (and especially in annotating errors), for conducting class discussions, for stimulating the discussions with guest lecturers, choosing films and practicals, and for tutoring. Not least of the teacher's tasks is designing the entire pattern of teaching, and writing

and revising the lesson notes.

It will be noticed that the distinction between the teaching of full-time and part-time students has been blurred. It will always be an advantage to be a full-time student, because the personal contact between teacher and learner is greater and more regular. But there seems no justification for avoidable differences in the learning opportunities.

One unavoidable difference is the time available. Full-time students can be expected to have weekly contact-time of three hours, for a 3-credit point course, but I think this is too much for evening students. It seems unreasonable to require attendance on two evenings, because of the travelling involved. On the other hand, three hours on a single evening has also appeared unsatisfactory, ever since I learnt that a 6 pm start means that at least half the class do not get an evening meal till 10 pm. Also, towards 9 pm there is a discouraging number of tired-looking students. The efficiency of learning is obviously low with hungry, tired students, so 6.30 - 9.00 pm seems long enough.

As regards External students, the demands of other courses prevent them from attending further week-long on-campus schools. So instead, they are required to attend two weekends, at each of which they have about 13 hours of classroom experience, equivalent to 2 hours each week. One weekend is early in the semester, to provide orientation, and the other towards the end, for the discussion of problems.

8. Student opinion.

How effective is this style of teaching, is hard to tell, but one yardstick is the assessment by students. They are given three questionnaires each time the course is presented, and the final one is for obtaining their anonymous comments on the course. (The other two questionnaires include an initial one to discover the calibre of the class in terms of prior academic achievement, prior knowledge of the subject, expectations and initial impressions. The second questionnaire (such as shown in Table 1) is administered halfway along, to discover what needs remedying in the course content or style, whilst there still remains the chance to do something about it). Assessment of the course as a whole by the three categories

of students in 1971 and 1972 is shown below.

TABLE 4

Rating of the course by students

	1971						1972					
	Very good	good	ade-quate	poor	bad	mean* rating	Very good	good	ade-quate	poor	bad	mean* rating
						-3						-3
rating	5	4	3	2	1							
Day	-	-	-	-	-	-	28%	52	29	0	0	+1.1
Even.	61%	29	10	0	0	+1.5	10	69	14	7	0	+0.8
Extern.	27%	59	6	3	0	+1.1	21	53	18	5	3	+0.8
Mean						+1.3						+0.9

* on a 5-point scale

The mean ratings are encouraging, but show a decline in 1972. Supplementary, open-ended questions revealed that there was dissatisfaction with excessive weekly assignments that year, as mentioned earlier. This has been remedied.

Table 5 shows that the bulk of the students reckoned that they learnt a useful amount from the course. Unfortunately the significance of figures like these is uncertain, except in a relative sense. It would be interesting to compare them with figures obtained from other courses.

TABLE 5

Rating by students of how much they learnt

	1971					1972				
	great deal	worth-while	irrele-vant	little	mean* rating	great deal	worth-while	irrele-vant	little	mean* rating
					-?					-2
rating	4	3	2	1		4	3	2	1	
Day	-	-	-	-	-	29%	71	0	0	+1.3
Even.	27%	73	0	0	+1.3	22%	74	0	4	+1.1
Extern.	21	64	0	5	+0.8	19	75	4	2	+1.1
Mean					+1.1					+1.2

* on a 4-point scale

Perhaps it is more meaningful to compare student achievement over the past 5 years, which includes primitive lecture teaching, a transition year (1970) and two years of development of the multi-facet, eclictic presentation. An inspection of the examination papers and tests shows that the questions are similar in calibre, but the range has widened, partly in response to student suggestions solicited by questionnaire. The change is indicated by the syllabi shown in Table 6. Despite demands made on the student by the greater breadth, the grades achieved have not declined. (Table 6b)

TABLE 6

Comparisons between offerings of the course 04213 Climatology in 1968 and 1972, respectively

A. Syllabi

(i) Both courses included lessons on -

The Atmosphere, Radiation, Evaporation, Energy balance, Humidity, Rain formation, Hydrology, Surface winds, Secondary circulation, Changes of climate, Air pollution

(ii) In addition the 1968 presentation dealt with -

Heatflux into the ground, Energy budget of animals, Urban climate.

(iii) The 1972 course included the topics in (i) above, and also these -

Temperatures, Stability, Clouds, Oceans, General circulation, Forecasting, Climate analysis, Various climates, Australian climates, Climate and vegetation, Climate and Man.

B. Examination questions.

1968	1972
Compare in detail the extra-tropical cyclone and the tropical cyclone.	Contrast wave and tropical cyclones.
Discuss briefly the ways in which climate changes during the past may be detected.	Consider periodicities of climate variations.

TABLE 6 (Cont'd)

"The total energy budget at any surface is a result of the input of energy and mass to the surface and of the way in which each particular surface modifies the partition of the net energy available." Using examples encountered in the course illustrate this statement.

Explain differences between the respective energy balances of any two continents, and also between those of a lake and a field of wheat.

Other questions on -

atmospheric stability
net radiation
albedo
general circulation
urban climate
rainfall measurement

Other questions on -

atmosphere structure
clouds
comparison of atmosphere and ocean
general circulation
highland climates
temperature-measuring errors
climates for various vegetation.

TABLE 6b

Student grades in successive years

	1968			1969			1970			1971			1972		
	A	B	C*	A	B	C*	A	B	C*	A	B	C*	A	B	C*
Day	15%	15	37	13	30	47	13	33	42	11	32	43	10	31	52
Even.	0	28	67	-	-	-	20	24	36	8	30	48	13	20	63
Extern.	-	-	-	13	13	54	-	-	-	11	26	52	11	19	48
mean grade**		1.9			2.1			2.3			2.1			2.2	

*including CQ
**4-point scale
i.e.grade-point everage

There has been a considerable growth in the enrolments into the course, with totals of 45 in 1968, and in successive years 38, 49, 143, 154, 169. This growth is influenced by factors other than any intrinsic merit of the course, because other physical geography courses have also become increasingly popular. A better indication of the effect of the course is the fraction of those taking this 200 level course who later take the sequel, 04321 Advanced Climatology. The latter has been offered only twice to External students, and their enrolments are affected by the varying availability of alternative courses. For such students the fraction continuing was 39% in 1971 and 29% in 1973. For internal students (full-time and evening together) the fraction has fluctuated from 22% in 1969, to 30%, 20%, 41% and 31% in 1973. These figures seem satisfactory.

9. Future stages in the development of the course

Perfection is still some way off. Already it is clear that a further rewrite of the notes is needed, to improve their fluency (see Example I). At present they reveal too clearly the pell-mell, scissors-and-paste efforts involved in their preparation. Also the notes need a reduction in bulk, to appear less forbidding to the student. It would be logical for the notes eventually to be issued as a book, relieving the load on the University printery, though annual revision would not then be possible.

Another improvement to be attempted when time permits is the developing of one or two audio-visual self-tuition components of courses, with associated practical work. This would provide another option in learning, and might replace one of the more hectic practicals. Alternatively each component might be devoted to strengthening the understanding of one of the more difficult concepts, such as the Coriolis force.

In addition, I hope that comments by readers of this monograph will suggest further opportunities for improvement.

10. Conclusions.

This description of one system of teaching has been evolved to suit a particular course. Any other course would require a different pattern, which can be developed gradually

by considerable effort though without great expense. The initial problem is overcoming an attachment to lectures as the chief medium of teaching. But that problem is seen in perspective by regarding the educational process from the viewpoint of the student, who is concerned with 'lerning not teching' (to confound New Spelling with Macquarie Chaucerian). That is the proper emphasis for the teacher too. His job is simply to facilitate learning. In particular, the teacher needs to provide a variety of learning opportunities to cater for a wide range of student differences. For that reason, lessons, notes, films and the rest, can be more useful than lectures.

APPENDIX I

Final evaluation of the course by students

A questionnaire was administered to the Day class taking the course 04213 Climatology, in the penultimate week of teaching, in the first semester of 1973. There was almost complete return, as the questionnaire was given immediately after the last test.

Table 7 shows the questions and the numbers of students out of 71 who selected the various answers. The answer '3' represents neutrality in each case. Table 8 gives the suggestions invited by questions 16, 17 and 18, along with my comments. Both Tables were put on public display the week after the questionnaire was administered.

Most aspects of the course appear to have been reasonably satisfactory, with the exception of the tutorials. The last point is confirmed in the replies to question 17, in Table 8, and reflects these to question 14 in Table 1. The point covered by question 13 in Table 7 is also not satisfactory, having an assessment hardly above neutrality, despite the relevance of the course (question 7). There is clearly room for improvement.

Of course there will always be worst aspects (question 17), however good the course. If the answers to that question are varied or few, they may be taken less seriously. With this offering of 04213, there does appear to have been more factual material than some students cared for. Despite this, the course was intellectually stimulating (question 6).

The workload was thought excessive (question 4 in Table 7, and question 17 in Table 8). This may be true, or might have resulted from a lack of discrimination by some students between the various learning opportunities offered. The over-conscientious student could spend far too long if he did everything available - attended class, tutorials, etc., used notes, tapes, self-assessment quiz, followed up all the references, and so on. Perhaps the course requires the student to become selective - which would be no bad thing to learn. This needs more consideration.

TABLE 8. Answers to the last three questions on those in Table 7.

11. Best features of [illegible] in 1975, first semester, as stated in open questions [illegible] students--

1. the notes (mentioned by [illegible] students)
2. guest lecturers (14)
3. film (17)
4. continuous assessment (13)
5. interesting topics (8)
6. major assignments (5)
7. slides (7)
8. practicals (6)
9. references (5)

and [illegible] others, less frequently mentioned.

12.

Worst features mentioned	Comments by ETL
1. workload (mentioned by 13 students)	Now reasonable
2. tutorials (12)	Puzzling
3. tests ([illegible])	Disagree
4. amount to be learnt (7)	Agreed too much
5. initial weekly assignments excessive (6)	Agreed, now O.K.
6. excessive information in notes ([illegible])	Disagree
7. emphasis on definitions (5)	Unavoidable in introductory course

and 24 others, less frequently mentioned.

13.

Suggestions	Comments by ETL
2.* Give more help in choosing major essay topic (mentioned by 2 students)	Agreed
3.* Ask for less reading outside the notes (1)	Disagree
4.* Set weekly assignments (12)	Too much work for students & staff
Omit 2 major assignments (1)	Disagree
Reduce workload (2)	We try
Set fortnightly assignments (7)	Agreed
Omit literature-survey assignment (3)	Disagree
Replace by 4-pt course (4)	Not permitted
5.* Have proper lectures (5)	We have some
Reduce tape length (1)	They have to suit Externals
Omit films (1)	Too popular
Increase coherence of course (1)	Agreed
More film. (3)	No time available
Increase coherence of notes (1)	Agreed
Omit notes (1)	Too popular
Omit tapes (4)	Optional: liked by some
Reduce number of class discussions (1)	Too much to discuss
6.* More practicals (7)	Wish we could
Reduce no. of concepts to be learnt (4)	Agreed
Eliminate maths & physics (4)	Present trace needed
Increase depth (4)	Prefer breadth in introd. course
Fewer practicals (1)	Disagree
Have outside field practicals (2)	Wish we could
More guest lecturers (2)	Not permitted
7.* Reduce scope of course (11)	Breadth for mind-expansion
Omit lesson on past climates (3)	Popular with some
Reduce information in notes (3)	Student needs be selective
Omit lesson climate and vegetation (1)	Popular with some
More on applied climatology (1)	See 04321, the sequel
More on regional climates (1)	See 04321
More on climate and man (1)	See 04321
8.* More tutorials (10)	Expensive, tutorials not yet satisfactory
Omit tutorials (5)	Disagree
Attach students to same tutor (2)	Maybe
Omit marks for tutorials (2)	Agreed
Require papers for tutorials (1)	Too much work for students
Relate tutorials to current issues (1)	Agree in part
9.* Don't let pupils pick their own essay topics! (1)	Disagree
11.* More tests (2)	Disagree. See below.
Increase mark for major assignments ([illegible])	Disagree
Fewer tests ([illegible])	Disagree. See above.
Tests all to include essa. (1)	Agreed
Reduce assignment work (1)	Disagree
Reduce mark for final exam (1)	Disagree: now only 35%

* These numbers refer to the questions in Table 7. The suggestions given in reply to question 13 were arranged in this way for clarity.

Appendix 2

TABLE 7. Final course evaluation questionnaire, 14 June 1975. The number and % of students choosing each answer.

	grade	5	4	3	2	1	mean grade
1.	Were the objectives of the course made clear?	20 clear	25	12	10	4 unclear	3.7*
2.	Was the teaching well prepared and well organized?	24 always	33	11	3	0 never	4.1
3.	How appropriate were the required reading materials?	15 very appro-priate	33	17	4	0 very inappro-priate	3.9
4.	Was the amount of work required appropriate for the credit points offered?	23 too much	20	26	2	0 too little	3.8
	CONTENT AND PRESENTATION						
5.	Did the teaching make the content clear?	8 very clear	31	25	7	0 very vague	3.7
6.	Was the course intellectually stimulating?	13 very stimulating	32	12	11	0 very dull	3.8
7.	Was the course relevant to your needs?	19 highly relevant	35	16	2	0 highly irrelevant	4.0
8.	How effective was the small group teaching?	6 very effective	13	15	26	11 very ineffective	2.7
9.	How free were students to question and disagree with ideas put forward?	43 very free	13	13	1	0 very restricted	4.4
10.	Were members of staff fair and considerate in dealings with students?	37 always	21	8	3	0 never	4.3
11.	How reasonable were the methods used to evaluate student performance?	25 very reasonable	32	8	5	1 very un-reasonable	4.1
	COURSE OUTCOMES						
12.	Did the course develop your ability to identify significant points of central issues?	9 very much	34	17	6	3 very little	3.6
13.	Did the course help you to recognize when people are using faulty arguments in this field?	8 very much	14	28	16	3 very little	3.1
14.	Since taking this course do you find that in conversations you can now recall important information in this field?	13 often	24	22	6	1 never	3.6
15.	Would you recommend this course to students who do not have to take it?	21 certainly	18	18	11	1 definitely not	3.7

* i.e. $\frac{5 \times 20 + 4 \times 25 + 3 \times 12 + 2 \times 10 + 1 \times 4}{20 + 25 + 12 + 10 + 4} = \frac{260}{71} = 3.7$

OTHER COMMENTS

16. What were some of the best features of the course?

17. What were some of the worst features of the course?

18. What changes would you recommend in the course?

Thank you.

APPENDIX II

Comparison of different kinds of student, and of 04213 Climatology marking with that of other courses

An unusual opportunity presented itself in 1972 when the course 04213 was taught simultaneously to Day, Evening, and External students. The numbers in the classes were sufficient for statistical comparison, shown in Table 9.

As regards the first few columns of Table 9, it may be seen that the three classes hardly differed in mean grades. (A chi-square test on the difference between the mean grades of the Day and Evening classes showed a statistic of 2.9 with 4 degrees of freedom, as against 9.5 for a difference significant at 5% level. The statistic of 4.5 for the Day-External comparison is also insignificant). Thus the achievements of the three classes in 04213 Climatology were similar.

The fourth column of figures in Table 9 gives the mean of the grade-point averages (GPS) of all students in each group. For instance, 2.68 is the average of 5 numbers, each being the GPA of a Day student who obtained an A grade in 04213 Climatology. That GPA was calculated by listing all the courses attended by the students by Christmas 1972 (typically 15 courses, say), with their credit-point rating and the grade the student achieved in each. The GPA is calculated by dividing the sum of the credit-points for all the 15 courses, say, into the sum of the products (grade value x credit point) for the courses. Such a GPA is a measure of the overall calibre of the student, almost independent of his success is Climatology. The last column shows averages of the group mean GPA values, weighted according to the size of the group, to obtain a figure for the calibre of the class.

A more detailed examination of the data has been carried out by D. M. Aitkin. He confirmed the similarity of the three groups of students, provided those failing were excluded. However, there were a disproportionate number of External students failing, and, if failed students were included in the comparison, the External group had a group score about 0.4 of a grade point below the other two groups. Investigation of the individual GPA's of failed External students showed that they included several superior students, so failures was presumably on non-academic grounds.

Table 9 contains other incidental information. Few students in any class failed after taking the examination (i.e. most of the failed students were graded FA or FW, meaning absent from the final examination or withdrawn beforehand). This may be attributed to the effect of continuous assessment in encouraging the weaker student to improve. The mean grades obtained by each class in 04213 Climatology were higher (in two cases) than the mean GPA, e.g. 2.35 for the Day class as compared with 2.10. This may be due to larger failure rates in 100-level courses affecting the latter number. Finally, there is a remarkable correlation between grades achieved in this course and the means of grades earned in other courses, the correlation coefficient being 0.606.

TABLE 9

Analysis of results of 04213 Climatology classes in 1972, and of the same students over their University careers of at least two years (i.e. at least a dozen courses), ending at Christmas 1972.

Class	grade	grade value	04213 results		overall grade-point average (GPA)		
			no. of students in group	mean grade of class	mean GPA of group	standard deviation	mean GPA of class
Day (52 students)	A	4	5	2.35	2.68	0.49	2.10
	B	3	16		2.29	0.41	
	C + CO	2 + 1	27 + 0		1.99	0.34	
	F	0	1		(1.81)	-	
	FA + FW	0	3		1.25	-	
Evening (28)	A	4	3	2.28	2.59	-	2.02
	B	3	6		2.40	0.28	
	C + CO	2 + 1	17 + 1		1.33	0.57	
	F	0	1		(1.62)	-	
	FA + FW	0	0		-	-	
External (70)	A	4	8	2.01	2.89	0.56	2.09
	B	3	14		2.55	0.46	
	C + CO	2 + 1	42 + 3		1.97	0.42	
	F	0	6		1.38	0.24	
	FA + FW	0	1 + 6		1.46	0.73	

APPENDIX III

The ABCDE method of marking essays

Having to write essays encourages the student to explore the literature, to relate information together, and to gain practice in developing an argument. However, they are hard to mark. One has to avoid being merely subjective. Marking a large number of essays at different times or by different people can lead to differing standards. And the student may not know what to aim for.

This problem can be reduced by subdividing it, and using specific characteristics to define the ideal essay. A useful set of features is the following: Accuracy, Breadth, Clarity, Depth, Enterprise, i.e. ABCDE. This mnemonic encapsulates the aspects of a good-calibre essay, and can be remembered by both marker and student. Instead of marking against some vague concept of 'goodness', one rates the extent to which each of the five features is present, and then adds the marks. For a 15-mark essay one might allot 3 marks to each feature, with 3 representing excellent, 2 good, 1 poor, 0 bad.

Accuracy is obviously necessary. Breadth refers to the extent to which the topic is adequately covered, taking into account all the various aspects. Clarity covers the essay's general architecture, as well as the lucidity of the separate parts. Is the argument developed logically? Is the English clear? Then Depth deals with the degree to which the writer has wrestled with the complexities of various aspects of the topic, rather than being satisfied with a simple mention. A topic is examined more deeply when adjectives are replaced by numerical quantities. For instance, does the essay refer to A being warmer than B, or, better, to a difference of 3°C? Enterprise allows for the element of initiative, of creativity in the essay.

Of course, different qualities may be sought in essays on topics other than climatology. But it helps marking and guides the student to be explicit about them, as with the ABCDE method.