

STAFF AND STUDENT PERCEPTIONS OF THE TEACHING-LEARNING ENVIRONMENT: A CASE STUDY



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ABSTRACT

This case study forms part of a large-scale project on Enhancing Teaching-Learning Environments in Undergraduate Courses: <http://www.ed.ac.uk/etl> It is based on questionnaires and interviews with students and staff in a post-1992 university, on a final year module in analogue electronics. Both staff and students highlight the importance of coherence, continuity and connectedness in teaching and learning over the course of the degree.

KEYWORDS

Staff perceptions, student perceptions, university teaching, student learning, electronic engineering

BACKGROUND TO THE RESEARCH

The previous paper described the teaching-learning environments in two departments in research-intensive universities. In these large electronic engineering departments the course units were taught by different lecturers as students progressed through the four years of the degree course. In departments with fewer specialist staff, a single lecturer may take much of the responsibility for an area like analogue electronics throughout the degree course.

There has been a growing recognition that the modular system, brought in to provide students with opportunities to 'mix and match' modules within a degree, and allow ready transfer between institutions, has undesirable side effects. Students experience modules as separate blocks to be covered, examined and then put to one side, and the continuity and coherence of the degree can be compromised, at least in the students' experience. If students have the same lecturer for one of the main topic areas throughout the degree course, there is a greater likelihood of coherence.

Lecturers having this role are also likely to feel more strongly the responsibility for students' developing understanding of their specialism and to get to know the students as individuals. As the emphasis on research has grown, the specialist areas of staff have tended to narrow, making it more difficult for them to point up connections with other areas and again this can affect the perceived coherence and connectedness from the students' perspective.

While the emphasis on research within HE career development was strong, it seemed that the role of teaching generalist was disappearing. However, the changes envisaged in the RAE are already leading to changes in institutional policy which would allow that role to reappear. This case study thus has relevance for institutions where 'teaching-only' appointments are again being considered, as well as for departments where coherence may have been lost through a lack of continuity in the students' experience.

THE COURSE UNIT

This paper presents a case study of a single course unit in a post-1992 university: the final year of the B.Eng. (Honours) degree in Electrical and Electronic Engineering. Attendance is full-time over three years, or four years including a paid, work-based placement. The degree leads to Incorporated Engineer status and is therefore more practical and less theoretical in orientation than the degrees offered by the departments described in the previous paper. Students enter with a variety of qualifications, including A levels, BTEC National Awards, GNVQ, National Certificate / Diploma and the university's own preparatory (foundation) year. The course has a systems approach to electrical and electronic engineering. Circuits are taught from first year, with increased complexity being introduced in each successive year. The degree is well supported by industry with placement support,

real life projects, case studies and occasional guest lectures. The final year unit in analogue electronics represents one sixth of the year's requirement and involves 48 contact hours spread over 24 weeks (long thin module over two semesters). Teaching time is distributed between lectures, tutorials and labs, and using actual circuits. All of the teaching is delivered by one lecturer, who has responsibility for analogue electronics throughout all three years of the degree.

METHODOLOGY

As described in the previous paper, the data collected included interviews with staff and groups of students, as well as two questionnaires, the *Learning and Studying Questionnaire* (LSQ) given to students towards the beginning of the unit and the *Experiences of Teaching and Learning Questionnaire* (ETLQ) at the end. Compared with the units described in the previous paper, numbers here were small. Out of a final year group of 38, complete sets of questionnaire data were collected for 24 students. Individual interviews were held with two members of staff and two group interviews carried out with a total of seven students.

THE LECTURER'S PERSPECTIVE

The lecturer had considerable experience both in HE teaching and in industry. In his interview comments, he emphasised the practical nature of the degree, together with the coherence, continuity and increasing complexity of the teaching and learning over the three years.

The electronic engineering degree qualifies students to become incorporated engineers as opposed to chartered engineers. So the tendency is for the units to be practically orientated rather than theoretical and deeply academic. The 1. Eng. course is really aimed at getting chaps out into industry immediately after they've completed their studies... This is the third year of the electronic engineering unit so they've already done what we call Electronics 1, Electronics 2 and this is Electronics 3...It basically extends their knowledge from Electronics 2 and becomes deeper in terms of complexity than the foregoing units.

Asked what he wanted the students to get out of the course, he emphasised the importance of teaching for understanding. Commenting on his approach, he described how he tried to keep things simple, particularly with the maths, using repetition to promote understanding and drawing on a mixture of methods to encourage active participation, including gapped notes and diagrams. Above all, he emphasised the importance of hard work for the achievement of real understanding. He actively looked out for evidence of understanding, for example from his continuous assessment of laboratory work. He openly acknowledged that his approach was determined both by the changing nature of the student intake and the reduction in class contact time. Aware of the criticism that he might be perceived to be spoon feeding students, he staunchly defended his approach as one which started where the students were and led them gradually towards increasing confidence and self reliance.

*I don't feel happy, personally, unless I feel that the students **understand** what I'm talking about. I probably repeat, in order to make sure that they **have** caught what I'm saying, I do it deliberately, feel happy if I can see by the expressions on the students' faces that they really have grasped what I'm trying to tell them...And I encourage them to ask questions and, by the third year, they perhaps have confidence enough to, and they know you well enough, because you won't make a fool of them if, you know, if it's a stupid question to ask.*

I never assume too much knowledge. I try to keep things simple and I use a lot of diagrams...The first ten minutes, that to me is the most important time in a lecture. I don't just stand there and talk, I draw diagrams and I leave blanks in the notes so that they can fill a few diagrams in, so that they've got something to do other than just listen. I mix it with a few questions as well, to try and gauge whether they understand what I'm on about.

*I believe in hard graft as the only way to really **understand** these technical subjects. I always say to the students there's no shortcut. You've just got to do a few examples, get in the lab, do a few tests, find out from experimental results how things work. I just tell them, these are hard subjects, you've got to go away, read it. Obviously they can come back and ask me things that they don't understand. No shortcut basically.*

I always assess laboratory work and I feel that laboratory work is a very important support to the lectures. I mean, if you can understand what you're doing in a lab, then I think you understand

the subject. So I always mark lab works and I'm particularly interested in the comments that students make having got a set of results, what does it mean, and can they express [that] clearly?

*The students that we get, and I'm not underestimating their ability, but there are a lot of poor students... And to me, over the years, they have got worse and worse. Their mathematical abilities and their general intellectual abilities have declined. Over the years we've reduced our class contact time and the number of units that we teach **and** the number of weeks in which we teach. As far as I'm concerned that's a bad thing. I feel now that I'm probably teaching maybe half the quantity that I taught when I first joined 14 years ago. But I've come to accept that, within this limited time you're in contact with the students, there's only so much you can deliver. So these days I just try to make a good job of the small amount that I do deliver in the time.*

I think [with] the more mathematical stuff you can guarantee there'll be problems. If you can keep the maths to a minimum and just try and get the concepts and the ideas across, then I think you can succeed. Once they've got a certain amount of knowledge, they can cope a bit themselves. Some of my colleagues tell me that I spoon feed students and I think that's true, that I do. But I feel that, unless you can give students sufficient confidence, feelings for this and that in electronics, then they get lost and they give up and they just try and pass the exam, you know, just do enough. So I think you've got to recognise students' limitations.

Finally, he highlighted the influence of the lecturer in the encouragement of student learning by his own approach and behaviour towards students: conveying his own enthusiasm; being approachable and available outside time-tabled classes; being well organised and prepared.

*I think if **you** can be enthusiastic, you can perhaps rub it off onto the students a bit. If you're prepared to give them as much as it's possible within your hour or so that you're stood in front of the class, I think that they must recognise that and they must perhaps think, well, this chap's doing his best to give us some knowledge. And I like to think that the students get on with me OK. Students come to my door and knock and I never turn anybody away even though it might be an interruption.*

*My background was in the engineering industry and for sure there you had to make things work because if a steel works shut down, you know, it caused a lot of pain, people were onto managing directors saying, 'Look here, this equipment's broken down. It's costing us thousands of pounds an hour, come and get it sorted out'. So I think that's influenced me to make sure that things are **right**. That's why I've reduced the amount of information that I pass across these days. I think if you give them too much they just shut down, they get lost.*

THE STUDENTS' PERSPECTIVE

There is now a fairly extensive literature which considers the impact of students' perceptions of the teaching and learning environment on the ways in which they learn (see first paper). The ways in which students are taught, the guidance they are given in support of learning, and the quality of the relationships between staff and students, are all important concerns when it comes to understanding students' learning in a particular setting. For example, there is evidence that enthusiastic and empathic teaching, with good explanations, can have a beneficial effect on students' approaches to learning. Further, the students themselves form an important part of the environment of a course unit ¹. For example, students who differ in their beliefs about learning, their preferred approaches to learning, or their background knowledge of the subject area, may perceive the same context in quite different ways.

Analysis of questionnaire responses

The first analysis of the students' perspectives on the unit looks at the responses to our second questionnaire (ETLQ). Students were asked about their experiences of teaching and learning and Table 1 compares their responses with students in the other units described in the previous paper, based on the items used in Table 1 of the previous paper. These items are indicated in a somewhat shortened form here. The main differences can be seen in the figures set out in bold type, although the small numbers make the differences only indicative.

Briefly, the lecturer in this unit (D) was perceived as having made the subject more interesting and having provided more examples than was the case in the other units. Also the assessment had been made clearer, with good feedback on set work. Students also felt more confident about their knowledge and understanding, but were not as positive about shared enthusiasm as in the other units (although the mean was affected by a very high score in one unit).

TABLE 1 – Comparison of means and standard deviations between Unit D and other units

	Unit D N = 24 Mean (SD)	Other N = 155 Mean (SD)
<i>Relative easiness of demands made by course unit</i>		
What I was expected to know to begin with.	3.7 (0.9)	3.5 (1.0)
The rate at which new material was introduced	3.8 (0.7)	3.1 (1.1)
The amount of work I was expected to do	3.3 (1.0)	2.9 (1.1)
<i>Experiences of the teaching provided in the course unit</i>		
I could see the relevance of most of what we were taught	4.1 (0.8)	4.0 (1.0)
I found most of what I learned really interesting.	3.8 (0.7)	3.3 (1.2)
The teaching encouraged me to rethink my understanding	3.9 (0.7)	3.7 (1.1)
How this unit was taught fitted in well with what we should learn.	4.0 (0.4)	4.0 (0.9)
Staff tried to share their enthusiasm about the subject with us.	4.0 (0.6)	4.4 (0.7)
Staff were patient in explaining things which seemed difficult	4.2 (0.8)	4.1 (0.9)
The handouts and other materials helped me to understand	4.0 (0.7)	4.0 (1.1)
Plenty of examples and illustrations were given to help us	4.2 (0.7)	3.7 (1.2)
It was clear to me what was expected in the assessed work	4.3 (0.9)	3.8 (1.1)
The feedback given on my set work helped to clarify things	3.8 (0.9)	3.3 (1.2)
<i>Self-ratings of learning outcomes</i>		
Knowledge and understanding about the topics covered	4.3 (0.6)	3.9 (1.0)
Ability to think about ideas or to solve problems	4.0 (0.8)	3.9 (0.8)
Skills or technical procedures specific to the subject	3.9 (0.8)	3.7 (1.0)
Overall academic progress (out of 9)	5.6 (1.6)	5.4 (1.6)

Overall, we see the students showing a great deal of satisfaction with their experience of teaching and learning in the unit, and this feeling can be shown more clearly through their comments during the group interviews.

Analysis of interviews

The broadly positive picture presented by the ETLQ findings was supported by the student interview data. Those interviewed expressed a high level of satisfaction with the experience of the analogue course. They were particularly appreciative of the lecturer's organisation, approachability, availability, patient explanation and general supportiveness, all of which were perceived as having positive benefits for learning. The following comments are typical:

I think analogue is one of the best organised units that we do. And if we have any problems we know that we can always go and see [the lecturer] and it'll get sorted out... He's never too busy to help.

We've been lucky with our tutor. We've had him all the way through and he's very approachable and easy going and he makes it as easy as he can for you to ask questions and stuff like that. He's got a good teaching style. It's just quite laid back and relaxed, the way he goes about it, and it makes you enjoy it and be more relaxed about the whole thing as well. He's one of the better lecturers.

The way he teaches is a very good way of teaching. He's relaxed, he's laid back and he's a nice guy as well, you want to learn off him and you actually do. Like, we've had a couple of lecturers where, it's the way they

teach, it's just like a constant stream of information, and I'll just be batty with information, where he sort of drip feeds it to you. You absorb more information.

As already outlined, we have been using the idea of **ways of thinking and practising in the subject area (WTPs)** to encompass the breadth of what students may learn in studying a particular discipline, and here we consider what students said about how they went about learning analogue electronics. First, they mentioned a particular way of thinking that depended on memorisation for understanding, especially with regard to mathematical equations. They also drew some comparisons with digital.

I think if you're OK at maths you should be alright, you should understand most of it. It's not the difficulty of it, it's just remembering what goes with what. I think that's probably why it's harder [than digital]. Analogue is like a lot of equations and stuff. You have to learn the equations to be able to do it. With analogue you have to get your head round the maths whereas, with digital, it's sort of very logical and straightforward. You don't rely on the maths so much, I guess. ... With digital, things really kind of progress through, whereas with analogue you have to have to understand the whole thing really and understand where the maths gets applied to each bit.

Yeah, with the digital, when you make circuits, it's either right or it's wrong. There's no grey area, whereas with analogue, there is. If you get one little thing wrong, it'll almost work but not quite. Then you've got to re-do the entire thing, just find out what's wrong. If a digital circuit doesn't work, it doesn't work.

In terms of **doing well in analogue**, those interviewed indicated an awareness of their own responsibilities as learners in terms of maintaining interest and enthusiasm and putting in the work. This, they felt, was particularly important given that both analogue and digital continued throughout the three years of the degree, unlike other one-semester units where 'you never look at it again'. The students also talked about the incremental nature of the subject, how it built on learning and knowledge from previous years and the importance of mastering the 'building blocks' and keeping up with the work. Several expressed a wish for additional help with maths, to be provided by people familiar with engineering applications.

You've got to be enthusiastic and you've got to be interested, and you've got to be prepared to work hard. When I first started, I weren't really enjoying it but then in the second year I thought, I'm going to have to start studying and get into it. And when I did, my marks picked up a lot. I think you can get into this more because it's something what you do for the whole three years, and a lot of things we've done have been one semester units where there's not been that much to learn. You can learn it quite easily, then you take an exam and you're done with it, you never look at it again.

In the first year you learn it, then in the second year you learn it all over again, but more detail. And also, if you do miss it in first or second year, you'll maybe not remember basic equations that larger equations are based on. If you don't know like, the building blocks, you're not going to get the entire thing at the end.

There's maths help for people struggling with maths, but you go to them with any engineering equation and they're stuck. They don't have a clue; they're maths teachers. If you had people who had engineering knowledge who you could go to, engineering lecturers or technicians who could help you with stuff you're stuck on, that would probably increase the marks.

Another aspect highlighted by those interviewed referred specifically to the importance of learning how to apply the theory; demonstrating applications to the world of work; learning to think like a professional engineer. Some would have liked even more in the way of practical application, seeing the skills they were developing as related mainly to academic theory rather than to professional practice.

*I like analogue, mainly because of the practical hands-on side, which is what I prefer. Actually seeing how the theory works in practice, that's what I like about it. Very few of them actually do that, like digital and simulations and stuff like that. In analogue, we get given a specification, and we take it away and design it, come up with equations that express it and what the circuit that has those expressions. Test it, adapt it; test it, adapt it. Then we might find out how it works and then do a discussion on how it works. I think it's more developing the skills and understanding about how it all works academically. That's what university mainly is, not the **use**. The vast majority of what we learn we're not going to use professionally. What we learn mainly is understanding it all academically, how the theory works, stuff like that.*

The wish for practical application to the world of work is expressed particularly strongly by those students who had done a **placement year**. They were particularly enthusiastic about the experience and emphatic that the course theory and concepts should be even more closely linked to applications met in industry, with more practical, hands-on experience. They also referred specifically to the benefits of the placement experience when tackling their final year project, and to the positive motivational impact of the placement on their approach to their final year studies.

I found out on my placement there's too much emphasis put on, like, writing and not enough emphasis put on doing. On my placement I did a lot of analogue, and the first month or so I struggled with it. Theoretically I knew what it all was, but we hardly have any time to actually get our hands on and make circuits and use equipment and stuff. And then in the real world, you don't sit down and write equations out, you're there actually doing it. So you get taught in uni one way, then when you're actually working it's the opposite. There's a lot of very basic practical skills that, when I went on placement, I didn't have. You could sit down and write the equations and do the maths, but when it comes to actually doing some soldering or using test equipment and stuff, you're struggling with it. [How has the placement year helped you?] Loads of things, like on my project, when I was fault-finding and stuff, it was skills that I'd picked up at work, not from college, that has helped me loads. If I hadn't done my placement I think I would've struggled a lot more with my project. And I'm hopefully going back to work at my placement so I guess I'm a bit more keen to learn, 'cause I know that I need to know that sort of thing for the job I'm going to. ...'Cause everything we get taught in the real world, it does integrate analogue and digital in it. But 'cause we get taught like at a concept level rather than at a real practical level, they don't sort of come together. Do you know what I mean? On the placement a lot of what I was doing was like, I'd have an actual physical circuit there whatever, then I'd have a circuit diagram. And it was when I was working there that I got my head round like relating a picture on a piece of paper to something real. Whereas when we're here, there's too much, well not too much, but more emphasis on theory. So you've got like little pictures representing things on a circuit diagram and then if you go out in the real world and someone gives you a circuit, they obviously don't look like that. It takes a lot of getting your head round. If I didn't do that placement and I was, like, going out into the world of work, I'd be nervous about it really. Because although I've done three years, I know like, theory but I don't know real things, if you know what I mean. So, I think what we need is more practical, more hands-on.

As indicated in the first of these papers, our emerging conceptual frameworks include both the overview map of the teaching-learning environment of a course unit and our developing interpretations of Biggs' ² notion of *constructive alignment* to describe a teaching-learning environment in which all the elements within the system interact coherently in support of learning. This includes the importance of alignment with students as part of constructive alignment ^{3, 4, 5}. While a teaching-learning environment may seem well aligned in terms, for example, of the correspondence between the forms of learning encouraged by the different aspects of the teaching and assessment, this does not mean that this environment will be equally suitable for all the students involved. Differences in students' aims and goals, preferred approaches, background knowledge and beliefs about learning may have a considerable impact on their perceptions of a particular context. A further layer of complexity is introduced in recent research ⁶, which argues for the importance of 'constructive friction', where a teaching-learning environment makes sufficient, but not excessive, demands on students to encourage their learning and development. In this particular unit, students expressed their appreciation for the way in which the different forms of teaching - lectures, tutorials and labs - were all interconnected.

Each different subject within analogue will give us the notes - like six, seven pages - and that's just about one particular subject. Then we'll have a tutorial a few days later and they'll just give us the sheet. And all the questions on that are about the same subject that we did that week. And then the lab will be on the same.

In terms of **lectures**, those interviewed commented on how the lecturer went through the material in detail, step by step, checking all along on their understanding; also, the provision of gapped notes, to maintain their attention. They were particularly appreciative of having full notes for exam revision.

As far as lectures go, they're pretty good. Some lecturers just talk at us and baffle us with a lot of information and no-one's any the wiser. But he gives you a set of notes and then probably leaves spaces where there's diagrams to be drawn which are obviously the most complicated parts. And he'll draw them on the board and get us to copy them down and explain them, what's going on. Whereas if we had like, full notes, nine times out of ten we'd just switch off. He'll go through it step by step and make sure everyone knows what he's doing.

Similar comments were made about **tutorials** and **labs**. For these, the group was split into two and numbers were perceived as manageable. While tutorials were not compulsory, most students attended and found them helpful. Likewise, everyone referred to the importance of lab work. As indicated above, those who had done a placement year wanted even more in the way of such practical, hands-on experience. Overall, we see the students showing a great deal of satisfaction with their experience of teaching and learning in the unit.

We get really good tutorials. You always end up coming out knowing more than when you went in. He'll give you a tutorial sheet and he'll work through the answers in the tutorials so that, when you come to revise, you can see what you've done. [Labs and tutorials] are split into two groups, so there are less people and you get more time with the lecturer. We've learnt the theory the previous week, so it's all like just putting theory into practice.

Students were **assessed** on the basis of one main assignment, five labs and an exam. Again, they were appreciative of the perceived alignment of assessment to what they were being taught in analogue. In terms of preparation for working as a professional engineer, the final year project was particularly valued by those who had not done a placement year.

The assignments link in really well with what we're taught. [For the final year project] you choose the general topic. There's about 50 subjects and then within the subjects you're given a choice. It's the major part of the last year, 20 credits, although it's not directly analogue based.

I think the main thing that I've done that might be relevant to a future career is my project. Like, if we went into being design engineers, we were given a specification to design, then now I might know where to start. Whereas, before I started the project, I had no idea.

CONCLUSION

This paper has drawn attention to the value in constructing a degree course in electronic engineering which retains coherence and continuity from the students' perspective. In this particular case-study, it was the lecturer's own choice to take responsibility for the teaching of analogue electronics throughout the degree course. While this situation may be unusual, it does serve to highlight the perceived advantages of building in continuity, coherence and connectedness over the degree as a whole.

As changes in university teaching occur as a result of the new arrangements for research funding, there will be an opportunity for more degree courses to take account of these advantages, although it is recognised that this approach will not suit all contexts nor courses. Nevertheless, the difficulties which students experience within a modular system without built-in connections between modules are increasingly being recognised and do need to be addressed.

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