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Students' experiences of the value of lectures for their learning: A close-up comparative study across four institutions

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Abstract: There is limited contemporary evidence around students' experience of lectures, notwithstanding critiques of their value. This study focuses on second year chemical engineering students across four institutions in England and South Africa. The analysis of student interviews identified three themes describing what students value in lectures. In terms of interaction they valued simply being able to ask questions. In terms of explanations, pacing was key and working through problems by hand was valued, while the use of powerpoint often received critique. The final theme shows how resources form a crucial link from the lecture into students' private studying. This study also drew on lecturer interviews, and the comparison shows considerable coherence between lecturer intentions and students experiences. The final aspect of this study compared across institutions, and here we see the structural impact of the high levels of contact time in the South African programmes.

Keywords: lectures, interaction, active learning, engagement, experience of learning

Introduction

A recent article in this journal describes lectures and their effectiveness as ‘one of the most heatedly debated topics in the field of higher education’ (French and Kennedy 2017, 639). Across the popular and scholarly literature there is much condemnation of the lecture as an anachronistic and ineffective mode for teaching. There are also some defences of ‘the lecture’ that might be regarded as nostalgic laments by those who are resistant to change. In their conceptual analysis of these debates, French and Kennedy argue that we are not well served by these relatively simplistic arguments or their homogenized ‘straw-man’ type characterisations of the lecture as a teaching form. A key point they make is that there is significant evidence that the contemporary lecture in many contexts does not fit the stereotype of a monotonic monodirectional transmission of information that tends to be assumed (see, for example, Tormey and Henchey [2008]).

A further problem with these relatively simplistic debates is that there is typically little accounting for the very different ways lectures are used in different disciplines. In considering the literature on students’ experiences of lectures, a crucial starting point is to consider the disciplinary differences in the role and experience of lectures. Clifford, Richardson and Monk (2012) found that students in Arts and Humanities students prioritized self-study over lectures, while Science and Engineering students prioritized lectures (although sometimes attendance was compromised by coursework deadlines) and expressed an expectation that core concepts will be covered in lectures in a far more effective manner than self-study. There is thus little point in attempting to assess the contemporary value of lectures in a generic manner, and the present study is broadly located within Science and Engineering, looking at the way lecturers use

lectures and how students experience these, in the second year of chemical engineering across four institutions in both England and South Africa.

Administratively, the ongoing presence of lectures in university life can be identified by their place on the academic timetable, by venues on campus that are designated for this purpose and by the notion of ‘contact hours’. Our focus in this study is on universities where the majority of courses are offered through in-person teaching; this study is not concerned with fully online programmes. Following a major disruption of education globally during the shift to emergency remote teaching during the COVID-19 pandemic, most university campuses are again inhabited by students. At particular times in the week, students taking a particular course with a particular lecturer, will assemble in a particular place on campus and for a particular duration of time to attend a “lecture”. Despite their ubiquity in undergraduate Science, Technology, Engineering and Mathematics (STEM) programmes, we have surprisingly little contemporary evidence on what is going on in lecture periods, and - crucially - how these do or do not support student learning in their wider courses of study. This was a significant focus for the early decades of student learning research from the 1980s (see, for example, Biggs [1989], Gibbs, Habeshaw and Habeshaw [1987], Ramsden [1985]), but in recent decades there are relatively few studies on how the experience of lectures contributes to student learning. French and Kennedy (2017) identify two dichotomies that have unhelpfully structured the educational research literature in relation to lectures. Firstly, there is an approach that pits the lecture against small group teaching, arguing simplistically that the former is irredeemably limited and the latter full of potential, while both actually require advanced pedagogical skill for facilitating learning in the given context. Secondly, there is an assumption that teaching that utilizes technology is inherently more effective and innovative, thus creating a dichotomy between the in-person lecture and its

online pre-recorded version, a debate that has only increased in the wake of the COVID-19 pandemic.

The study presented in this article is part of a larger project entitled ‘Understanding Knowledge and Student Agency’, a comparative and longitudinal study of student learning in science and engineering across six institutions and three countries. In this collaborative research project, we have tracked students annually through the full duration of their undergraduate programmes, seeking to understand close-up how the engagement with disciplinary knowledge is promoting the distinctive formation of these graduates and their agency to engage with the world. This article draws on a subset of these data, using curriculum documentation and interviews with lecturers and students in second year chemical engineering at four institutions, two each in England and South Africa. Importantly, we locate the student experience of lectures in the broader context of each programme, to attempt to avoid the problem noted above where lectures are pitted simplistically against other forms of teaching that have an important part to play in a STEM undergraduate programme, such as laboratories and tutorials.

In framing the analytic focus for this article, this study builds on a theoretical position previously advanced in an article in this journal (Case 2015) which attempted to build a new way of understanding the relationship between teaching and learning. A starting point for this work was the extensive literature on the topic of ‘good teaching’ which as noted above seems to have fallen out of vogue in contemporary times. A key advance with the growth of student learning research from the 1980s onwards was the recognition that there needed to be an alignment between teachers’ approaches to teaching and students’ approaches to learning (see, for example, Prosser, Ramsden and Trigwell [2003]). Building on this core understanding, it can be proposed that there is no simple deterministic linear causality between teaching and learning, but rather

that this is an emergent relationship, and thus the analytical task is to identify the kinds of teaching environments in which learning is more likely (but not assured) to occur. Drawing on Ashwin (2009), it is also argued that what is emergent from the distinct activities of teaching and learning is a specific ‘teaching-learning interaction’, which, crucially, is centred on a ‘learning object’ (and not only on a metric like ‘student satisfaction’). The interactional nature of this process means that the human relational dimension is as significant as the knowledge in hand.

Building on this theoretical angle centred on learning as a phenomenon in an emergent relationship to teaching, this study is therefore centrally focused on students’ experiences of lectures, but also aims to compare these to what lecturers are aiming for, and then uses the comparative aspects of the research design to be able to compare across the four contexts. The following research questions guided this study:

1. What aspects of lectures do students deem valuable to their overall course learning?
2. What considerations of value to students, if any, do lecturers include when designing and delivering lectures?
3. How do the different structural arrangements and typical lecturer approaches relate to what students deem valuable in lectures?

This article firstly overviews the contemporary literature on students’ experiences of lectures in STEM programmes. The study is then introduced, with an overview of the contexts in which it took place and the approaches to data collection and analysis. Thereafter, the findings of the study are presented and discussed.

Contemporary research on what STEM students value in lectures

In line with the focus established above, in this review we sought to identify studies published from 2000 onwards that report on STEM students’ experiences of in-person lectures. We were

interested to observe that nearly all these studies use as a departure point the apparent conundrum of why students still attend live lectures these days, in contexts where recorded materials are available. The issue of lecture attendance has always been a prominent part of the debate around lectures and the availability of recorded lectures played into this anxiety understandably felt by lecturers and university administrators. For our purposes, which were to understand students' experiences of lectures, this issue in and of itself is of less interest than exploring the potential value that students do derive from lectures. We identified some studies which were only really focused on the perceived competition between lectures and lecture recordings but did not explore in detail the experiences of live lectures (Gosper et al., 2010; Petrović & Pale, 2015). We therefore identified a subset of seven studies whose research designs led to findings aiming to characterize this perceived value, summarized in Table 1.

What each of these studies show is that the STEM students surveyed do express (often in response to open-ended questions) many different aspects of what they value in the experience of attending live lectures. The availability of recorded lectures is widely reported as being of benefit for the occasions when it is not possible to get to the lecture due to competing commitments, but also for being able to go over material that is unclear.

Table 1: Overview of articles surveyed – what STEM students value in lectures

Authors	Institution	Discipline	Data	Findings
Bergsten, 2011	Linköping University, Sweden	Mathematics	Questionnaire responses – both close- and open-ended items	<ol style="list-style-type: none"> 1. The lecturer as a person; 2. Demonstration of examples; 3. Good explanations; 4. Clarity; 5. A comfortable pace; 6. Coherence; 7. A mix between theory and methods.
Fitzpatrick et al., 2011	University College, Cork, Ireland	Chemical Engineering	Questionnaire responses – both close- and open-ended items	<ol style="list-style-type: none"> 1. Engaging environment; 2. Good notes / presentation; 3. Use of visuals; 4. Match to assessment in the course; 5. Positive learning environment; 6. Problem solving; 7. A deep learning experience.
Gysbers et al., 2011	University of Sydney, Australia	Biochemistry and Microbiology	Questionnaire – both close- and open-ended items	<ol style="list-style-type: none"> 1. Students enjoy lectures; 2. They like the discipline provided; 3. It's a good environment to concentrate; 4. They perceive it as a key part of university experience; 5. Lectures are engaging; 6. There is a bit of guilt if not attending; 7. Online is not the same as in-person; 8. It's risky to rely on the technology.
Hill et al., 2003	Canterbury Christ Church University College, UK	Business Studies, Management, Education and Nursing	Focus groups	<ol style="list-style-type: none"> 1. Delivery in the classroom 2. Feedback to students 3. Relationship with students
Loughlin & Lindberg-Sand, 2022	Pre-1992 research-intensive English university	Health Sciences	Lecturer interviews and student focus groups; Student questionnaire	<ol style="list-style-type: none"> 1. Structure 2. Ability to develop peer networks

O’Keefe et al., 2017	University College, Cork, Ireland	Neuroscience	Questionnaire – both close- and open-ended items	<ol style="list-style-type: none"> 1. Engagement 2. Time 3. Varied format
Yoon et al., 2013	University of Auckland	Mathematics	Questionnaire – open-ended items	<ol style="list-style-type: none"> 1. More conducive to learning 2. Easier to concentrate 3. Enabled them to interact with the lecturer or fellow students

As might be anticipated, the lists of what students value as presented in each study vary in their formulation, but what all the lists do point to relate to the findings of Clifford et al. (2012) mentioned above, which stated that STEM students prioritize lecture attendance for its impact on their learning and understanding of the course material. What appears quite differently across the lists are relational aspects, whether with the lecturer or with peers, and this seems related to the degree to which the lectures under consideration were intentionally interactive or not. The study by Loughlin and Lindberg-Sand (2022), for example, described the format of the lectures under consideration as ‘largely transmissive’, with occasional questions posed to students and rarely receiving any response. This might explain why their list of what students value does not refer to any relational connections with the lecturer, but rather with peers. Mostly the other studies in Table 1 did not formally document the modes of teaching in the lecture, but it should be noted that all of them were conducted by lecturers in Departments who evinced a focus on teaching and a concern about attendance.

Our study sought to bring forward further empirical evidence on what students value in lectures, but crucially also linking this to an analysis of what a typical lecturer in each programme said that they were aiming to achieve in the lecture format. We also aimed for a more

systematic comparison across institutional and national contexts, to be discussed further in the following section.

Research design

As noted in the introduction, this study is part of a larger comparative project (Carnoy 2019) which followed student experiences longitudinally across the years of the bachelors degree in two programmes in each of six institutions which spanned three countries. The research design comparing teaching and learning across multiple institutions is methodologically informed by McLean et al. (2017). This particular study draws on the data from the second-year chemical engineering students in England and South Africa, focusing on these two countries because of degree structures with similar origins but different contemporary formats and student bodies. From the broader study we could see that second year was a pivotal moment for students in attuning themselves to undergraduate study, and we were interested to be able to explore in-depth both faculty and student experiences of lectures by focusing in on the chemical engineering programmes which we already understood to have heavy lecture components, and also by selecting four institutions in two countries where we could see there were substantial curricular differences which could help to highlight the influence of context. In Table 2, we overview these four institutional and programmatic contexts:

Table 2: The institutional contexts for the study

Institutional pseudonym	Erbium University	Europium University	Sodium University	Samarium University
Country	England	England	South Africa	South Africa
Institutional profile	Top research-focused university in the country	Known for high quality teaching & good industry placements	Research-intensive historically white Afrikaans medium	Research-intensive historically white English medium

Data collection and analysis

Based on the research questions outlined above, for this study we drew on three forms of data:

1. Student interviews – to be able to analyze student experiences of lectures and their views of what was valuable.
2. Lecturer interviews (based on observations of a lecture) – to be able to analyze lecturer intentions and practices.
3. Curriculum documentation - to be able to analyze the structural arrangements for how lectures were included in each curriculum.

All institutions and participants were anonymised in line with the ethical approval granted by Lancaster University as lead institution in the research (Reference Number FL15035). Ethical approval was also obtained as required at each of the four research sites.

Student interviews

This study drew on interviews with chemical engineering students that were conducted during their second year at the English and South African institutions in the broader study. Overall, this constituted 41 interviews, 10 from each programme, excepting for Europium, where 11 students were interviewed. A semi-structured protocol explored a range of aspects of students' experience and the completed interviews took about one hour. In-person or online interviews were used based on student availability. Informed consent was obtained, in line with the broader ethics procedures in place for this study. All interviews were recorded and transcribed.

This study draws on a part of the interview protocol that focused on students' experiences of course activities and is shown below in Table 3:

Table 3: Sample student interview questions

Timetable/Studying schedule
<ul style="list-style-type: none">• What does your timetable look like during a week? Please talk me through a recent week of studying
Learning
<ul style="list-style-type: none">• What parts of labs/lectures/tutorials do you find essential for building your learning? And why?• Would you change anything in terms of the way your courses are being taught?
Curriculum
<ul style="list-style-type: none">• What do you think is the main difference in terms of the curriculum and the teaching and learning process this year compared to last year?
Labs/Practical Work
<ul style="list-style-type: none">• Tell me about the practical work/labs that you do in your courses.• What do you think is the role of practical work in your course/degree?
Balance of in-class and out-of-class
<ul style="list-style-type: none">• What is the balance between your structured work/contact time and your individual work/non-contact time (study time, assignments, preparation)?
Expectations
<ul style="list-style-type: none">• Did you have certain expectations about the second year of your studies? What were these?• Has anything surprised you?
Quality
<ul style="list-style-type: none">• What do you think of the quality of the study and lecturers this year in comparison to last year?• What do you think of the quality of the infrastructure this year in comparison to last year?

For this study we drew especially on student responses to the question 'What parts of labs/lectures/tutorials do you find essential for building your learning?'. The phrasing of this question was deliberate, to make sure we were not over-emphasizing any one activity over

another, and also so that we could understand students' experiences of lectures in the broader course context. For this reason, we also contextualized responses to this one question against those in the full set of related questions reproduced in the figure.

Following a thematic focus, the analysis of student interview data sought to identify distinct categories of response to the focus on 'what do students value in lectures'. Following an iterative process, three themes were identified, and a further analysis of coded extracts within each theme allowed for a description of variation within the theme.

Lecturer interviews

For each programme, we also worked with the Department to identify one or more 'typical' second year lecture-based courses. Following invitations, we were able to secure one second-year lecturer in each of the four programmes who consented to our observing a lecture and conducting an interview with them based on this lecture. We acknowledge the limitations that this study did not interview every lecturer that might have worked with the students in that particular year; this of course would not be possible given elective courses – therefore the analysis rests on the assumption that this was a reasonably typical lecturer approach that we were able to characterize.

For each lecture, we used the recording to craft an interview protocol for the interview with the lecturer, in which aspects of what had been observed in the lecture were used to craft prompts to ask the lecturer to talk about the choices they made in their teaching. The lecture recording itself was not used as a data source in this study. Some of the questions from the interview are shown in Table 4 below:

Table 4: Sample lecturer interview questions

Choice of overall teaching methods

- During the video that we recorded, we noted that you have chosen to use different technologies/tools – blackboard, projector, and book extensively. Could you talk more about that choice?

Use of different forms of representations

- You extensively used graphs for explaining concepts in the class. What is the importance of using graphs in teaching/learning of chemical engineering?

Importance of numerical problem solving

- You introduce a concept, provide an example and then get students to work through example questions, as a process why does this work for the students?
- Why do you emphasise the practice questions on [the Learning Management System]? And how does this relate to what students are doing in the lecture?
- Your class made extensive use of calculation problems to discuss the content. Could you talk about the reasoning for that?

Connection to industry

- What is the relationship between the lecture and what students may do in industry in the future?

Assessment

- What is the relationship between the practicals, assessment and the lecture?
- Can you tell me the role of assessment in learning engineering?

Each of these four interviews was then condensed into a summary document highlighting the main points that each lecturer emphasized in the interview. The analysis across the four interviews then aimed to identify common themes, as well as variation within the theme.

Curriculum documentation

Here we obtained the curriculum documents which outlined course credits and contact time for various activities in the week, focusing on the second year of the chemical engineering programmes at these four institutions. The initial analysis here focused predominantly on comparing the time allocations for lectures across the four programmes.

To fully address the third and final research question, at this stage we had to look back at the findings for lecturer and student perceptions in each context and relate these to what we understood about the different curricular and institutional contexts.

Research findings

What students value in lectures

In the interviews, students were encouraged to talk about what kinds of teaching styles they found valuable for their learning. Three key themes were found across all programmes. Two aspects which were valued were *explanations* (sometimes given in terms of the lecturer working through problems on the board) and *interaction* (mostly defined in terms of being able to ask questions of the lecturer). Students also spoke about the kinds of teaching they did not find helpful. While they noted some frustration if not able to get their questions answered, most concern here was directed at lecturers who did not explain the material, who just ‘flipped through the slides’. A third aspect of what the lecturer does which received much comment was on the provision of *resources* to support their studying, including notes, solutions and lecture capture. This aspect, which is the relation between what happens in the lecture and what students do on their own, has been less commented on to date in the literature. These will now be considered in turn.

Explanation

Compared to the theme of interaction, where students' expectations were relatively low and they seemed happy simply to have their questions answered, on the theme of explanation, however, students were scathing about lecturers that did not help them learn what they needed to learn. Students recognized that some subjects, especially from first year, were more content ('theory') based, but in the engineering subjects they felt they needed to be able to solve problems, and this meant an expectation that the classes would help build this skill (and related understanding).

A few students at Erbium University made explicit mention of positive experiences of a lecturer doing worked examples in class:

I really like the way he teaches. He takes his time, goes through examples, and I think if you're doing engineering, all you really need is examples. [Lekan]

Another Erbium University student gave a vivid description of a point in a course where something 'just kind of clicked':

The lecturer just described it in a different way. Described it while she was drawing a graph, kind of thing, and then all of a sudden, I was like, 'Oh. That's how it is.' [Liam]

Half the students from Europium University made explicit mention about positive experiences on this theme, for example, echoing the comment above about pacing:

Like, at least one example, he goes through it step by step. He makes sure everyone understands it, but in some lectures they just rush through it. They will just assume everyone knows it and they will just jump steps. [Rachel]

One student at Europium University described a mode of lecturing that seemed a hybrid between a lecture and a tutorial:

Actually, one of our lectures, sometimes rather than teaching us from the booklet - we have booklets that has all the theory in it - we go through the theory before the lecture. Then, we sit in and work through two examples together, rather than sitting there and talking at us for two hours. We do questions with him for the full two hours sometimes. [Rosalie]

Similar to the theme of interaction, there were some comments suggesting that the lecturers engaged differently now that students were in the second year, not only in a smaller class, but more focused on the subjects that the lecturers really cared about.

With regard to this theme of explanations, there were many comments from Sodium University students on the shift more towards working through examples in class in second year, what some students described as ‘practical’, compared to first year which they felt was more ‘theoretical’ and taught through notes on powerpoint slides. For example, Tracy notes:

In first year it was sort of slides everywhere. But now it’s more interactive, working through problems.

At Samarium University, working through problems ‘on the board’ was not described as such a prevalent feature. It was noted that some of the chemical engineering lecturers across the blocks worked through examples on the board, but they were in the minority. For example:

Most of my lecturers just use slides, so they’ll just follow through the slides and some, like a few, like, two out of ten will actually do examples on the board with us. ... So, the examples really help. (Ndodzo)

The comment from another student at Samarium University is rather telling regarding their experience of the use of powerpoint slides:

The ones I like is when they do it on the board as they’re going through the lectures. ... It’s generally slower because they have to keep up with themselves. They can’t just flip through slides. (Nicholas)

Here it is worth considering the many comments across all sites from students on what they considered unhelpful teaching styles. As per this above comment, Powerpoint comes in for much mention, in relation to all the problems noted: going too fast, not actually working through problems but just posting equations on slides, talking too much without noting whether students understand. One further poignant comment will suffice for concluding this theme:

Some of the lecturers read their slides and it's like I might as well read the slides at home.
[Nomathemba]

Interaction

The higher education literature tends to frame interaction around 'active learning pedagogies' where a lecturer actively prompts students to interact. At only one university, Sodium University, was there any mention of this kind of intentional pedagogy – this will be described below. When students spoke about interaction, which they did a lot, and valued, they referred mostly to being able to ask questions and get these answered (not to the lecturer posing questions to them). There were a few mentions of lecturers knowing their names and that this was more likely because of the smaller classes in second year compared to first year.

At Erbium University, it was noted that many students commented on the lack of tutorials compared to first year, and lamented the lack of opportunity to ask questions. Only one student at this institution made a positive mention on the topic of interaction, commenting on the value of smaller classes for being able to ask a question. At Europium University, by strong contrast, nine out of the eleven interviewees mentioned positive experiences of interaction with lecturers, and some felt this was a distinct feature of this institution. As mentioned above, the tutorials at Europium University were highly rated for the opportunity they gave to ask questions and students also spoke of the availability for consulting lecturers in their offices.

At Sodium University, students spoke in considerable detail about their experience of lectures which as noted were a very prominent part of the programme in terms of time commitment. With regard to this theme of ‘interaction’, one Sodium University student mentioned that in second year they had noticed that lecturers now used students’ names on occasion (this was not mentioned by any Samarium University students):

Like, some of my lecturers actually made the point of learning the people’s surnames. ... They will ask you like, so, Ms XX, tell me the answer to this, or something. [Tanika]

There was one lecturer at Sodium University that many students spoke about:

Basically, he walks around the class, actively engaged with the class and asks questions. So, you’re always on your heels because you don’t know if you’re going to be asked a question next. The questions aren’t asked in a mean spirit, they’re just asked to keep you awake and get you involved. But you might look a bit silly if you don’t answer the question or if you give a silly answer. [Tiaan]

While this mode of teaching seemed to stand out, there were other classes at Sodium University that were described in terms of the interactions that took place, in terms not only of the lecturer posing questions in class, but also in being open to receiving questions whether during class or after the class.

At Samarium University, as described above, lectures featured less significantly in students’ accounts of their learning experiences than at Sodium University. These students noted that they had different lecturers through the ‘blocks’ of the chemical engineering subject and these had different teaching styles. There was less mention of interaction than at Sodium University. One Samarium University student spoke at length about the value of engagement in

teaching and felt that some lecturers tried to promote interaction but that few students were keen to participate:

But this is from my perspective, because for me, I like asking questions, I like speaking, I love interacting. And sometimes it's just me. Sometimes I'll find it's only maybe two or three people, but it's the same people. So, I feel like sometimes the class gets 'shy-ed out' or people just don't want to ask questions. [Nevin]

Resources - the connection between the lecture and private studying

In a third and final theme on what students find helpful in lectures, there was much discussion on what lecturers provide them for use in their study time after class. Usually these comments were in response to resources that were not made available to students: notes, slides, solutions, lecture capture. Except for the case of Europium University reducing the amount of printing for budgetary reasons (to be discussed below), most of these arguments seem to have been made for pedagogical reasons (even if questionable) such as making sure students came to class, making sure students worked through problems on their own, etc. Students often recounted what the lecturer said in giving these reasons, for example from Sodium University:

People complained that he doesn't put up his powerpoints on Sunday. And he works quickly so a person can't write down everything. Then he said 'But the powerpoints are for me, it's not for you. The book is for you. Work through the book'. And he said it repeatedly at the beginning. Then he left us, then we had to learn it ourselves. [Thomas]

This comment is clearly in response to an expectation from the students that he makes the powerpoint slides available. Students spoke in many ways about how they used the class slides as a key resource as they studied. They also noted that knowing these were available gave them more opportunity to concentrate in class rather than frantically having to write everything down.

Another issue that was mentioned by some students was the availability of solutions. At Erbium University a student said:

The worked example questions in the lecture notes, he's not uploaded the answers. He was like, 'Oh, you should've come to the lectures.' ... So I'm going to have to go and try to find my notes now, and hope that I've written the answers down. Some people don't like doing that. Some people just like to go and sit and listen and watch. He's denying people, who learn a specific way, answers to punish people that haven't come. [Leanne]

At Samarium University a student also referred to a departmental practice not to provide tutorial solutions, which some lecturers didn't follow. As mentioned above, Europium University had a policy about class printouts which a number of students commented on, for example:

But, there are some lecturers who have decided, 'No, I'm not printing anything for you. It is too much effort.' Then some lecturers who have really gone round it creatively. Like my [subject] lecturer, he has actually put everyone's names on the booklets, so he has only enough booklets for the people that actually attend. People that haven't attended the week before don't have a booklet. You have to sign for it, and it has got bits and bobs missing that you have to write in yourself, because it is a handout. [Lekan]

Lecturer intentions and practices

As already noted, in each programme we had recorded what was deemed to be a 'typical' lecture session in the second year, and we had interviewed the lecturer afterwards about what they did in their teaching and why. All the lecturers we interviewed were in permanent full-time positions, and all except the lecturer at Erbium were in roles that combined undergraduate teaching and research. The South African class sizes were in the order of 100 students while the English class sizes were considerably lower, more in the order of 30-50 students.

In each context we found lecturers very intentional about how they used lectures and able to articulate clearly how they had developed their approach over time. All lecturers

conceptualized their role in terms of preparing students for professional practice even though they were only in the second year of the programme. In analyzing their interview responses, we identified two main themes: 1. Fostering understanding of concepts and 2. Fostering interaction with students.

Fostering understanding of concepts

In all cases we found lecturers very explicitly directed towards making sure students understood the concepts in the course, and they focused their teaching towards this. In most cases they spoke about concepts as the foundation of what they were building. The Erbium lecturer emphasized how concepts learnt in second years would be needed in later years of the program.

All lecturers spoke about the place for working through examples (they often referred to these as ‘problems’) in class. The Sodium lecturer said he made sure he uses different examples to those in the textbook and that he uses the document camera. He wanted to make explicit to students their thought processes while solving a problem. The Samarium lecturer said she starts with introducing concepts and then goes onto how these will be employed in solving problems. She focuses on outlining the variations in different problems that students will encounter. The Europium lecturer stressed the step-by-step working needed for engineering problem solving and wanted to show students explicitly the progression of a problem being solved.

All of the lecturers spoke explicitly about the role of diagrams and visualizations in class in order to aid understanding. The Sodium lecturer said this serves as the link between the concepts and their real-world applications. Similarly, the Samarium lecturer said that drawings and sketches are important because they are the tools that engineers use to communicate. The Erbium lecturer said he uses visualizations mostly because he thinks they help student learning.

Fostering interaction with students

All lecturers spoke about how they try to foster interaction with their students in class. The Sodium and Samarium lecturers spoke of this in terms of asking questions of students in class but did not seem to have strategies beyond this. The Sodium lecturer noticed that the interactions in class tend to die down as the semester progresses and there is more of a focus on completing the work. The Erbium and Europium lecturers showed evidence of having worked more intentionally on how to use different strategies to foster engagement in lectures. The Erbium lecturer shared that he had read the scholarship on teaching and learning and was convinced that students learn best through ‘active learning’ and thus he includes these activities in his instruction. This emphasis also resonated with his own experiences as a student. The Europium lecturer had an explicit conceptualization of himself as a ‘facilitator in the room’ and structured lecture sessions on this basis. This lecturer spoke explicitly to students about their learning and the reasons why he was doing what he was doing in class and the kind of learning he anticipated for students. Following experimentation with powerpoints this lecturer had arrived at an approach based on worksheets where students work with the lecturer to fill in the gaps.

Variation across contexts

An important starting point for comparison in this study was to look at overall contact time (scheduled class time, including lectures, laboratories and tutorials) in each of the programmes. In the South African programmes, contact time in the first two years equates to about 28 hours in the week, while in England, programmes contact time equates to about 20 hours in the week. In the South African programmes, students describe spending of all mornings and all except one afternoon in scheduled sessions. In the programmes in England, students have different schedules on different days, but on average no more than half a day in scheduled class

sessions. Notwithstanding the above patterns of variation in all programmes, lectures were a significant part of the schedule of contact time for all programmes: 12 hours a week in the two universities in England, and 15-20 hours a week in the South African universities.

We found that the design of contact sessions in a week has a significant structuring influence on students' experiences in these programmes. Lectures and tutorials were not compulsory, but nearly all students interviewed felt that 'attending class' was important. It was rare for a student to talk about strategically missing a class, missing class featured more as an admission of not coping with multiple demands.

All engineering students feel that they have a demanding programme when they compare to the schedules of other students. Across all the institutions studied, second year students had somewhat less contact time than in the first year and this was generally commented on. Beyond the general similarities, it was noted that the South African students have a particular challenge attuning themselves a very high schedule of required lecture attendance in the week; students talked about this a lot and evaluated themselves quite predominantly on their levels of attendance. One South African student was surprised to hear from a friend also studying engineering but in England who has lectures starting only at 10am:

... I'm like, 'you're an engineer and you have 10 AMs?'. So I feel like probably their approach to things is a bit different because it feels like he has more time on his hands. Yes, we're doing the same degree and probably it's going to be of nearly the same quality, but I'm putting in more compulsory hours. [Nomathemba]

What is striking about the programmes in England is that students in these institutions just do not talk much about issues related to attending class.

Discussion and Conclusion

The data for this study were collected shortly before the pandemic, and this final write-up of the study is taking place at a point where most universities have resumed in-person teaching, but where the debates on the value of in-person lectures are even more prominent, in the wake of differing perceptions and interpretations on the student experience of emergency online teaching (Watermeyer et al. 2021). Building on evidence that the role of lectures in STEM curricula is quite different to that of other programmes (Clifford et al., 2012), we confined our focus on the literature accordingly. We identified a very small group of studies on this topic, each of which delivers a list itemizing what it is that students value about the experience of live lectures.

Our study drew in data on student interviews, lecturer interviews (in response to one recorded lecture) and curriculum structure across four different institutional contexts, so that we could contrast student experiences and lecturer intentions in different contexts.

What students value in lectures

In response to research question 1, we generated three themes describing what students said they valued about lectures. The first two themes, Explanation and Interaction, can be used to organize the lists identified earlier in relevant similar studies on STEM students, as shown here in Table 5.

Table 5: Interaction and Explanations themes in prior literature

	Explanations	Interaction
Bergsten, 2011	Demonstration of examples Good explanations Clarity Comfortable pace Coherence Mix btw theory and methods	The lecturer as person
Fitzpatrick et al., 2011	Good notes/presentation Use of visuals Match to assessment Problem solving Deep learning	Engaging Positive environment
Gysbers et al., 2011	Discipline Concentration Guilt if not attending	Enjoyment Key part of university Engaging Online not same as in-person Risky to rely on tech
Hill et al., 2003	Delivery in the classroom Feedback to students	Relationship with students
Loughlin & Lindberg-Sand, 2022	Structure	Ability to develop peer networks
O’Keefe et al., 2017	Time Varied format	Engagement
Yoon et al., 2013	More conducive to learning Easier to concentrate	Enabled them to interact with the lecturer or fellow students

The theme of Explanation carried significant weight in what students said they valued in lectures. Where this dimension was lacking (which students had mostly experienced) they were scathing, and they praised lecturers who were strong in this regard. In this theme, students talked about the value not only of direct explanations but also step-by-step solutions to problems which they found very helpful in understanding the complex theoretical concepts, how they are logically interconnected, and how to use these concepts in solving engineering problems.

A notable finding of the present study is that Interaction does not necessarily need to involve the strategies promoted under the label of ‘active learning’ although these seem to be particularly well received by students. What these engineering students conceptualized as

interaction seemed to focus on being able to ask questions and get these answered, i.e. specifically focused on the ‘learning object’ (Ashwin 2009).

The third theme identified on what students value appears to be a significant new insight emerging from this study. Students talk about the way in which the lecture context provides the space in which the lecturer provides resources and guidance for students’ out of class study. In a world in which there is nearly infinite availability of ‘information’ on the internet, it is notable how students valued lecturers’ ‘curation’ of resources to support the specific learning outcomes of the course at hand. It’s also worth noting that very strong feelings were evoked when students felt that lecturers were unjustly withholding resources from them.

As noted earlier, it might be that the issue of attendance is something of a red herring in the debate on the value of live lectures. Nonetheless, students in this study appeared to mostly aim to attend lectures given the benefits that they perceived from doing so. As some students recounted, it was only to manage the competing demands on their time that they decided to miss a few lectures to be able to cope up with their extremely demanding schedules, something noted across most of the studies reviewed earlier.

What lecturers intend to achieve with lectures

An important aspect of the research design is that, while students spoke about their experiences across all classes in the second year, we were only able to observe a class of one lecturer in the second year, someone who had been deemed to be ‘typical’ and also who agreed to our invitation for the observation and a follow-up interview. It can be assumed that the four lecturers we interacted with, were of the more intentional and effective across the programme. In other words, what is represented in this part of the analysis is likely the top end, not the average, of what students would experience.

We found strong commonality across the four lecturers in these different contexts, with a few key differences. All of them spoke spontaneously about the importance of building conceptual understanding, and how they used worked examples and visualizations to achieve this; here the variation was slight. This theme can be seen to have its counterpart in the student theme of Explanations. With regard to the second theme of fostering interaction, all lecturers said this was important, but the two South African lecturers did not seem to have strategies beyond asking questions in class. The two English lecturers both showed evidence of having engaged with strategies for pedagogical innovation in relation to active learning, and had developed quite sophisticated techniques for fostering interaction.

The relationship between context, lecturer intention and student experience

The third and final research question built off the distinctive research design of the broader study, which involved four institutional contexts across two countries. While lectures were a significant part of the schedule of contact time for all programmes, the South African students had 50% more lecture time squeezed into the week, and, not surprisingly, spoke much more about the challenges of attending lectures and the struggle to keep up.

Going beyond the issue of lecture attendance, there are other contextual features influencing the lecturer intentions and student experience that are highlighted by this study. In each context, students were able to identify classes where they had positive experiences in relation to the important theme of Explanation. They reference similar strategies to what the lecturers had said they used – worked examples and visualizations, which were more prevalent in second year and which students appreciated. The South African students seemed to be experiencing a wider range of effective teaching strategies, with some evidence of poor use of powerpoint, while students mostly seemed to prefer lecturers who wrote on the board (or a

tablet). It seemed that powerpoint carried the risk of inappropriate pacing, while writing helped the lecturer work at a pace that students could follow.

In relation to Interaction, while this was a theme where student expectations were generally lower, there was also a wider range of student experiences, not entirely allied with the accounts of the lecturers we observed and interviewed. At Europium University, the more teaching-focused of our English universities, students were effusive about the positive experience of interaction with lecturers, while at Erbium it was felt that this was limited especially due to the lack of tutorials compared to first year. At Sodium University, there appeared to be one lecturer (not the one we interviewed) who was especially skilled at using active learning techniques, but even beyond this class students felt noticed by lecturers who knew their names. At Samarium University, in general, lectures played a lesser role in the second year curriculum, which was quite strongly project-centred, and students mostly did not experience lectures as highly interactive.

Based on the findings of our study we conclude that despite a growing body of literature on teaching and learning demeaning lectures, they are still valued by both students and lecturers in STEM curricula and offer a significant means to help students engage with the disciplinary knowledge while bringing a much-needed human element in the process of learning. What students especially value is the quality of explanations in lectures, and here the lecturer foci on worked examples and visualizations, did appear to be effective. Students valued interaction to a lesser extent, and were content mostly with being able to ask questions, although they did notice and value lecturers whose skills went beyond this.

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