

# **An investigation into the teaching and learning of argumentation in first year undergraduate courses: A pilot study**

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## **Abstract**

*A fundamental role of universities is to develop independent and critical thinkers. An effective strategy to do this is a good command of argumentative skills, but there is little evidence that such skills are explicitly taught at introductory courses. This paper presents the results of a one-year pilot study examining the teaching and learning of argumentation among all first year undergraduates across three disciplines in UK universities. Data were drawn from surveys, interviews and documentary analysis. The results indicated that students were less likely to be taught the use of arguments at university than they were at school. Whether argumentative skills were encouraged depends very much on the lecturers, the mode of testing and the assessment criteria that dictate how and whether arguments were emphasised. The role of universities as simply a vehicle for the transmission of knowledge needs to be reconsidered, and how students are assessed and evaluated needs to be reviewed. To the extent that argumentative skills contribute to the development of a better quality of knowledge and cultivation of a rational and human society, it should be encouraged and supported.*

## **Introduction**

A fundamental role of higher education is to develop in young people a set of skills that will enable them to become independent thinkers, able to make informed decisions and engage in useful debates about moral and ethical issues (Roth 2010; Underwood and Wald 1995). Traditionally, such skills have been central to the goals of higher education, and valued as key attributes of graduates (Mitchell *et al.* 2003). They enable students to reason, think critically and present information in a logical and coherent way. Some have argued that argumentation should be a central component of education (Driver *et al.* 2000; Sadler 2006), and that the teaching and learning of argumentative skills should be made a priority in higher education (Mitchell & Andrews 2000; Kuhn 1991).

To ensure that such skills are being taught at university level, the Teaching Quality Assurance (TQA) and Quality Assurance Agency (QAA), which monitor and assess the quality of provision in higher education institutions, were introduced. Their main aim was to ensure that graduates from UK universities were equipped with such thinking skills. The QAA was particularly concerned about the inability of science students to *'construct reasoned arguments to support their position on the ethical and social impact of advances in biosciences'* (Quality Assurance Agency 2002). It emphasised the need to teach arguments as *'much of what they are taught is contested and provisional, particularly in the light of continuing scientific advances.'* (Quality Assurance Agency 2002, p.4). It argued that as students were *'expected to be able to debate issues in a mature and critical manner, including engagement in moral and ethical themes'* such skills were essential (Hounsell & McCune 2002).

In 2011 the reform in science education explicitly made the teaching of argumentative skills its goal calling for the promotion of argumentative skills through teaching and debates in the classroom (Eurydice 2011).

However, although argumentative skills have often been encouraged as a goal of higher education, there is little evidence that they have been taught (Arum & Roksa 2011; Andrews & Mitchell 2001, Andrews 2007). A report in the Independent (Independent 2006) bemoans the lack of argumentative skills among undergraduates in UK universities. Poets and authors called it a scandal that many of our supposedly brightest could not follow a logical train of thought or string a coherent argument. In a study in America involving over two thousand students, Arum and Roksa (2011) found that many students graduated not knowing how to distinguish facts from opinion, or make clear written argument or objectively review conflicting reports.

In recent years with the increasing marketisation of higher education and the shifting emphasis towards universities as a business enterprise, questions arise as to whether argumentative skills are still relevant, and whether they should still be valued as necessary attributes of graduates. Or, should there be a focus on a whole new range of skills to meet the changing role of universities. Universities are now increasingly seen as research institutes rather than institutes of teaching and learning. Their aims are now more about attracting research income and raising the research profile. The focus is now on attracting high quality post-graduate researchers able to bring in research income. Some fear that this may be happening at the expense of teaching. Undergraduate teaching, in particular appears to be neglected and marginalised.

A quick search of the internet revealed quite surprising results. None of the first four UK universities searched mentioned developing thinking individuals as one of their main aims. What came through consistently from these four universities were:

- to improve the ranking of the university relative to peer institutions (e.g. Russell group and Times Higher international league table)
- to raise the research profile of the university (measured by research outputs and research incomes)

- maximise research impact and scholarship
- build business partnerships and networks

Perhaps the aim of universities as institutions that develop independent thinkers is assumed. No matter, there is no denying that such skills are still very relevant today, if not even more so than before, given the proliferation of information in our global and technological world. Young people need to be able to evaluate the integrity and validity of information they are confronted with, weigh the evidence presented to them, and make judgements about what to believe and what not to believe (Renaud & Murray 2006). Driver et al (2000) and Sadler (2006) argued that an effective strategy to foster the development of such skills is the use of argumentation.

Walker (2011) explained that the role of argument is central to the construction of scientific knowledge and students need to be able to use evidence and justify the choice of evidence with appropriate rationale. Undergraduates are expected to read academic and research papers. The ability to critically analyse academic literature efficiently requires certain skills, such as interpreting data, judging the reliability of the evidence, recognising assumptions and unwarranted conclusions. Although academics use these skills daily, they are rarely taught in an explicit and systematic way (Coil et al. 2010). Lecturers in first year introductory courses often find that there is pressure to cover the content and little attention is paid to the acquisition of argumentation skills (Coil et al. 2010).

A national survey in America (National Survey of Student Engagement 2012) confirmed the benefits of such learning skills that require students to synthesise information from multiple sources over rote memorisation. There is a lot of research suggesting beneficial effects of explicit instruction in critical thinking on learning (e.g. Fortner 1999, Herman 1999, Kozieracki et al. 2006, Hoskins et al. 2007 and Gehring and Eastman 2008). Kozieracki et al. (2006) described a specially designed course to train undergraduates in the critical analysis of scientific journals. The results showed that students trained under the programme demonstrated increased ability to read and present scientific research as well as increased in confidence. They were also more likely to be successful in gaining admission to graduate programmes of their choice compared to their peers in the traditional seminar programmes. Hoskins et al. 2007 developed a pedagogical tool called CREATE to teach students to read and interpret research findings. They found that students taught critical thinking showed improvements in their ability to read and analyse academic literature measured using an independent test of critical thinking skills. Gehring and Eastman (2008) conducted a study where undergraduate science students were taught using an inquiry-based learning. They reported that the explicit teaching enhanced students' skills in applying and identifying valid sources of information. Herman's (1999) was a description of her own experience teaching undergraduate biology students using the Ann McNeal's method of teaching students to read primary literature.

Unfortunately, for studies to enhance critical awareness, all these studies to determine the impact of explicit teaching failed in the most basic requirements for scientific experiments. Even more ironic is that these were all science lecturers who

should know better about the importance of controls, pre-post- comparisons and the use of independent measures. There were no comparison groups and almost all were small-scale, some involving one class (taught by the researcher themselves). The majority used pre-post test comparisons of pupils' self-report and subjective evaluation of student's work by the instructor who was not blinded (e.g. Gehring & Eastman 2008; Hoskins et al. 2007; Kozeracki et al. 2006 and Herman 1999). The content of the course is invariably subject-related pertaining to understanding and analysing text closely related to the discipline. A systematic review of effectiveness of critical appraisal skills for training clinicians (Taylor et al. 2000) also found evidence of benefits of teaching critical appraisal skills, but almost all the studies had serious methodological flaws. Only one study employed a randomised controlled design. It is apparent from these research articles that these teachers of critical thinking themselves were unable to apply critical thinking in their own research and teaching.

This suggests that while there has been attempt to explicitly teach critical thinking, it is often not very well done. Academics themselves are not critical and lack the generic skills of critical thinking. There is thus even more justification for argumentation and critical thinking to be emphasised.

Some argue that as subject disciplines differ in the kind of knowledge required, the skills demanded should also be different, and therefore argumentative skills may not be relevant to all disciplines. Others argue that the ability to construct arguments, to evaluate evidence and to think critically is a generic skill required of all graduates regardless of disciplines. Early studies (for example, Berrill 2000) suggest that there were variations across disciplines regarding whether such skills were taught (implicitly or explicitly) and how they were taught. Van Lacum et al. (2014) argued that the ability to read research article is an essential skill and should be introduced at an early stage in academic study so that sufficient time is given to develop such skills. Few studies have been conducted that examine the course structure in first year undergraduate studies to understand the role of argumentation in teaching and learning practices. This study aims to do that.

This paper examines the teaching and practices within three diverse disciplines (biology, electronic engineering and history) to understand the role of argumentation in each discipline and the extent to which it is emphasised. It looks at students' perceptions of argumentation and their experiences and engagement with argumentation. It draws on the results of an earlier pilot study by Andrew et al. (2006) with a follow-up analysis of recent (2016) first year course modules in the three disciplines (biology, engineering and history), looking at the syllabus, methods of delivery and assessments in the two UK Russell Group institutions in UK that participated in the original research. This was to see if there had been any changes in the emphasis on argumentation skills in first year undergraduate courses in the ten years. For wider comparisons, the course modules of three other Russell Group universities were also examined to see if the practice was not just limited to the two institutions studied.

The definition of argumentation used in the study draws on Toulmin's model which essentially comprises understanding assumptions, making claims that are supported by evidence and making conclusions that are warranted by the evidence or data presented. Since skills in making arguments also involve critical evaluation, which includes the ability to weigh conflicting evidence and the ability to provide alternative explanations (Allegretti & Frederick 1995, Bensley and Haynes 1995, Derry *et al* 1995), the term argumentation was defined broadly to include critical thinking or critical evaluation. These two types of skills are not mutually exclusive. Andrews (2015) argues that both critical thinking and argumentation are closely related in their territories of engagement and both have implications for teaching and learning in higher education. Critical thinking demands the ability to make arguments and Toulmin's definition of argumentation involves critical thinking skills. Therefore, the study defined argumentation as the ability to question existing theory/belief, put forward alternative explanations, present evidence and make critical evaluations of issues on the basis of sound reason, adequate evidence, and articulated values.

## **Methods**

A combination of methods was used to investigate the practices and views and context within each discipline. This included a questionnaire survey, focus group interviews with students, semi-structured interviews (both with students and lecturers) and document analysis.

### *Focus group interview*

To explore students' learning experiences and to identify issues that would inform the design of the survey instrument exploratory focus group interviews were conducted with second year undergraduates prior to the questionnaire survey at the beginning of the academic year. Since second year students had just completed one full year as first year undergraduates they were felt to be the most appropriate to tell us about their learning experiences. These students were also not involved in the questionnaire survey so including them in the focus groups would not influence the questionnaire responses.

The focus groups also provided opportunities to test the questionnaire items in terms of readability, ambiguity and sense, and to test for validity.

### *Questionnaire survey*

The purpose of the questionnaire survey was to:

- establish students' views about the relevance of argumentation skills in their course;
- explore students' experience of argumentation in their course, and to
- examine differences in curricular structure in the teaching and learning of argumentation

The questionnaire also asked for students' demographic background information, their university entry and subjects of study at A-level or equivalent. These questions

sought to identify factors that could help explain differences in students' ability and experiences in the use of arguments. Four additional items were included as a quick test of students' critical awareness related to academic publications.

A range of strategies was employed in distributing the questionnaires depending on access. In general questionnaires were distributed to the whole cohort of first year undergraduates in the three disciplines in key lectures or during tutorials. These questionnaires were either completed in class or in some cases completed at home and collected in the next lecture.

#### *Documentary analysis*

To further understand the structure and emphasis of first year courses in each discipline, course modules, time-tables, undergraduate handbooks and assessment guidelines were also examined and analysed. These provided information about the methods of teaching, learning outcomes expected and assessment criteria.

#### *Semi-structured interviews*

Semi-structured interviews were conducted to get a deeper understanding of how different disciplines approached their curricular. Two to three students and two lecturers from each discipline in each institution volunteered to talk to us about their experiences. These interviews enabled us to have a clearer understanding of how the term 'argument' was understood and used by lecturers and students. The interviews provided rich data that helped us understand the subtle nuances that were not possible to extract from questionnaire responses.

#### **Analysis**

Because of the small number of cases in some categories, the five-point scale responses were first collapsed into 3-point scale. Two analyses were conducted. The first was a simple frequency count of the students' report about their exposure to arguments, the kind of activities they were engaged in and the kind of feedback they received. A simple cross-tabulation analysis was also carried out to compare students' attitude and their ability to use arguments.

Interview transcripts were transcribed and categorised into themes using an interview matrix to facilitate the process.

#### **Sample**

The sample for the survey included first year undergraduates in three disciplines (biology, history and electronics engineering) in two UK institutions. A total of 525 questionnaires were administered. Of these 237 were returned, representing a response rate of 45%.

Table 1: Sample and response rates for survey

<b>Subject</b>	<b>Number given out</b>	<b>Number returned</b>	<b>Response rate</b>
Biology	168	106	63%
Electronic	116	52	45%

engineering			
History	241	79	33%
Total	525	237	45%

Table 2: Number of participants in interviews

	<b>Biology</b>	<b>Electronic Engineering</b>	<b>History</b>
Focus groups	12	9	3
Student in-depth interviews	4	2	6
Lecturer interviews	4	5	5

### Findings

The results of the survey showed that interestingly first year undergraduates were more likely to report being taught argumentation at school than at university. An overwhelming majority were of the opinion that argumentation should be taught earlier before they even entered university.

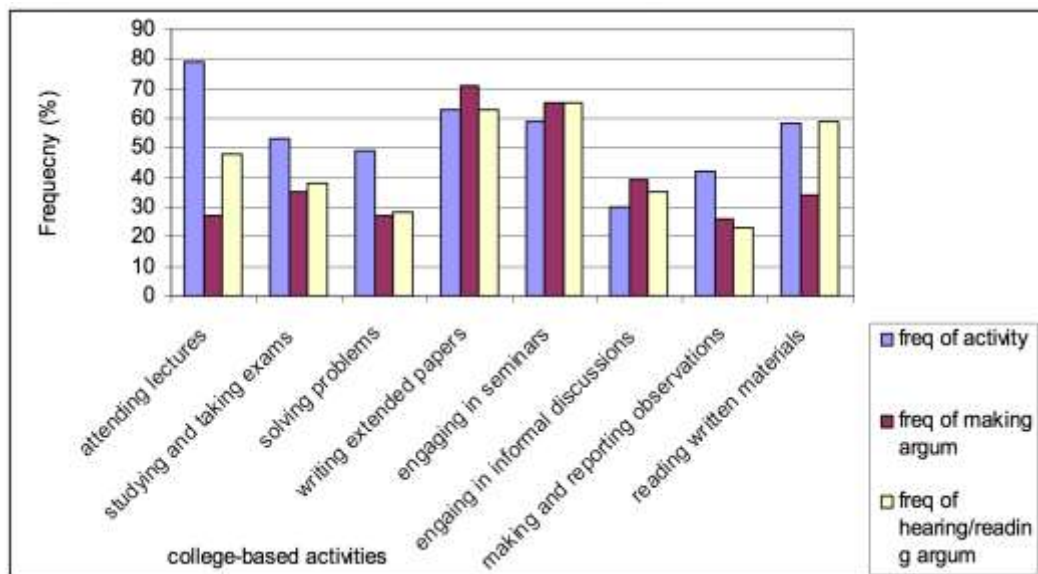
Only a quarter of biology students reported receiving instruction on argumentation at university despite the common notion that science is a discipline that demands an inquiry mind, while half of engineering and history students said they had explicit instruction on argumentation in their first year. History seems to be a subject where there was a greater need to use and learn argumentation compared to biology and engineering.

Table 4: Instruction on argumentation at school and university (% agree)

	<b>Biology</b>	<b>Engineering</b>	<b>History</b>
Is there formal instruction on the use of argumentation at university?	26	52	49
Is there formal instruction on the use of argumentation before university?	65	50	53
Should you be given guidance on using argumentation at university?	42	58	70
Should you be given guidance on using argumentation before university?	86	73	82

The survey also showed that despite the expected role of universities to produce graduates with a critical mind, there was little evidence that this was happening across the board, at least not in the first year of university. Only in extended writing and in seminars did students frequently hear or make arguments. Even so only 70% of students reported making arguments in extended essays. Slightly over 30% of students were engaged in argumentation when reading academic papers, suggesting that the majority did not read critically.

Figure 1: Frequency of first year academic activities



Although the majority of students (92%) surveyed considered the ability to construct an argument as an important skill, only history students were systematically and practically engaged in the use of argument as part of their course. Almost all (94%) history students, as opposed to only 31% of biology students, reported being exposed to arguments in lectures and in their course reading. Only 20% of engineering students reported hearing arguments used in lectures and only 24% read about arguments in their course materials. Engineering was generally not regarded by students as a discipline that lends itself readily to the use of arguments and critical thinking.

Examination of the course structure, course content and assessments together with interviews with students and lecturers/tutors provides answers as to why there is a differing emphasis and use of arguments across the three disciplines.

### History

First year history student handbook highlights the crucial role of argumentative skills, where the ability to construct an argument was paramount to success in the discipline. Students were actively encouraged '*to use persuasion, cite evidence to support their contentions and be a soap salesman as well as a lawyer.*' Learning outcomes in course modules also provide good evidence of the kind of skills emphasised in the discipline. Examples include:

- exploring, analysing and engaging in history debate;
- present ideas and respond to arguments;
- develop critical reading;
- apply methods of literary criticism;
- develop critical skills;
- expound general overview to ground exposition in sound evidence and cogent argument;
- cite evidence to support your contentions.



The use of arguments is central to the teaching and learning of history. Such skills form the main emphasis of the curriculum, in students' written work and in their end-of-year assessments.

*The term 'argument' is very much taught in the field, and especially when giving feedback to students on their essays. The role of argument is central to History: "it's the discipline".*

History lecturer A

*The role of argument is a high priority in History. With first years, I tend to work with a survey text supplemented by articles and chapters. Students mainly write essays. The 'essay' is an attempt to bring in all the information they have been exposed to and to answer a central question regarding the state of debate about a topic.*

History lecturer B

There were ample opportunities for history students to learn and use arguments, particularly in seminars and discussions.

*I think oral presentations in seminars are great, [...] and if someone's challenging it, and even if you have to agree at some point that that person is better on that particular point, the point you have to take onboard, I think it'll just you know help you to develop further.*

History student

Argumentation is also actively encouraged in class through the use of debates:

*I regularly use debates e.g. line-up debates where there is a spectrum of positions. I sometimes take questions and dissect them with them. I use role-play – not directly for argument "but it is for argument" to empathize with others' point of view.*

History lecturer A

*I see what we do [in the first year] as questioning summaries, critiquing the bases of evidence, what are the limitations of the evidence, i.e. a critical reading of secondary works.*

History lecturer B

## **Engineering**

In contrast, learning outcomes of first year engineering course focus on mathematical skills and knowledge transmission. It was very content-based, focussing very much on the teaching and learning of the fundamental knowledge of engineering, in particular mathematical skills. The list of outcomes includes:

- knowledge acquisition, e.g. understanding sound transmission;
- analyse circuits;

- write programs;
- design filter network;
- undertake basic calculations

This emphasis on teaching the fundamentals was repeatedly highlighted by academics in the department.

*At the undergraduate level, we teach the very fundamental stuff, very prescriptive. I don't think the definition of argument you have in mind, I don't think it happens to a great extent in electronics, or at least in the bit of electronics I teach. I teach the fundamentals of electronics, which is conceptually very difficult.*

Electronic engineering lecturer A

*The first year we teach them more fundamentals and then in the second year they can start to use the fundamentals and then we can teach them further.*

Electronic engineering lecturer B

One academic suggested that the modules would have to be revamped to allow for more discussion and debates.

*Engineering design might be an appropriate place to put argument. For example, the new low-energy high efficiency bulbs, the ones which are spiral with fluorescent lamps, they contain mercury, they contain electronic circuitry, they may last 8 times longer and take about a fifth of the power but to manufacture them actually take a lot more power and to recycle them or to destroy them might be actually more environmentally damaging than the light bulb. This is a very good argument because you could put figures forward and opinions and so on.*

Electronic engineering lecturer A

## **Biology**

Unlike history and engineering, course modules within biology were more varied and opinions among lecturers differed depending on which fields they were in. For example, in modules like Population and Environment and Genetics there was scope for the practice and use of argumentative skills as one student pointed out.

*[...] some of the modules like there's one next term called Population and it's Environment, they set up seminars and debates so you get into groups and you have to go and find out about a topic and maybe you're given a slant you have to look at and then you report back and may be you have to argue about it, debate about it. I think a lot more of the, for example, genetics and*

*ecological and conservationist areas there's more room for debate ...*

Biology student A

Although there was scope for the use of arguments within some modules the focus in certain modules was very much on the dissemination of 'facts' or knowledge.

*Most of the subjects we do in tutorials don't have ethical implications. For example, my current tutor is teaching about cancer, it's all about the facts. You could go into a bit of the ethics like how pharmaceutical companies are developing drugs to get money, but the core focus is on the facts. At the end of the day that's what counts. I guess as a biologist, sometimes you use the word 'argument' because you can have conflicting evidence so you need to decide which one is more important and then you have to explain yourself, you have to like convince the reader or marker why you think that bit of evidence is more important than the other. Yeah, I would say in biology there is quite a lot of argument there. But not at an undergraduate level, perhaps at a higher level there is more of challenging existing theories.*

Biology student B

According to some students there was opportunity in assignments and in tutorials where the use of arguments could be practised, but this was often not explicitly encouraged.

*I did an essay on the function a particular cell called the Y-helper cell. Basically a lot of research had been done on how it's activated and its effects on other cells. It's all about structuring the argument [...].*

*[...] in science there's a lot that we don't know and so a lot of time people are finding out new things and they might put a case forward of how something behaves or in any part of biology might put forward a case, like a theory and that can be argued for or against it. It can be contested or so I think a lot of people always forget that it's not just facts, it's an ongoing process of learning and finding out.*

*[...] I've a Genetic tutor and we're spending quite a lot of time not learning about Genetics but looking at the social and ethical impacts of like genetic findings and genetic diseases. We did a role-play as genetic counsellors. So I think there is room for debate and like arguments, especially maybe like kind of conservation and like kind of population and the environment. These are the kind of areas that you can debate over certain issues.*

It is clear that in biology, although there were opportunities for using argument, it was not always taken up. These were missed opportunities. Disappointingly there was not more emphasis on the use of arguments as one would have expected in the

field of science. Contrary to the popular image of scientists as logical thinkers there was little evidence in this study to suggest that first year biology students were actively engaged or encouraged to speak or challenge conventional beliefs.

Perhaps it was not so much the discipline itself, but the way the subject was taught. There was evidence that within biology differences existed among lecturers in their attitude towards argumentative skills. Lecturers' personal interest, social and moral belief, their background, the way they delivered their lessons and whether they themselves had the confidence to allow students to think innovatively beyond just knowledge acquisition very much determined the extent to which arguments were used or not:

*I think there are the same opportunities in nearly all the modules, but some people will actually keep the argument out of the module because they just want to teach the facts. You'll find that individual lecturers will vary between choosing to work in an area where there's lot of argument or whether they choose to avoid arguments. Clearly those who avoid arguments will not incorporate such ideas in their teaching.*

Biology lecturer B

Students' experiences collaborated with the lecturers' views that the extent to which argumentation was emphasised or not very much depended on the individual tutor.

*I think it depends on what tutor you have because some tutors would be more interested in that kind of thing than others, but I think the essays, there is scope for arguments and depending on... I don't know what some tutors would do, but like if you're looking at bird flu and they split the tutorial group in half. Half of the group have to look from the side of, 'there's nothing to worry about, nothing bad is going to happen.' The other side will look at like, 'Oh my god we are going to die of bird flu.' So there's a lot of conflict of ideas and what people think.*

Biology student A

*I think it depends on the tutor. The tutor I have got this term is very aware of the social aspects of science and like implications of scientific findings and all of that and that is a really hot topic for debate and is quite current really. I'm sure other tutors do do that but like because you only have one a term it is potluck whether you get someone that like is kind of aware about like being able to make debates and things.*

Biology student B

What was surprising was the suggestion that biology and indeed science, contrary to popular belief, is not naturally an area open to debates because scientists are influenced by their own beliefs and value systems.

*Scientists never really like to talk about argument. They argue all the time but it's not a term which they will feel comfortable with. They are humans, I always try to emphasise to students that scientists are humans first and scientist second. Therefore, their normal social interaction tends to come out. If they like arguing, they'll argue. They get quite vehement about it and their logic is sometimes distorted by their passions and their beliefs and their own views. That's the weird thing about scientists. There is a wonderful book called, the Brief History of Everything. To me the staggering consistent message is that scientists are anything but the kind of people that they're portrayed as being. They are not as logical as they should be. And people have discovered something and everyone else just ignore something that doesn't fit in with what they are thinking. And why does that happen time and time again, and I think part of it is that if they were better at argument, and if they recognise that this was part of the subject, we'd make far better progress. So that's why I think it's actually important to get scientist to be better at it because it helps the subject.*

Biology lecturer B

Biologists were also perceived as not comfortable in arguing.

*Well my guess is that students who are opinionated and like arguments and debate have not chosen to be biologists.*

Biology lecturer B

These findings suggest that although students and lecturers across the three disciplines perceived the use of arguments as important, argumentation was not as widely practised or emphasised as one would expect in higher education courses, although there were implicit references to its use in some disciplines. There were clearly opportunities for the use of arguments in the three disciplines. So why was there still so much focus on the teaching of facts and rote memorisation? The answer lies largely in the way learning is measured or assessed.

### **Assessments**

A large majority of students surveyed agreed that the ability to construct an argument was an important skill (100% for history; 95% for biology and 64% for engineering), but this was only for the passing of exams. They did not see it as necessary for their general intellectual development, nor a skill that would enable them to engage in current debates on moral and ethical issues or to question research reports they read. If the assessment criteria were based on students' ability to argue and debate on issues, as in history, they would be more likely to practice and use such skills. If students were not assessed on their ability to argue, as with

engineering and to some extent biology, they were less likely to see the relevance of the skills or practise them.

In biology, for example, essays provided scope for the use of arguments, but students often did not apply such skills because their essays did not count towards their final grades.

*[for] quite a lot of people I know, the essays (because they don't count towards the course and they are not officially marked...) are just something to get over with and they'd do so quickly the night before. Because essays for history are marked, [and] that's what counts towards the final grade, I think you are going to put a lot more effort into doing them.*

Biology student C

*Students are much better at passing exams - all directed at how to learn something in order to reproduce something to pass exams. Student expectations are now much more we'll tell them what they've got to know, exam them on that and then move on to the next bit of the course. I think it's the demand of the whole education system and schools. [...] the idea that you might have a debate about something is true or false is less important because most students don't want to know the debate, they want to know whether the answer is true or false. That comes through to us.*

Biology lecturer B

End-of-year examinations for first year biology courses also did little to encourage the use of arguments. Exams were largely in the form of short-answer questions consisting of fact-based, knowledge recall, short-answer type of questions that required factual statements or a 'yes' and 'no' answer. There was little emphasis and demand for critical evaluation. The comment below very much encapsulates what many thought:

*Our own exam system here has been changed so that there is more emphasis on factual recall, partly because of student numbers. It's easier to mark an exam where students just have to say yes or no or give a particular fact rather than constructing an argument. Therefore, the number of assessments to do with constructing an argument has declined.*

Biology lecturer A

According to the 2016 course module description in institution A assessments in the first year involves short questions and answers. Only further on in the course do essay questions feature in exams. The university website explains that exams are designed "to assess conceptual understanding as well as important facts about the subject. The exams also contain problem-solving questions which we think should be fundamental to any scientific discipline." No explicit reference was made to

transferable thinking skills. It is not clear what the problem-solving questions are. In institution B the course content for 2016 emphasises real world skills and experience through practical and fieldwork. Assessments include theory exams (which account for 75-80% of the final mark) and course work (e.g. practical reports, field reports and online tests and exercises). There was not explicit teaching of critical reading skills.

In engineering, assessments were invariably in the form of clear-cut right or wrong answer type of questions. There was limited scope for interpretation and discussion as some students had suggested.

S: *No I was just sort of saying the term 'argument' or sort of arguing your views is more sort of to be done in subjects like history, e.g. you've got your piece of evidence or whatever and to a certain extent it is open to interpretation, whereas in electronics/engineering and possibly the sciences it's more of a right...*

B: *It's more of a right or wrong answer.*

S: *It's more of a right or wrong answer because you got to obey certain rules.*

The 2016 course modules in institution B describe the assessments as closed book exams (for more mathematically based courses), short technical reports (largely practical work), portfolios (such as programming exercises or media report/blog), project-based presentations and technical report ([https://www.york.ac.uk/electronics/undergraduate/courses/electronic\\_engineering/elec\\_eng\\_h610/#course-assessment](https://www.york.ac.uk/electronics/undergraduate/courses/electronic_engineering/elec_eng_h610/#course-assessment)). Although formative assessment was used, it was for identification of mistakes students make in their projects. In addition, students have to complete an online Academic Integrity module which covers academic ethics, appropriate referencing and sourcing for materials. Again there was no mention of skills relating to assessing evidence in academic papers. In institution B assessment is via exam and coursework and project work. Students are encouraged to read widely and develop their critical ability, but there is no mention that such skills are being taught. The course content emphasises design and project work.

In history, on the other hand, the ability to argue well was essential for a good pass. History exams, unlike biology were more open with scope for debates. Marking criteria were based on students' ability to put together a good argument.

*...exams for history were open exams and you had two days to write two essays. But for biology you just go in for an hour and a half or whatever and it's closed and you have to answer the questions on the paper.*

Second year biology student who did history in the first year

*For history students, it is crucial to learn to argue. They have wider reading, but don't always solve the structural problems in argument. Argument is central to a 'good' degree.*

History lecturer A

The 2016 course modules for first year history in institution B emphasize research skills and knowledge of historical periods. It explicitly states that critical reading and source analysis are among the core skills taught. Students are expected to develop core skills relating to research and academic writing, such as bibliographic referencing as well as critical analysis of source materials. Most of the teaching is largely through lectures, seminars and a couple of workshops. Short essay and course work contributes 100% of the final assessment. In addition students have to complete a 1,500 word critical review as part of the formative assessment. However, it is not clear if this contributes to the final grade. The course module description in institution B is rather sketchy but emphasized core understanding and basic skills in research skills and historical writing.

A quick look at the first year course modules in two other Russell Group institutions showed the same picture. For example, at Durham University the first year history lectures aim to “introduce broad historical questions and offer contextualisation and critical commentary; seminars provide an opportunity for students to develop their critical skills through discussion for which they have prepared in advance.” (<https://www.dur.ac.uk/courses/info/?id=9170&title=History&code=V100&type=BA&year=2016#learning>). The first year biology course emphasises knowledge content. It states that most of the contact time will be devoted to lectures “to allow the effective delivery of large amounts of knowledge, which forms the factual basis of a science subject. At level 1 the emphasis is on core knowledge across the broad spectrum of the sub-disciplines of biological sciences.” (<https://www.dur.ac.uk/courses/info/?id=10113&title=Biological+Sciences&code=C103&type=BSC&year=2016#learning>). Similarly, the engineering course is delivered mainly through a combination of lectures, practical classes and design activities. The website explains that the “lectures provide key information on a particular field of study, and identify the main underpinning engineering concepts in that area.” (<https://www.dur.ac.uk/courses/info/?id=8549&title=General+Engineering&code=H103&type=BENG&year=2016#learning>). However, there is scope for interpretive skills during practical sessions, but it is not clear what these skills are. It is also not clear how students are assessed, but possibly through project design work and oral presentation of their project.

At the University of Birmingham the first year compulsory history module includes research skills, note-taking, referencing and participation in class debate. The teaching and learning of argumentative skills are not explicit but implied. (<http://www.birmingham.ac.uk/undergraduate/courses/history/history.aspx#CourseDetailsTab>). All first year biological sciences students take the same modules. The module on evolution includes topics the origins of altruism and genetic determinants of evolution. This module lends itself very well to the teaching of critical thinking. The electronics and electrical engineering course at Birmingham University is



delivered through a combination of lectures, laboratory work, small tutorials, project work and enquiry-based learning (group activity and research reports and presentations which are either individual or group). The emphasis is on physical and mathematical principles. (<http://www.birmingham.ac.uk/undergraduate/courses/eese/electronic-electrical-engineering.aspx#LearningAndTeachingTab>)

In summary, the attitude towards teaching and learning of arguments in higher education depends very much on the first year course structure, the personal conviction of individual lecturers and their style of delivery. In biology and engineering much focus was on content and information transmission in the classroom. In history, on the other hand, there was a consistent emphasis on the use of arguments and critical evaluation. But most of all, it is the way first year courses were assessed. In some disciplines assessments clearly do not require students to argue or be critical. Some remarked that the large class sizes in first year courses necessitate the use of short answer, multiple-choice type of questions which require heavy fact memorisation. These are perceived to be easier and quicker to mark. Extended writing requiring synthesis of facts and interpretation of data that test argumentative skills are considered time consuming to grade, and thus avoided. One therefore questions whether existing modes of assessments requiring rote learning chunks of facts are indeed a valid test of learning.

### **A simple test of critical awareness**

The question is whether students (e.g. history students) who were exposed to critical thinking skills in their course demonstrate critical awareness in their reading. To test this we asked four simple questions that test whether they were sceptical in their reading and whether they question assumptions and arguments (Carlson 1995; Browne & Keeley 1988).

Table 3: Critical awareness in reading academic papers (% disagree)

	Biology (n=106)	Electronic engineering (n=52)	History (n=79)
Accept findings if recently published	33	15	56
Accept findings if peer reviewed	20	8	33
Good research should be substantiated by numerical data	9	4	30
If argument is convincing conclusions must be true	86	48	86

The findings show that history students were the most critically aware: not accepting findings from research papers just because they were recently published. They were the most sceptical about research that was not warranted by evidence. The least critical of all were the engineers. There is therefore some evidence that exposure

and emphasis on argumentative skills in the class does help develop critically aware individuals.

### **Discussions**

Students and academics alike clearly recognise that there is a place for the teaching and learning of arguments in university introductory courses. The reasons why it has not been made more explicit in some cases are partly due to the belief among some lecturers that first year students need to be taught facts first before they can learn to argue, and partly the way courses are assessed that limit the use of arguments. If we believe that a key attribute of graduates is the ability to argue, then the teaching and learning of argumentative skills should be made a priority. This will have implications for the way first year courses are taught and assessed.

#### *Rethink about the way courses are assessed*

Because of large classes in first year undergraduate courses multiple-choice or short-answer type tests are often favoured by lecturers. Such tests are good at testing students' ability to memorise chunks of information but less valid for testing their ability to interpret the information and presenting and constructing evidence. They encourage lecturers to teach to the test. Lecturers feel that they have to teach students according to how they will be assessed in order for them to get good grades. Students likewise think that understanding the issue tested is less important than being able to memorise and regurgitate facts.

New ways of teaching and assessments would have to be developed. There are a range of strategies to overcome the over-emphasis on teaching 'facts' and the use of recall type tests. One is to make assessments not solely reliant on tests, and introduce formative rather than summative assessments. These assessments could be supplemented with termly assignments which necessitate students to practice the skills of argumentation and which will be graded. Their marks should count towards a portion of the students' final grades. In some universities and some courses, this is common practice, but to encourage a wider use of argumentation more weight and credence could be given to assignments. Cynics would argue that this will not work as it means more marking for teachers. Marking extended essays is time-consuming. There will always be resistance from the teaching staff. Also teachers may still be concerned about whether students have learnt the basics.

One way to overcome this is to treat teaching and testing as complementary activities. For example, lectures and seminars/tutorials (small group classes) provide the opportunities to challenge students and get them to evaluate evidence and question assumptions, while tests could be used to check for understanding of basic facts. To encourage the use of argumentation in class discussions, students' participation in these small group discussions could be assessed and marks awarded. This is to discourage over-reliance on summative tests alone.

#### *Consider changing teaching styles*

Some may argue that assessments of class participations are difficult to implement especially in large groups. Alternative versions could be conceived. Teaching staff

need to be creative. For example, set up situations where debates are graded to encourage the use and practice of arguments. Use small group discussions (for example, tutorials/seminars) as opportunities for examining and presenting conflicting evidence to encourage debates and arguments. Students could be given time to gather 'facts' or information and they will be assessed on how they argue their case. A simple diagnostic tool indicating the kind of skills needed not only facilitates assessments but also gives an indication to students as to what skills are desired. For a start lecturers could model some of the behaviour they want students to aspire to. In practice this is often not easy as interview data suggest, teaching staff do not always have the capacity to teach argumentative skills.

#### *Staff development/training*

If lecturers themselves do not know how to construct arguments, it is hard to imagine that they could design courses and assignments that would train students to argue. This has implication for staff development and recruitment. To implement the strategies suggested so far would require the support of university leaders and administrators in the form of training, resources, time and encouragement.

#### *Re-focus the role of university*

Evidence from this case study and others suggest that our university courses are very good at teaching young people what to think but not how to think (Daud & Husin 2004). To change the existing instructional practice would also require a re-evaluation of the purpose of teaching and learning and more broadly, the aims of universities.

This has implication for wider reforms in higher education. We need to remind ourselves of the fundamental role of universities. Questions we need to ask are: Is the role of university to train young people to think or is it for the transmission of knowledge? Is subject matter knowledge more important than generic knowledge on analyzing arguments? Are argumentative skills still relevant and should they be taught in introductory courses?

In the new global knowledge economy and digital age, students are constantly bombarded with information. The profusion of information- generating devices like the mobile phones, iPhones, iPads, Blackberry, and modern means of sharing and accessing information like google, twitter, blogs and instant messaging make it so easy for students to access information. Therefore, what students need is not more information, but the ability to sieve through those information, to be able to judge what is believable and what is not, to evaluate the evidence, to interpret the data received and reported and to critically appraise the quality of such evidence. It is a useful skill for young people to have to be able to evaluate the integrity and validity of information they are confronted with, weigh the evidence presented to them, and make judgements about them (Renaud & Murray 2006). It is through the process of argumentation that knowledge can be developed and verified. Such skills are therefore even more necessary in the 21st century.

Perhaps because universities are now increasingly seen as an instrument of economic growth, a business enterprise and less of a training institution that its fundamental role of developing thinking individuals is forgotten. Drew Faust, President of Harvard, in her speech at the Irish Royal Academy, reminded us that the role of education is to develop in individuals capacities to interpret information, to distinguish between knowledge and information (Faust 2010). She added that:

Education measured only as an instrument of economic growth neglects the importance of developing such capacities. It misses the fact that we are all interpreters; it ignores that some things are not about "facts" but about understanding and meaning.

In summary, argumentative skills can and should be introduced in introductory courses at university. There needs to be a revamp of existing instructional practices and modes of assessments. The role of university lecturers as vehicles for the transfer of knowledge is no longer relevant. Academics should be inspirational educators able to inspire and motivate young people to question and argue and critically evaluate information.

The place of traditional teaching styles that emphasise knowledge acquisition should be reviewed. Argumentative skills should be integrated into content learning (Bakhtin 1986). To the extent that argumentative skills contribute to the development of a better quality of knowledge and cultivation of a rational and human society, it should be encouraged and supported.

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### **REFERENCES**

- Allegretti, C. and Frederick, J. (1995) A model for thinking critically about ethical issues. *Teaching of Psychology*, 22(1): 46-48
- Andrews, R. (2015) Critical thinking and/or argumentation in higher education. In Davies, M. and Barnett, R. (Eds) *The Palgrave Handbook of Critical Thinking in Higher Education* (pp.49-62). London: Palgrave Macmillan.
- Andrews, R., Bilbro, R, Mitchell, S., Peake, K., Prior, P., Robinson, A., See, B.H. and Torgerson, C. (2006) *Argumentative skills in first year undergraduates: a pilot study*, York: The Higher Education Academy
- Andrews, R. (2007) *Argumentation, critical thinking and the postgraduate dissertation*. *Educational Review*, 59(1):1-18
- Andrews, R. and Mitchell, S. (2001) *Essays in argument*. London: Middlesex University Press.
- Arum, R. and Roksa, J. (2011) *Academically adrift: limited learning on college campuses*. Chicago: University of Chicago Press

- Bakhtin, M.M. (1986) *Speech genres and other late essays*. Austin, TX: University of Texas Press.
- Bensley, D.A and Haynes, C. (1995) The acquisition of general purpose strategic knowledge for argumentation. *Teaching of Psychology*, 22(1): 41-45
- Berrill, D (2000) In Mitchell, S. and Andrews, R. (ed.) (2000) *Learning to argue in higher education*. Hull: Heineman/Boynton-Cook
- Browne, M. (1986) Preconditions for encouraging critical thinking on the campus. *International Journal of Social Education*. 31:18-27
- Browne, M. and Keeley, S. (1988) Do college students know how to think critically when they graduate? *Research Serving Teaching*, 1(9):1-3. Center for Teaching and Learning of Southeast Missouri State University
- Carlson, E. (1995) Evaluating the credibility of sources: a missing link in the teaching of critical thinking. *Teaching of Psychology*, 22 (1):39-41
- Coil, D., Wenderoth, M.P., Cunningham, M. and Dirks, C. (2010) Teaching the process of science: faculty perceptions and an effective methodology. *CBE Life Sciences Education*, 9(4):524-535.
- Derry, S., Levin, J. and Schauble, L. (1995) Stimulating statistical thinking through situated simulations. *Teaching of Psychology*, 22(1):51-57
- Eurydice (200) *Science education in Europe: National policies, practices and research*. Brussels: EACEA.
- Faust, D. (2010) *The role of the university in a changing world*. Speech given at the Royal Irish Academy, Trinity College, Dublin, June 30 2010.  
<http://www.harvard.edu/president/role-university-changing-world>.  
Accessed April 19 2013
- Fortner R. W. (1999) Using cooperative learning to introduce undergraduates to professional literature. *Journal of College Science Teaching*, 28(4):261–265.
- Gehring, K. M. and Eastman D. A. (2008) Information fluency for undergraduate biology majors: applications of inquiry-based learning in a developmental biology course. *CBE Life Sciences Education*, 7(1):54–63
- Gibbs, G. (ed.) (1994) *Improving student learning – theory and practice*. Oxford: Oxford Centre for Staff Development.
- Hermann, C. (1999) Reading the literature in the jargon-intensive field of molecular genetics. *Journal of College Science Teaching*, 28(4):252–253.
- Hoskins, S. G., Stevens, L. M., Nehm, R. (2007) Selective use of the primary literature transforms the classroom into a virtual laboratory. *Genetics*. 176(3):1381–1389.
- Hounsell, D. and McCune, V. (2002) *Teaching-learning environments in undergraduate biology: initial perspectives and findings*. Occasional report 2, October 2002. ETL project
- Independent (2006) *University students: They can't write, spell or present an argument*. Wednesday 24 May 2006.  
<http://www.independent.co.uk/news/education/higher/university-students-they-cant-write-spell-or-present-an-argument-479536.html>.  
Accessed March 29 2016.
- Kozeracki, C. A., Carey, M. F., Colicelli, J. and Levis-Fitzgerald, M. (2006) An intensive primary-literature-based teaching program directly benefits undergraduate

- science majors and facilitates their transition to doctoral programs. *CBE Life Sciences Education*, 5(4):340–347.
- Kuhn, D. (1991) *The skills of argument*. Cambridge : Cambridge University Press
- Mitchell, R. Myles, F., Johnston, B. and Ford, P. (2003) *Criticality and the 'key skills' agenda in undergraduate linguistics*. University of Southampton. Notes of talk given at subject Centre for Languages, Linguistics and Area Studies Seminar: 'Key Skills Linguistics', CILT, London 23 May.
- Mitchell, S. and Andrews, R. (Eds.) (2000) *Learning to argue in higher education*. Portsmouth NH: Boynton/Cook
- Muench, S.B. (2000) Choosing primary literature in biology to achieve specific educational goals. *Journal of College Science Teaching*, 29(4):255–260.
- National Survey of Student Engagement (2012) *Promoting student learning and institutional improvement: lessons from NSSE at 13- annual results 2012*. [www.nsse.iub.edu](http://www.nsse.iub.edu), accessed on 15 April 2013
- Quality Assurance Agency (2002) *Subject benchmark statements: biosciences*. Cheltenham: Quality Assurance Agency for higher Education.  
<http://www.qaa.ac.uk/crntwork/benchmark/phase2consult.htm>
- Quality Assurance Agency(2000) *Subject overview report: molecular biosciences*. Gloucester: OAA
- Taylor, R., Reeves, B., Ewings, P., Binns, S., Keast, J., and Mears, R. (2000) A systematic review of the effectiveness of critical appraisal skills training for clinicians. *Medical Education*, 34:120-125.
- Underwood, M. and Wald, R. (1995) Conferencing-style learning: method for fostering critical thinking with hear. *Teaching of Psychology*, 22(1):17-21
- Van Lacum, E.B., Ossevoort, M.A. and Goerdhart, M.J. (2014) A teaching strategy with a focus on argumentation to improve undergraduate ability to read research articles. *CBE Life Sciences Education*, 13(2):253-264.
- Walker, J.P. (2011) *Argumentation in undergraduate chemistry laboratories*. PhD thesis. Florida State University.