

Accepted Manuscript

Title: Active Financial Analysis: Stimulating engagement using Bloomberg for introductory finance students

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PII: S1477-3880(18)30055-0
DOI: <https://doi.org/10.1016/j.iree.2018.12.001>
Reference: IREE 153



To appear in:

Received date: 14 June 2018
Revised date: 26 October 2018
Accepted date: 3 December 2018

Please cite this article as: McCann M, Russon J-Anna, Active Financial Analysis: Stimulating engagement using Bloomberg for introductory finance students, *International Review of Economics Education* (2018), <https://doi.org/10.1016/j.iree.2018.12.001>

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Active Financial Analysis: Stimulating engagement using Bloomberg for introductory finance students

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Abstract

There is increasing interest in the adoption of real-world interactive and participative learning techniques within economics and finance teaching through the use of trading room software. Previous research suggests that the integration of trading room software can improve knowledge development and performance. However, the time constraints of providing software training and requirements for foundation knowledge of basic maths and economics has restricted the adoption of trading room software to advanced courses. This paper outlines how the Bloomberg Professional Software was used in an introductory finance course and analyses student engagement, learning and attainment using feedback and performance data. We find that students valued the novelty of Bloomberg as part of a mix of different learning activities which facilitated the practical application of theory. Results also indicate that the alignment of teaching, learning and assessment promotes deeper engagement, and is associated with higher attainment. We demonstrate that trading room software can be effectively used in introductory courses to enhance the student experience and deepen understanding.

Key Words: Trading Room software; Economics; Finance; Teaching; Active Learning; Integrated Assessment; Bloomberg.

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1. Introduction

A recent innovation in economics and finance education has been the employment of trading rooms and related specialist software. Economics and finance teaching has previously been criticised for being passive, dull and abstract (Wilson and Dixon, 2009). The employment of trading rooms has been cited as a mechanism for enhancing the student experience by creating an active and stimulating learning environment where the use of real data enables students to see the point of what they are studying whilst enhancing skills in data analysis (Owen, 2007; Tsigaris, 2008; Roach, 2014; Chulkov and Nizovtsev, 2015). The Bloomberg Professional Software is one such desktop application that allows users to monitor and analyse historical and real-time financial market data. Much attention has focused on the value of trading labs and finance software in teaching economics and finance on intermediate and advanced level courses. Meanwhile, there has been limited consideration of their use in introductory finance courses at undergraduate level. An important issue warranting attention, is whether the perceived benefits of using the software can be valuable in stimulating engagement and deeper learning among students at introductory level. This paper addresses this gap by demonstrating how the Bloomberg software can be effectively integrated into the learning environment of an introductory finance course in a way that enhances both engagement and attainment.

The analysis presented here contributes to a strand of research which has studied the effectiveness of trading room / finance labs using software such as Bloomberg, Thomson Reuters Datastream, Trade Ex and Stock-Track in enhancing the student experience. Existing research relies on practitioner-based qualitative observations or bespoke surveys of student perceptions and opinions to assess the effectiveness of finance labs in student learning. Almost all identify the benefits of active, hands-on learning for stimulating deeper learning and higher attainment. Moffit et al. (2010) report that equity trading simulations using a trading room increased student interest in financial investment among a large percentage of the students

surveyed. Comparing pre- and post-simulation knowledge of finance within the group, the authors also found a significant improvement, irrespective of whether students had studied finance before. Huffman et al. (2012) report on the integration of a portfolio trading simulation in a course, concluding that the students surveyed enjoyed applying the concepts, with more meaningful class discussions ensuing. Stewart et al. (2012) used a quasi-experimental design in an assessment of student performance in financial strategy classes. They found that active learning within a trading room environment deepens financial knowledge even when controlling for gender and subject area. Similarly, Chou and Liu (2013), conducting multiple surveys over five semesters to track student knowledge, found that as the simulation of foreign exchange trading progressed, students' understanding of these markets increased. Kazemi (2015) reflects on his observations of using the Bloomberg software in a lecture setting, finding that the live interaction of news and financial markets stimulated interest and deeper discussion. Marriott et al. (2015) and Noguera et al. (2011) emphasise how the use of a trading room and Bloomberg helped improve understanding when incorporated into assessments. Further, both Zhang (2014), using solely observations, and Sharma (2015), using both observations and student feedback, identify the usefulness of Bloomberg in data analysis, especially when used in conjunction with Excel spreadsheet software.

We add to existing work in several ways. Firstly, we are pioneers in reporting on the use of Bloomberg for teaching introductory finance to first year undergraduates. The reluctance to employ trading room software for teaching introductory level economics and finance courses stems from two concerns. Students require knowledge of basic maths (Ballard and Johnson, 2004) and threshold concepts in economics (Davies and Mangan, 2007) to make sense of finance. The absence of such knowledge may compromise the effectiveness of the Bloomberg software in making finance accessible to first year undergraduates. In addition, time is required to train students in the use of the software. Sharma (2015) identifies the dilemma for tutors

leading introductory finance courses between the time devoted to developing threshold knowledge and time spent using the software, concluding it is taught most effectively on courses where students have prior knowledge of finance and training on the software. This perspective is broadly accepted across Higher Education courses, both in the UK and internationally, yet introductory finance courses are a fertile environment within which the practical approach afforded by finance software could make the subject more accessible. We address this gap in reported provision by researching the use of Bloomberg in an introductory finance course.

Secondly, we adopt a different methodological approach compared to existing work. The qualitative observational studies referred to above are limited in deriving an understanding of students' experience of using finance software for learning. Observational studies rely on a lecturer perspective, whilst the use of student surveys focus on the narrow deployment of trading room software in economics and finance courses. This paper builds upon the work to date by gauging student perceptions of the course provided through student course evaluations from four cohorts in their first year of an undergraduate degree. The first cohort is prior to the integration of Bloomberg, and the remainder coincide with the increasing integration of Bloomberg across three cohorts of delivery. As a result, our work can draw out specific aspects of Bloomberg that are beneficial at introductory level in the context of the broader learning environment of the course. Further, rather than the quantitative summaries reported by previous work, we adopt a more nuanced qualitative analysis of students' perceptions of integrating Bloomberg. We also investigate whether students learn more deeply by conducting a quantitative analysis of students' attainment data both in the introductory finance course and in subsequent finance courses to assess the extent of current learning facilitated but also, how well students retain their learning.

We demonstrate that employing Bloomberg at introductory level is beneficial. Consistent with existing work, students find Bloomberg's hands-on, practical approach engaging. However, our novel analysis draws out several key findings that are valuable to other practitioners who are considering employing Bloomberg at introductory level in finance and related courses. Students value its novelty, but its novelty would soon wear off if every class was in the trading room using Bloomberg. Bloomberg needs to be embedded into a learning environment which involves a mix of different types of applied, interactive learning activities. It is the variety and emphasis on application which appeals to students. Further, a close alignment of learning activities, including Bloomberg sessions, with the requirements of the course assessment seems to be important for stimulating the deeper learning, which improves attainment levels, not just within the course but on subsequent finance courses too.

The paper proceeds as follows. Section 2 explains the development of the learning environment incorporating Bloomberg over the three cohorts. Section 3 describes the methods adopted to analyse student perceptions and learning. The results and analysis are discussed in Section 4, and the paper concludes with implications for the integration of specialist trading room software into introductory finance modules.

2. Implementation of Course Innovations: Incorporating Bloomberg Software

The introductory finance course which is the subject of analysis here, is entitled 'Introductory Finance for Economists' and is taught to first year Economics Majors at Nottingham Trent University (NTU), in the UK. The course was conceived in the aftermath of the financial crisis of 2007-08 to address concerns about financial literacy in economics education (Lusardi and Mitchell, 2014). It spans three terms of teaching across the academic year, introducing students to financial institutions, markets and instruments, and developing the intuitive skills to make effective financial investment decisions. Students would have at least a grade B in GCSE

mathematics (UK qualification normally achieved at 16 years of age). However, there is no requirement for students to have any prior knowledge of economics or finance and consequently, a lot of these undergraduate students are being exposed to threshold concepts in finance for the first time and many find it a steep learning curve.

Prior to the course innovations incorporating the Bloomberg software, the course outcomes focused on an appreciation of financial instruments, institutions and markets as well as a knowledge of basic concepts. Delivery involved weekly lectures which introduced concepts, and seminars where both conceptual and applied problems were completed. The sole assessment was an end-of course unseen examination. In 2014, following issues of poor engagement and weak performance over several years, it was decided to make changes to the course. Table 1 illustrates the iterative changes made to the learning environment across three cohorts of delivery, referencing 2013/14 prior to Bloomberg being introduced. From 2014/15, changes were made to learning outcomes, teaching, and assessment. The intention was to adopt a more practical approach to finance than had been the case in the previous version of the course in order to make it more engaging and relevant. Data analysis was at the core of the innovations. During delivery to the first cohort in 2014/15 which followed the redesigned course, the new course tutor attended a Bloomberg taster session. Despite the lack of examples elsewhere in the use of such software for introductory finance taught to undergraduate first years, the tutor thought that the Bloomberg software, used in conjunction with Excel software, would be an exciting, 'hands-on' vehicle for learning. Moreover, it was felt that the careful integration of the software with other course innovations such as interactive lectures using near-time or real-time data, and applied group / individual tasks in seminars, had the potential to promote more interest, and opportunities for deeper learning.

Table 1: Iterative changes made to teaching, learning and assessment across the four cohorts of delivery

	2013/14	2014/15	2015/16	2016/17
Extent of Integration of Bloomberg	None	Four sessions in term 2 applying financial concepts to data but no alignment with assignment	Five sessions in term 2. One induction session and remaining seminars analysing data aligned with assignment tasks	Eight ¹ sessions throughout the year. One induction session and remaining seminars analysing data aligned with assignment tasks
Emphasis of Module Outcomes	Knowledge of financial sector and finance concepts	Knowledge of finance concepts and application of concepts to activity	As 2014/15	As 2014/15
Lecture Style	Content-driven didactic delivery	Interactive with emphasis on application	As 2014/15	As 2014/15
Seminar Activities	Short-answer seminar questions	Individual and group tasks with real-world data	A variety of activities involving both individual and group tasks with real-world data. Five lab sessions using Bloomberg and Excel.	A variety of activities involving both individual and group tasks with real-world data. Eight lab sessions using Bloomberg and Excel.
Assignment Design	Unseen examination. Short-answer questions testing knowledge; Essay questions encompassing concepts	Unseen Examination with structured questions involving the application of concepts to data	Data-based project incorporating the sourcing and analysis of data in the context of finance concepts using Bloomberg and Excel software.	As 2015/16

¹ There were a total of 20 seminars during the year. In addition to Bloomberg, a variety of different seminar activities were used including structured questions, group discussions, presentations and periodic quizzes.

The process outlined in Table 1 extended the practical application of Bloomberg, but also aligned its use with the requirements of the redesigned course assessment. The overall learning approach adopts a ‘see one, do one, teach one’ philosophy, consistent with the principles of constructivism (Biggs, 1999). Concepts are introduced in lectures and applied using the software so students ‘see’ the analytical manipulation of near-time or real-time economic and financial data. Students then ‘do’ applied analysis in seminars using the analytical tools of the Bloomberg Professional and Excel spreadsheet software in a trading lab. Finally, they ‘teach one’, testing their analytical skills on different data, completing an individual project report for their assignment. Bloomberg enables students to collect their own unique real-world data for the assignment, providing them with an opportunity to construct their knowledge and understanding by applying theory in order to make sense of what they are observing. This also gives students the opportunity to use Bloomberg in tasks which reflect the type of data analysis which may be expected of them in future careers. Appendix 1 shows an example of a seminar activity using Bloomberg and the aligned assessment task.

We addressed the potential concerns raised in the literature of employing Bloomberg in an introductory course by developing knowledge in numeracy and economics as well as demonstrating Bloomberg in lectures at the beginning of the course. Complementary screencasts and online reference materials are available explaining software functions. Both were developed by the lead tutor for the specific purpose of accelerating student learning of the software. This approach frees up class-time at introductory level and removes this need in subsequent advanced study. The alignment of Bloomberg with the assignment also provides an incentive for students to learn how to use the software. Our research addresses the following questions to assess the impact of the Bloomberg integration on student engagement and performance:

- 1) Does the integration of Bloomberg in an introductory finance course enhance the students' experience?
- 2) If so, which aspects of the integration of the software are perceived as beneficial?
- 3) What problems do students perceive in using Bloomberg?
- 4) Has the integrated adoption of Bloomberg led to deeper learning and improved attainment?

3. Methods

The integration of Bloomberg was reviewed by analysing data obtained from student evaluations and assessment results. Research questions 1, 2 and 3 were addressed by analysing data from the course evaluation survey 'EvaSys' used at Nottingham Trent University (NTU)². The EvaSys survey is administered to all students taking undergraduate and post-graduate courses. It is intended to be a 'systematic' and 'comparable' data collection tool, capturing student feedback on course content, delivery and overall learning experience (NTU, 2014). To address research question 4, we compare levels of attainment achieved by students on the course from before the Bloomberg innovations were introduced (2013/14), and through the following three years (2014/15, 2015/16 and 2016/17) where Bloomberg was progressively employed. In addition, we analyse how well knowledge and understanding was retained by analysing the performance of students from each cohort in more advanced finance courses pursued in subsequent years.

At this point it is important to acknowledge challenges associated with data from student evaluations, particularly if they are 'customer centric' and therefore geared to measure student

² We have gained ethical approval for the use of this data for the research.

'satisfaction' rather than teaching quality (Bedggood and Pollard, 2001). Moreover, factors such as teacher popularity or a lack of control for measures such as gender, age, and environment are problematic (Clayson, 1999; Bedggood and Donovan, 2012). EvaSys is designed to capture student feedback in a way that aids course improvements, and whilst the design and administration of EvaSys does not resolve such challenges, it provides an important opportunity to review student observations of the broader course learning environment. Students were not asked specifically about Bloomberg, therefore the EvaSys data provides us with unprompted comments regarding the integration of Bloomberg software and its perceived role in supporting active learning. This distinguishes the work from existing research which focuses on students' perceptions of trading room and the Bloomberg software specifically (see Moffit et al., 2010; Noguera et al., 2011; Huffman et al., 2012; Chou and Liu, 2013).

3.1 EvaSys quantitative analysis

Section A of the EvaSys survey contains 23 statements categorised under five elements: Teaching on the course; Assessment and Feedback; Course Organisation and Resources; Relevance to Business, and Overall Satisfaction, which students respond to using a five-point Likert scale.

One EvaSys question asks whether students find the course intellectually stimulating. We trace the proportion of students who strongly agreed with this statement through the four iterations of implementation. A z-test of the difference-in-proportions who strongly agreed with the statement are used to test the statistical significance of differences observed between every pair of cohorts (Gregory Ward and Bradshaw, 1993).

The test takes the form shown in (1) below:

$$z = \frac{p_1 - p_2}{\sqrt{p(1-p)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} \quad (1)$$

p = combined estimated proportion calculated as a weighted average of P_1 and P_2

P_1 = proportion of respondents who either agreed or strongly agreed in cohort 1

P_2 = proportion of respondents who either agreed or strongly agreed in cohort 2

n_1 = number of respondents in cohort 1

n_2 = number of respondents in cohort 2

By combining these results with qualitative comments provided by students, we can trace the changing perceptions across four cohorts, discerning which aspects of the incremental changes were crucial for intellectual stimulation.

3.2. *EvaSys: Qualitative analysis*

EvaSys Section B asks students to provide more detailed responses to four open questions:

- a) What aspects of the teaching do you particularly value and why?
- b) What aspects of the teaching could be improved and why?
- c) Things I like about the Course and why?
- d) Things I feel could be improved about the Course.

Researchers differ on whether open questions within surveys represent quantitative, qualitative, or ‘quasi-qualitative data’ (O’Cathain and Thomas, 2004). The EvaSys questions ask important ‘how’ and ‘why’ questions, generating data which can be subjected to qualitative analysis (Shevlin et al., 2000). However, the ‘free-text’ questions are situated within a structured quantitative survey (Murphy et al., 1988) and the student responses are approximately one line

in length (Denscombe, 2008). Hence, we suggest that the data captured from the open questions in EvaSys should be broadly categorised as quasi-qualitative.

We sought to discover themes arising from the students' free text comments through qualitative content analysis, namely the systematic, but flexible reduction of data in relation to the overarching research questions (Schreier, 2014). We developed emergent codes inductively by condensing the students' words and phrases into content related themes and patterns (Holsti, 1968; Ryan and Bernard, 2003), and using the students' free text comments as a basis for generating insight on their perceptions and experience of the Bloomberg software (Berelson, 1952). Given the quasi-qualitative nature of the data, we used Microsoft Excel as a qualitative data analysis tool to prepare and organise the imported EvaSys data using tab-delineated sets for each cohort, and using the spreadsheet interface to display, code and analyse the data (Meyer and Avery, 2009; Amozurritia and Servós, 2011). To address concerns of subjectivity in content analysis (Mason, 2002; p.142, 149) two coders analysed the data. One coder was the course leader who oversaw the implementation of Bloomberg in the course, and the second coder was from a different discipline with expertise in qualitative research and coding. A pre-sample of 10 responses were coded independently, and the coding process was then reviewed and refined for consistency (Krippendorff, 2004). Both researchers also noted questions, hunches and thought processes independently throughout the process of looking for patterns, themes and categories of analysis (Patton, 1990).

3.3 Analysis of Attainment

We analyse whether the integration of Bloomberg in teaching, learning and assessment, encouraged higher levels of engagement and stimulated deeper learning. By analysing the changing distribution in student grades across the four years (ranging from no integration to full integration of Bloomberg), our study evaluates the impact of the iterative changes in the

learning environment, incorporating Bloomberg, on students' performance. We compare the proportion gaining higher grade categories (2.1s and above) and the proportion of fails. To further assess whether student learning and retention improved in line with the course innovations, we also examine the grades obtained by each of the four cohorts in advanced finance course pursued at the next stage. For all the comparisons, we employ z-tests to identify significant difference-in-proportions across pairs of cohorts. The test takes the form shown in equation (1).

Drawing conclusions from attainment outcomes needs to be treated carefully. The four cohorts had different characteristics in relation to age distribution, gender profile, and academic background. Further, the academic environment in which the students worked would be different (time of day, time of year, wider academic study being pursued) and this may have influenced their performances. We acknowledge such caveats in our discussion and interpretation of attainment outcomes.

4. Presentation and Discussion of Results

4.1 Presentation of Results

Table 2 shows the number of students who took the course across the four years and illustrates the percentage of students who provided feedback through the course evaluation process. In each cohort, varying numbers provided responses to each of the prompts in sections A and B. The Table also shows the percentage of respondents who strongly agreed with the statement that the course was intellectually stimulating. In addition, Table 2 also presents the results of our analysis of attainment in the introductory finance course and further advanced study.

Table 2: Data on Student Cohorts, Engagement and Attainment

	2013/14	2014/15	2015/16	2016/17
Number of students on the course	112	112	116	128
Percentage providing feedback	48.2	55.4	52.6	53.9
Percentage finding course intellectually stimulating	24.5	39.3	44.2	45.6
z-test: differences between the cohorts		1.616 Cohorts 13/14 and 14/15	0.546 Cohorts 14/15 and 15/16	0.16 Cohorts 15/16 and 16/17
Analysis of Attainment				
Percentage in the 2.1 class or higher	22.3	40.2	45.7	58.6
z-test: differences between cohorts		2.9** Cohort 13/14 and 14/15	0.839 Cohort 14/15 and 15/16	2.015** Cohort 15/16 and 16/17
Percentage of Fails	19.7	17.8	14.7	7.8
z-test: differences between cohorts		-0.364 Cohort 13/14 and 14/15	-0.635 Cohort 14/15 and 15/16	-1.715* Cohort 15/16 and 16/17
Attainment of students in advanced courses pursued in subsequent years				
Percentage in the 2.1 class or higher	29.5	35	51.3	44.7
z-test: differences between cohorts		0.542 Cohort 13/14 and 14/15	1.472 Cohort 14/15 and 16/17	-0.58 Cohort 15/16 and 16/17
Percentage of Fails	21.7	24	5.1	2.6
z-test: differences between cohorts		0.253 Cohort 13/14 and 14/15	-2.182** Cohort 14/15 and 16/17	-2.763** Cohort 15/16 and 16/17

**significant at 1% level

*significant at 5% level

In section B of the course evaluation form, a number of students provided multiple comments in response to the question prompts and these were coded and counted separately in the content analysis. Appendix 2 provide numerical summaries of the key aspects cited by students across all four cohorts in response to the prompts in EvaSys section B.

4.2 Impact of Bloomberg on the Student Experience

Our results indicate that the employment of Bloomberg software in a trading lab can have a positive impact on the student experience, with students commenting that the software is something they like about the teaching specifically and the course generally. By 2016/17, 30% of students mention the Software as an aspect of teaching they particularly like. This is consistent with existing work which report the benefits of incorporating Bloomberg into course learning (Moffit et al., 2010).

However, our approach, tracing perceptions across multiple cohorts, enables us to investigate student views of different degrees of integration within the broader learning environment of the course. In 2014/15, the first year of course innovations which did not involve substantial use of Bloomberg, positive student perceptions emphasise lecturer manner, seminar activities, variety of activities, practical application, and the support and enthusiasm of tutors. These aspects are still frequently cited in subsequent years, even as Bloomberg was integrated further, for example:

"I like the range of different things that we have to do in lectures" (2014/15);

"Range of techniques and real-life examples, e.g. questions, calculations, drawing diagrams, analysing graphs, using Bloomberg, etc." (2015/16);

"...variety of activities to sustain interest" (2016/17).

This is consistent with the students changing perceptions about how the course is intellectually stimulating which are reported in Table 2. The most significant rise in the percentage who found the course intellectually stimulating, occurred following the first iteration of changes which involved more practical application and variety across all learning activities in 2014/15, with limited use of Bloomberg. Further integration of Bloomberg did not raise the percentage significantly further. This suggests that while the software is valuable for enhancing the student

experience, it is only one aspect and it needs to be integrated carefully into the wider mix of learning activities.

4.3 The Perceived Benefits associated with Bloomberg

The results indicate that the undergraduate students view the Bloomberg software as beneficial for learning in ways which are consistent with the limited number of findings from other practitioners who have considered its application in advanced and post-graduate courses. Firstly, like Kazemi (2015), we find that students on the introductory finance course report that the software facilitates the practical application of theory, enabling students to see the point of what they are studying. Comments included:

“Bloomberg application helps to understand and add context to topic”
(2014/15);

“...gives a real insight into the global economy” (2016/17).

This practical application also has a high level of citations in both 2015/16 and 2016/17 without reference to Bloomberg. Students may be implying the use of Bloomberg without explicitly referring to it. However, the value of practical application was also linked to other aspects of teaching and learning, such as examples in lectures and exercises in seminars, as well as the nature of the subject itself. This echoes reasons given by earlier cohorts, suggesting students perceive practical application beyond the use of Bloomberg as important.

Secondly, the Bloomberg software was perceived as a novel way of learning, not only compared to prior study, but also in comparison to other courses on the students' programme. Students characterised this approach as active, hands-on learning. This finding is comparable with the results of other practitioners (Noguera et al., 2011; Stewart et al., 2012). However, existing work focuses on employment of the software whilst our approach analyses Bloomberg in a wider learning environment and indicates that this freshness was also perceived in relation

to other aspects of teaching, learning and subject content. In particular students referred to finance as a new aspect of economics that many students have not met before. This suggests that one must not rely solely on a trading room environment because our findings indicate that the novelty may soon wear off. An active and varied learning environment is important for keeping students stimulated.

Finally, consistent with the findings of Marriot et al. (2015), aligning the use of Bloomberg with the requirements of the coursework assessment is perceived to be beneficial. For example,

“...the coursework has caused need for analysis and further reading - unlike most modules” (2016/17).

This is important in order to avoid the danger of the software being seen as a peripheral extra (Huffman et al., (2012). Indeed, in the year where we employed Bloomberg without alignment with the examination assessment (2014/15), some students commented negatively:

“What is the relevance of Bloomberg?”;

“Bloomberg! What is it for?”

Once the data-based project was introduced as the assessment, no such comments arose, possibly because using the software creates a mechanism for actively developing knowledge and skills which are directly relevant for completing the assignment.

4.4 Problems associated with using Bloomberg

Previous work analysing the employment of Bloomberg emphasises the learning curve associated with the software and the struggles students face with finance as a new subject with unfamiliar terms and concepts (Sharma, 2015). Despite attempts to address these problems, our experience suggests that students still perceive these issues. Firstly, despite the expansion of online resources to help students learn about the software outside class, students' in later years

still raised concerns about time and resources which echo issues raised by previous research. In 2016/17 additional support via online resources was the most cited request for improvement in both the course and the teaching. Some students will always want more time and resources, but one must be careful in how this is done. Consequently, the provision of online resources is crucial.

Secondly, across all of the cohorts, students reported that finance is a new subject and some struggle with the unfamiliar terms and concepts. Previous practitioners recommend that Bloomberg is used with students who have prior knowledge of finance - beyond introductory level (Sharma, 2015). However, our analysis demonstrates that this approach delays the exposure of students to the hands-on, practical application which makes finance more accessible.

4.5 Capacity of Bloomberg to improve undergraduate learning and attainment

The integration of the Bloomberg software into teaching, learning and assessment was a deliberate attempt to stimulate deeper learning by more students and to improve their attainment levels. Our analysis indicates that this was achieved to some degree, with many students reporting that one of the reasons they like Bloomberg was that it stimulated learning and encouraged deeper engagement with the coursework. This is consistent with reported evidence from other practitioners (Huffman et al., 2012; Stewart et al., 2012). We also found evidence of improvements in attainment levels which can be traced across the four cohorts under analysis. This is associated with the reported deeper engagement by students among later cohorts. We acknowledge the limitations in comparing the performance of different cohorts, particularly as this was aligned with a change in the assessment from unseen examination to individual data-based projects. However, as Table 2 illustrates, the percentage of students submitting at least 2.1 quality work nearly trebled over the period, while the percentage failing more than halved. There was a significant increase in the percentage of work at 2.1 quality and

above in 2014/15 (prior to the assessment being changed) compared to the previous cohort, but there was still a stubborn tail of students whose performance was compromised because the new approach adopted that year did not help in preparation for the examination. However, in 2016/17 there is a significant shift in the overall distribution of grades. By then, the learning environment was aligned. Therefore, our findings indicate that it is this careful alignment that is crucial both to facilitating learning and to demonstrating that learning. Moreover, the capacity of Bloomberg to engage more students more deeply, and to demonstrate better knowledge and skills, requires not just an interesting, active learning environment, but also one which provides an appropriately aligned, active assessment. Our research suggests that this can translate to more first year undergraduate students passing per se, and more students able to translate good performance into very good performance.

Finally, to further assess whether the learning and retention demonstrated above is retained in subsequent learning, we also tracked and examined the grades of those students from our original cohorts who took finance in their second year. These grade profiles are also shown in Table 2. For cohorts who experienced greater use of Bloomberg at introductory level, the percentage of students achieving 2.1 or better is higher and the percentage failing is significantly lower compared to those who had no or limited experience of the software. We cannot claim that these subsequent improvements in attainment can be attributed to the Bloomberg interventions at introductory level. However, it does provide evidence that integrating Bloomberg in a constructively aligned learning environment can stimulate the deeper learning that can enable better retention and application in subsequent study. We suggest that this potential link between student engagement in year one, and attainment in year two warrants further study.

Conclusion

This paper traces the integration of the Bloomberg Professional Software into an introductory finance course at Nottingham Trent University, UK. The student feedback indicates that Bloomberg did contribute to improved student engagement, and the perceived benefits of Bloomberg was its relevance to the practical application of theory, and the novel alignment of teaching, learning and assessment. However, our findings also suggest that active learning is not just stimulated by the Bloomberg software alone. Students valued a mix of different, dynamic activities in both lectures and seminars, integrated with the use of the software and aligned with the requirements of the course assessment. All these innovations are strongly associated with increases in reported engagement and this, in turn, is strongly associated with improved levels of attainment. Finally, the follow-up analysis of grades for students who took finance in the second year, also show that those cohorts which used Bloomberg in an aligned learning environment performed better. The possibility of better retention and application in subsequent learning, further strengthens our argument that there are important benefits associated with the increased integration of Bloomberg in introductory finance courses.

Important caveats remain, such as the limitations of using student feedback and attainment data which were noted earlier, and neither do we attempt to attribute direct causality between the introduction of Bloomberg and the higher levels of attainment achieved. In addition, concerns about using trading room software at introductory level remain, as students still raised concerns about time and resources, and the challenge of unfamiliar terms and concepts. Nonetheless, we demonstrate that the trading room software can effectively be used with introductory level students to enhance the student experience, and their capacity to engage more deeply and demonstrate better knowledge and skills.

Whilst this research demonstrates that the integration of Bloomberg can stimulate deeper engagement, learning and attainment among introductory level finance students, future research is needed on *how* students build their learning, knowledge and experience of Bloomberg. This pedagogic understanding would be useful for influencing the design and development of participative learning courses in economics and finance more broadly, which encourages both developmental learning in class, and independent learning across an entire undergraduate programme. Future research could also explore whether students would use Bloomberg on their own initiative as part of their learning in subsequent study, having been introduced to the software at introductory level. Noguera et al., (2011) found that the alignment of the finance lab with assessment appeared to stimulate interest, yet students did not take the initiative to use Bloomberg for other activities where the software could be useful. Consequently, understanding why students do or do not choose to use specialist trading room software to support future learning could yield important insights for the ongoing development of economics and finance pedagogy.

In conclusion, we suggest that trading room software can be effectively used with introductory level finance students, but it needs to be employed carefully. We have demonstrated that the approach we developed is valued by students, but it is not sufficient to merely provide students with the opportunity to use Bloomberg. The software needs to be integrated with a variety of other practical, 'hands-on' activities which are linked with the requirements of the course assessment. This new approach to incorporating Bloomberg for introductory level finance students seems to have encouraged more students to move beyond surface learning, fostering deeper knowledge and producing higher quality analysis. Such an approach to incorporating real-world interactive trading room software should be encouraged in ongoing efforts to enhance economics and finance teaching, particularly at introductory level.

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Appendix 1: Examples of Seminar activities and aligned assessment task

Seminar Activity

- a) From the list of world bonds, select a UK benchmark bond. Display the line graph for the security. Select a 1M time period. You can 'eye-ball' the data to identify any significant movements in price / yields. Use the News icon to find any information which may explain the significant price / yield changes you observe.
- b) Explain the change in price / yield which you observe.
- c) Select the 'TABLE' option. These are the daily quotes for yield. The dates, expressed as MM/DD/YYYY, run in reverse chronology. Choose a trading week in January and trace the change in the yield quoted across the week. Consider the factors which may have led to the change in the quoted yields day-to-day across the week.

You can use the 'Edit' feature to narrow the dates quoted on screen. Go to the relevant data range.

You could then export the data by selecting 'Edit', then 'Export', then 'Copy Data to Clipboard'. Open Excel and paste the data there.

Assignment Task

- (i) Why are debt securities an attractive means of borrowing for firms?
- (ii) Why are they attractive to certain investors?
- (iii) Choose a week in January 2018. Identify the changes in yield of a UK government benchmark bond across the week.
- (iv) Using relevant theory, illustrate and explain the market processes which produce the changes in yield observed.

Appendix 2: 'Aspects' cited in EvaSys³

Q1: What aspects of the teaching do you particularly value and why?				
Aspects cited ⁴	Number of times cited			
	2013/14	2014/15	2015/16	2016/17
Bloomberg		7	5	26
Course subject	1		2	2
General learning support ⁵		10	3	1
Lecture slides	4	1	2	2
Lecturer manner ⁶	12	12	18	6
Lectures	10	15	6	5
Miscellaneous ⁷			3	5
N/A			2	
Online resources ⁸			1	11
Real world application	1	2	7	5
Relaxed learning environment			3	3
Seminars/trading room	14	13	24	17

Q2: What aspects of the teaching could be improved and why?				
Aspects cited	Number of times cited			
	2013/14	2014/15	2015/16	2016/17
Assessment support	4	3	4	9
Bloomberg				9
Real-world application	1			
Course structure/lecture format	2	1	5	10
General learning Support	5 ⁹	1	4	1
Lecture content	2	5	13 ¹⁰	
Lecturer manner	9	8	3	6

³ The number of responses to each open ended question on the EvaSys form varied. Sometimes the number of responses were well below the overall number who completed the EvaSys form (see Table 1).

⁴ We have not cited '0' for non-occurrence of an aspect because we did not set out with an *a priori* list for the content analysis.

⁵ No specific aspect was cited, but students made unexplained comments such as 'explanations', 'detailed analysis of finance'; 'relevant readings' which we categorised as 'general learning support'.

⁶ Lecturer explains things clearly, lecturer is helpful.

⁷ Miscellaneous/unclear aspects cited: 'The style of learning'; 'Use of examples';

⁸ Increased reference to online resources in 2016/17 to all questions, possibly due to a greater emphasis on online resources across the university e.g.: the introduction of recorded lectures.

⁹ Comments include class timetabling and changes to seminar tutors during the year.

¹⁰ Most of these comments requested more content on the lecture slides before they were uploaded to the online system, reflecting the increased availability of online access to lecture slides and recorded lectures.

Miscellaneous ¹¹			1	2
More explanations	2	5	5	5
N/A				1 ¹²
Nothing	2			5
Online resources			1	9
Seminars	12	9	6	3

Q3: Things I like about the course and why?				
Aspects cited	Number of times cited			
	2013/14	2014/15	2015/16	2016/17
Bloomberg		8	5	19
General learning support				5
Course design/structure	5	13	5	10
Course topic	12	16	16	19
Lecturer manner	8	7	5	12
Miscellaneous		2	5	3
Online resources		2		8
Real world application	8	4	27	15
Seminars	1	3	4	2

Q4: Things I feel could be improved about the Course				
Aspects cited	Number of times cited			
	2013/14	2014/15	2015/16	2016/17
Assessment support	3	5	5	6
Bloomberg ¹³		4	3	6
Course/lecture content	1	6	5	5
Course structure/lecture format	4	8	9	2
General Learning Support	2	2	1	1
Lecturer manner	16			1
Miscellaneous	1	3	3	2

¹¹ Miscellaneous statements: “sometimes feel pressured / frowned upon when I don’t know the exact answer”

¹² “[name] could have more eyebrow movement”

¹³ All comments requested more of use Bloomberg, and/or more support to use Bloomberg, with 2 x students questioning the purpose of Bloomberg in 2014/15.

More explanations		1	8	2
More feedback	1		5	7
Nothing to report ¹⁴	4	1	1	6
Online resources		3	2	12
Seminars	3	2	1	3

¹⁴ Included statements such as: 'I can't think of anything';