The Continuing Adventures of Library Learning Analytics: Exploring the Relationship between Library Skills Training and Student Success

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Introduction

The Open University (OU) is the UK's largest academic institution dedicated to distance learning, with over 173,000 students. Established by Royal Charter in 1969, in the fifty years since, we have evolved from providing a correspondence-based education to be the leader in online distance education. Our mission is to be open to people, places, methods, and ideas. Core to this is our provision of education without prerequisites; most of our undergraduate courses have no formal entry requirements. Our award-winning distance learning has seen over 2 million students receive an education otherwise denied to them at campus-based universities.

Learning analytics is a key organisational strategic driver at The Open University and we are known as a leader in this research field internationally. Library services within the university provide students and staff with access to an extensive online collection of library resources, digital and information literacy skills training, and 24/7 support. This paper is a continuation of our research into library learning analytics. Previously published research has identified a positive relationship between library collection access and student success,[1] but what about our skills training provision? This research explores the relationship between student attendance at library online training sessions and student attainment.

When the university library was first established, the service was predominantly provided for the academic staff based at the Milton Keynes campus. A collection of print texts and journals were established to support the academic writing for the curriculum delivery. Students were unable to access the library; the curriculum was designed to include all of the reference sources they would need within a core study text. As the provision of online information grew at the turn of the millennium, the library strategy evolved to improve access to resources for students wherever they were studying. In support of this, the library also established an information literacy unit whose aims included incorporating information literacy skills into the curriculum.[2] Today 70% of our 600,000 books and 100% of our journals are available electronically, and users of the service are supported by an extensive information literacy programme and a 24/7 helpdesk.

Information Literacy at the Open University

The information literacy unit at the library was the driving force behind the university strategy to embed information literacy skills into the curriculum. They devised our information literacy framework, which was subsequently revised to become the Digital Information Literacy (DIL) framework still used today.[3] Initially, DIL skills materials were embedded into the curriculum primarily through online learning activities incorporated into the module materials on the virtual learning environment. When the university introduced an online system for live tutorials, the library sought to use this technology to expand its DIL offer. After a successful pilot, coupled with the organisational strategy to improve online tutorial delivery, the library formed a new live engagement team in 2015.Their remit includes training classes of students on information seeking, evaluating, and referencing via our online platform. Since the launch of the team, approximately 20% of qualifications have added the library sessions to their group tuition strategies. Typically, these "targeted" sessions are introductory, enabling students to gain skills that will support them throughout their studies. In some cases, the sessions are designed to inform a specific assignment the students need to do, for example a literature review.

Alongside the targeted live engagement sessions, the team also regularly delivers a suite of tutorials available for any student to attend. Commonly known as the "generic" sessions these are advertised on the library website where students from any subject discipline can gain DIL skills. In line with our student expectations,

these sessions are typically delivered in the evenings and at weekends. Students will log into an online room from their homes at a prearranged time and date where they will receive live training from the librarian alongside their peer students. Students can engage with the online class through text chat, two-way audio, and video. For both the embedded and generic tutorials, recordings of the sessions are made available for students who are unable to attend the live session or for those who want to re-watch the session after the event.

Learning Analytics at the Open University

Learning analytics is a key organisational strategic driver at the OU and we are known as a leader in this research field internationally.[4] In 2014, we worked in partnership with the student association to develop and agree on an Ethical Use of Student Data for Learning Analytics Policy.[5] In line with the wider organisational strategy, the library embarked upon research into library learning analytics in 2015, initially focussing on the relationship between library use and student performance or retention.[6] Following a platform provider change in 2017 to Adobe Connect, data on student attendance at online tutorials, and any subsequent views of sessions after the event, have been collected as part of the institutional learning analytics strategy. The availability of this data prompted the research team to investigate the relationship between attendance at the training sessions and student performance or retention.

The drivers for this research are to identify if the online library training sessions are providing an impact on student success in line with key institutional strategic drivers. If they are having a positive effect, the information will be used to advocate the service with key stakeholders with an aim to increase resource for the service; with faculty to ensure students from all disciplines are able to benefit; and with students to encourage participation. If they are not having a positive impact on student success, future research will be conducted into the reasons why, with adjustments made to the training with the ultimate aim of improving student success.

Literature Review

Early work in the area of library learning analytics emerged from the University of Huddersfield's Library Impact Data Project,[7] where the researchers identified correlation between library content access and student attainment. This research went on to spawn further studies at eight UK university libraries, all with similar results.[8] It also echoed similar research being conducted in Australia[9] and the USA at the time.[10] These studies focussed primarily on the relationship between student access of library content and their attainment scores, for example Grade Point Average (GPA) or degree classification. Similar research was conducted at The Open University with comparable findings.[11]

A few studies have been conducted replicating these methodologies with information literacy instruction attendance. At an individual student level, Wong and Cmor investigated the effect of library tuition on the student attainment score throughout the duration of their qualification.[12] The number of sessions students attended varied due to course design. All first-year students must attend a compulsory orientation session, with some students benefitting from five different sessions whilst studying for their degree. Overall, a positive relationship between workshop attendance and GPA was identified in only a quarter of the students in the sample group. The authors found that the more sessions that they offered, the greater the positive relationship on student attainment; however, the overall results indicated that, for most attendees, there was no positive relationship. In 2012, Bowles-Terry conducted a mixed method review of the impact of information literacy tuition.[13] Their approach included focus groups with graduating seniors and an analysis of the GPA scores for students who had and had not received library tuition. The quantitative analysis of this study focussed on data at a class-level with some assumptions made on whether individual students had attended the session. The findings concluded that there was a positive correlation between librarian instruction and GPA when offered in later (upper) years of study as opposed to first (freshman) years. The research design differed from Wong and Cmor; however the findings could potentially be similar, with limited positive correlation between those who only completed the compulsory orientation session in their first year.[14]

At a multi-institutional level, the Greater Western Library Alliance study into student learning outcomes is investigating the relationship between library instruction, student retention, and student success.[15] They are also researching the impact of learning design with session characteristics being included in the analysis. The initial findings have compared the first-year students who received library instruction interactions compared to the first-year students who did not.[16] The GPA, retention rates, and academic outcome measures of over 42,000 students from 12 universities have been analysed, making this the largest study in the field identified. The study concludes that library instruction has a positive relationship; retention rates and GPA scores are higher for students who benefitted from the tuition. The study is continuing, aiming to eventually report on the impact on four-year and six-year graduation rates.

Approach

Study Design

This study has been designed to investigate the relationship between students who participate in the library-provided training sessions during the academic year 2017–18 and their attainment at the end of the module of study. Attainment data—defined as fail, pass or pass with distinction—and assessment scores have been used within the study. Attainment scores of students who chose to attend live, and those who watched the session later, have been compared with students who did not participate. It should be noted, however, that many factors will impact on student success alongside the library training session.

The research has been conducted in accordance with the institutional Ethical Use of Student Data for Learning Analytics Policy.[17] No new data was collected as part of this activity; the study was confined to analysing data that was already in existence. The analysis of data will be used to shape future services to improve them for students.

At the OU, students study for a degree in a series of modules. For undergraduate degrees, modules are designated as levels 1, 2, and 3. These broadly equate to years one to three of a standard UK three-year degree. An initial small-scale pilot was undertaken to look at the data for one level 3 module to show the viability of undertaking this analysis. This pilot suggested that students who engaged with the training were getting assignment scores on average six percentage points higher than students who did not attend the training. This implied that there would be some value in carrying out a more complete analysis.

The approach that has been taken is to investigate three distinct types of library training sessions. Firstly, the generic training sessions, which were run regularly during 2017–18 covering five different topics, an overview of which can be seen in the appendix. The second group were the targeted sessions; eighteen of these sessions were analysed as part of this study. The third group of sessions are library training sessions that were arranged to support specific assignments within a module; seven of these sessions are included in the study. This last group of sessions offered the potential to investigate whether there were any differences at the individual assignment level.

With each training session, it is possible for a student to attend the session live or to view the recording, or to do both, or to do neither. This offered the possibility of making comparisons between the different types of engagement and their relationship with student success. For example, are students who attend the live sessions more successful than those who view the recordings?

Study Methodology

The methodology taken for this study was to extract the identities of the students from the Adobe Connect platform for each session they attended or recording they viewed. Data on student results was extracted from the institutional data warehouse and matched with the student identity. Access to this data was restricted to one researcher in the team before being anonymised.

For the generic sessions and those targeted at specific modules, the final module result (a grade—pass with distinction, pass, or fail), the overall assessment score (a percentage), and the overall examination score (a

percentage) were used. For the third type of session, the individual assessment score for the assignment immediately after the date of the library training session was used.

For the first two types of session, two different analyses were undertaken, firstly to look at the percentage of students gaining the highest grade of result, a distinction, and secondly to look at the average assessment scores. In each case, a comparison was made between the pattern of students who attended the live session only or viewed the recording only against those who did neither. It was felt that this would give a good picture of the relationship with student success. The approach of using the percentage of students gaining a distinction offered a good way to allow comparisons to be made across the different types of sessions rather than trying to show the breakdown of all the possible results.

Findings

Analysis of the Generic Library Training Sessions

Just under 2,000 undergraduate students attended live or viewed the recorded generic sessions. An initial analysis of the data for all the sessions quickly identified that there was a pattern of higher attainment for students who attended the live sessions. As you can see from Table 1 below, 12% more students who attended at least one of the live sessions but no recorded sessions gained a distinction compared with students who did not engage with any live or recorded sessions (A compared to C). Students viewing at least one recorded session were also more likely to gain a distinction result compared with those who did not engage (B compared to C). The percentage of students failing was also lower for those engaging with a live session (A compared to C), but this was not the case for students who viewed at least one recording (B compared to C). The results from students who attended both a live session and a recording of a live session were also reviewed as part of this research. The number of people who had engaged with both the live and recorded sessions was not high enough to warrant presentation in this paper.

Table 1. Percentage of students gaining a specific result by level of engagement with generic training session.

Result/percentage	Students who attended any live generic session but no recorded session (n=809) (A)	Students who viewed any recorded generic session but no live session (n=1,000) (B)	Students who did not engaged with any live or recorded sessions (n=80,357) (C)
Distinction	31.15%	25.50%	19.50%
Pass	66.87%	69.40%	75.84%
Fail	1.98%	5.10%	4.66%
Total	100%	100%	100%

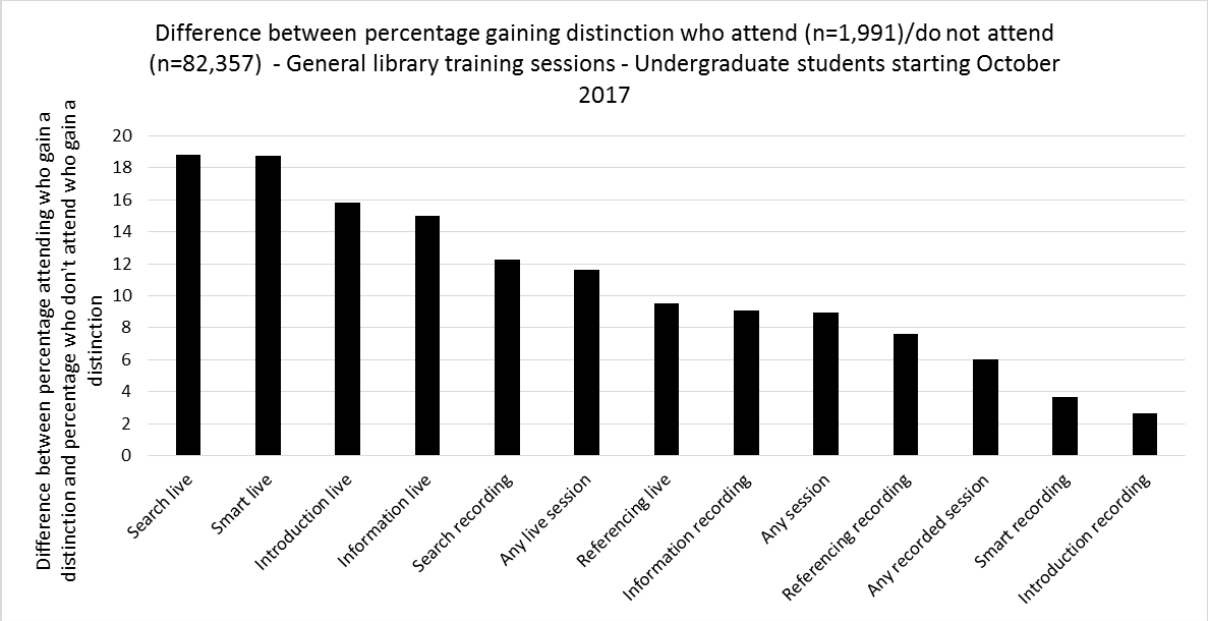
To compare the different sessions, the percentage of students gaining a distinction was used as the measure of attainment and a method was devised to compare them against a baseline.

The first step was to split the data into 11 sub-groups. For each of the five generic sessions, there were two sub-groups—students who attended the session live but not the recording, and those viewing the recording but not the live session—to give a total of 10 sub-groups. The eleventh sub-group was made up of students who did not engage with any live or recorded session—this was used as the baseline.

The next step was to calculate the percentage of students in each sub-group who gained a distinction. For example, 29% of students who attended the live referencing session gained a distinction and 35% of students attending the introduction session went on to gain a distinction at the end of their module.

The final step was to compare the percentage for each of the ten sub-groups against the baseline (the percentage of students who did not engage at all who gained a distinction). Sorting these in order gives the graph shown in Figure 1.

Figure 1. Difference in percentage of students gaining a distinction between students engaging or not engaging with the different general library training sessions.



The analysis found some interesting features. Students attending the live session are more successful as a group than the students viewing the recording in all cases. The session with one of the highest increases in the percentage of students gaining a distinction—"Smarter searching live"—also had one of the lowest differences for the recording. There were quite large differences between the live and recorded sessions in some cases. The referencing session, a topic we know from feedback covers a particular pain-point for students, did not seem to be associated with higher student attainment. One hypothesis for this is that there are some differences in referencing practices across the institution, resulting in students receiving conflicting advice from different sources. The library is currently working with faculty colleagues to try to overcome this challenge.

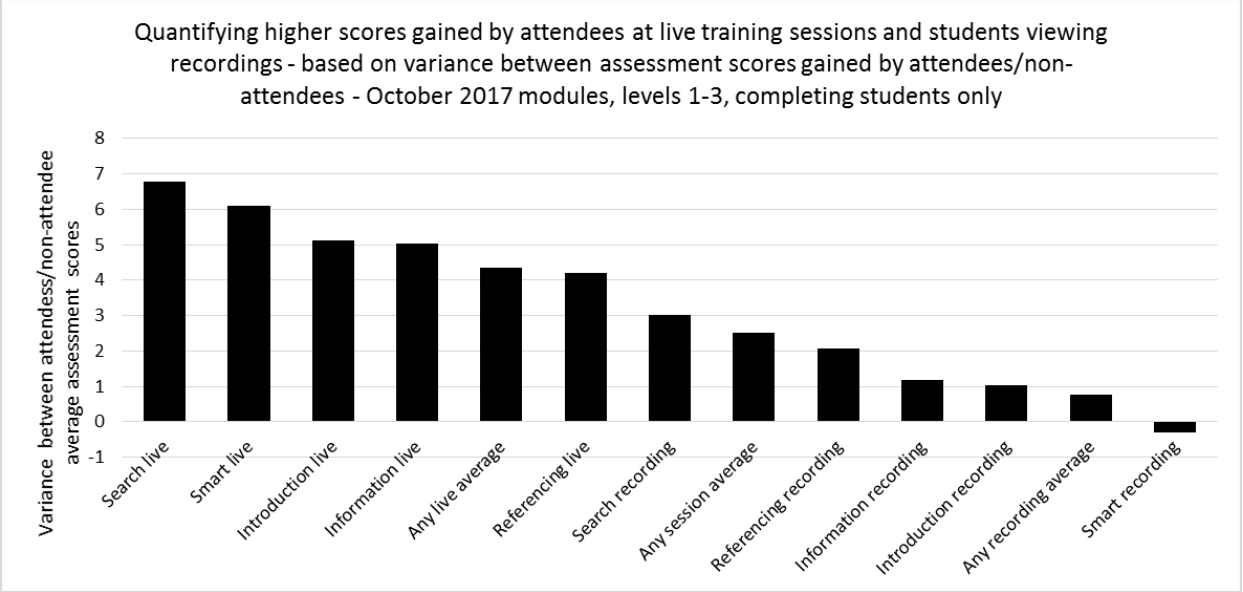
The second approach used was to take the average assessment score for students who attended the live session only (i.e., attended the live session but did not view the recording) and deduct the average score for students who did not engage with either the live or recorded sessions. This gave a value for the difference between the two averages. Two assessment values are available—a continuous assessment score derived from the individual assignment scores within the module and an overall examination score—so the exercise was repeated for both scores. The two differences were added together and divided by two to give an average score for the live session. The same calculation was then carried out for students who only viewed the recordings, compared again with students who did not engage at all. An illustration of the calculation is shown in Table 2.

Table 2. Illustration of the calculation used to determine a value for the increase/decrease in attainment.

Module: Level 3	Average score for students attending live (A)	Average score for students not attending live or viewing recording (B)	Difference (A-B)
Average continuous assessment score	76.05	70.82	5.23 (C)
Average examination score	73.60	67.31	6.29 (D)
Calculation	(C+D)/2 = (5.23+6.29)/2 = 5.76		

This analysis gave a score for each of the five live sessions and five recorded sessions and provided a way of comparing the sessions. Sorted by order of value, the highest difference to the left gives the pattern in Fig. 2.

Figure 2. Difference in assessment scores between students attending/viewing or not attending/viewing the library training sessions for each session.

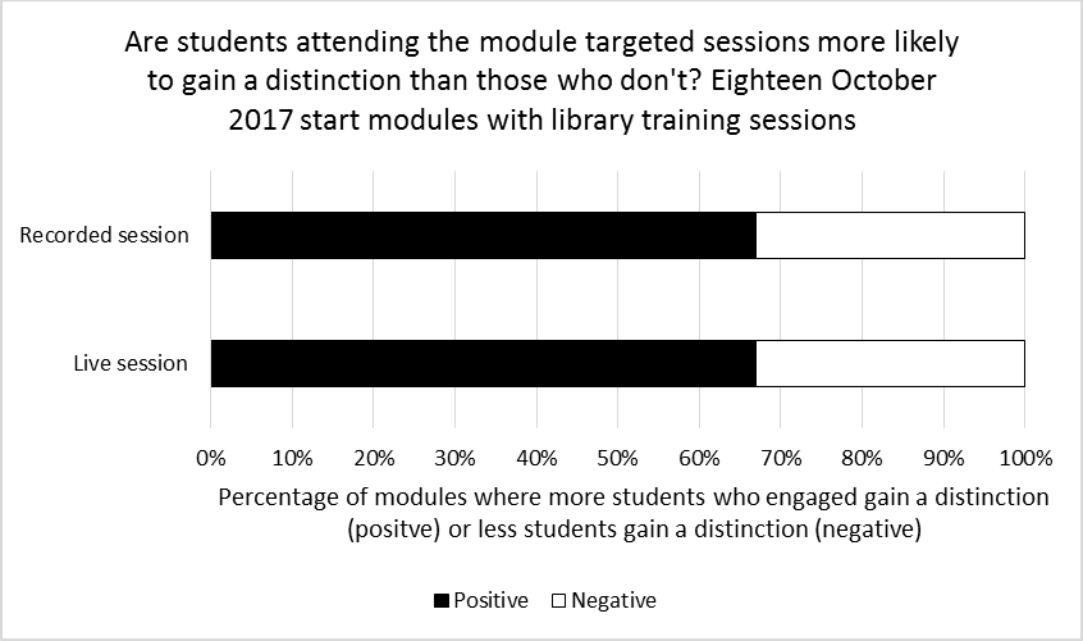


This second approach shows a very similar pattern to the first approach. Again, we see the live sessions seeing more engagement by students who do well in terms of results. We also see that some of the recorded sessions see only a small increase and, in one case—the recording of the "Smarter searching session"—students viewing the recording are those who do less well.

Library training sessions targeted at specific modules

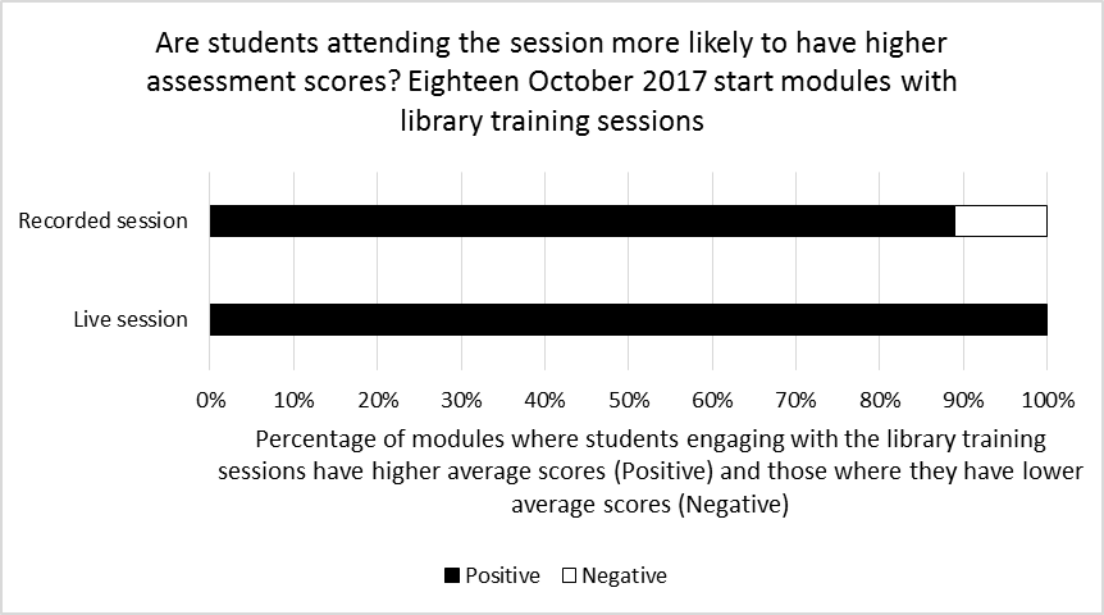
Eighteen library training sessions were delivered for specific modules that started in October 2017. The majority of these (13) were delivered for level 3 undergraduate modules, with two each for undergraduate levels 1 and 2 and one for a postgraduate module. Carrying out a similar analysis to that used for the generic sessions showed that, for the live sessions, twelve modules saw a higher percentage of attendees gaining a distinction. In the recorded sessions, there was the same picture, although these were not the same modules in each case (Fig. 3).

Figure 3. Percentage of live and recorded library training sessions targeted at modules that see an increased number of students who engage achieve a distinction in their end of module result.



Analysing the assessment scores gave a slightly different picture, with all the live sessions showing an increase in assessment scores and with all but two of the modules showing an increase for the recorded sessions (Fig. 4).

Figure 4. Percentage of modules where students who engage have higher assessment scores.



Library Training Sessions Targeted at Specific Assignments

Seven sessions targeted at specific assignments were also analysed. Six of the modules were level 3 undergraduate modules with one level 1 module. The topics covered in the sessions varied but all the level 3 sessions were on topics associated with finding material for their assignment. The level 1 session was on digital literacy. Just over 3,000 students studied these modules, 277 (9%) attended live sessions only, 221

(7%) viewed the recording only (before the date the assignment was due), 54 (2%) did both, and 2,637 (82%) did neither.

The approach taken to analyse this data was different, as the assignment score for the specific targeted assignment was used, rather than the final module result. The average assignment scores for students attending the live session only was taken and compared with the students who neither attended the live session nor viewed the recording. A similar calculation was carried out for students who only viewed the recording, again comparing with students who did neither. Finally, the students who did neither were compared with students who engaged with either of the sessions. As you can see from Table 3 below, in most cases there is a positive difference between the assignment scores for those who engaged compared with students who did not engage at all. Only one module showed a negative value (i.e., where non-attendees did better for one of the recorded sessions).

Table 3. Difference in assignment scores between attendees/viewers and non-attendees/viewers for seven modules where library training sessions were delivered to support specific assignments.

Module	Difference between average assignment score for students who attend live session only and students not attending the live or recorded session	Difference between average assignment score for students who view recording only and students who don't view it or attend the live session.	Difference between average assignment score for students who do not engage compared with students who engaged with either the live or recorded session.
Arts level 3	5.48	3.27	-4.46
Arts level 3	5.41	-1.97	-1.44
Social Sciences level 3	8.22	2.72	-5.99
Social Sciences level 3	7.66	4.95	-6.05
Childhood level 3	4.50	5.73	-5.38
Childhood level 3	7.28	5.24	-6.14
Science level 1	7.81	3.06	-6.59

Again, this analysis shows a picture where students who engage with the live sessions seem to be gaining better results. In all cases the group of students who don't engage at all have a lower average score for the group than those who do engage.

Library Training Sessions and Student Completion

The dataset compiled for this study also allowed an analysis to be undertaken to investigate whether students who engaged with the library training sessions were more likely to complete their module. Analysing the data for the generic and module-targeted sessions identified some interesting themes. Of those who did not engage with any of these sessions, 71% of students completed their module. But 84% of those students who attended at least one of the live sessions completed their module and 87% of students who viewed at least one recording completed their module. If students attended at least one session (either a live or a recorded session), there was an 86% likelihood that they completed their module. As with the data on student attainment, it appears to be the case that students engaging with library training sessions are those

who are more likely to be successful (i.e., that there is higher retention in the group who engage with library training). What is particularly interesting about this finding is the suggestion that, whilst students attending the live modules seem to be gaining higher results than those who view the recording, the opposite seems to be the case when it comes to student retention.

Conclusions

Throughout the analysis, we see a picture where students engaging with library training sessions are those who are gaining higher results. This applies whether we look at the generic sessions, the module-targeted sessions, or the individual assignment targeted sessions. There is a general picture that students attending the live sessions are doing better than those viewing the recordings. Is this that these are better organised and motivated students, maybe with better study skills, or are they just more experienced at studying with the university? Do these students see that these sessions are to their advantage? With the module-targeted sessions being mainly level 3 modules, that implies that students should be experienced in study at the Open University.

One of the other features that comes out of the study is that there are quite distinct variances in student success between the different library training sessions and not just between the live and recorded sessions. It may be that some of the sessions are less well-aligned to improving overall student achievement but more aimed towards building study skills, but it is slightly surprising to see topics such as referencing, a known pain point for students and one they can lose marks for, being less associated with student success.

There is also some suggestion, particularly from the analysis of the module-specific sessions that even in modules that do not see a larger percentage of students engaging with the session gaining a distinction, there is still a pattern of higher assessment scores for those engaging with the training session.

When it comes to student retention, this study also seems to show that students engaging with library training sessions are more likely to be completing their module but that students viewing the recording are more likely to complete than students who attend the live session, which is the reverse of the case with student success.

Overall, the study tells us that students who engage with library training sessions are getting higher attainment scores and are more likely to complete their studies. Attendance at the live sessions is also more likely to be associated with higher attainment than viewing the recorded sessions. This initial study helps our understanding of the value and impact of these sessions and starts to shed some light on the relationship between library training sessions, student success, and student completion.

As with many studies, this piece of work raises as many questions as it answers. Are the students attending the sessions more successful and well-motivated? What contribution is the library training playing in student success, alongside other contributory factors such as tutors, support, and learning materials? How good a predictor of student success is attendance at these library sessions? Follow-on work could include a robust statistical analysis to understand if the differences reported here are significant and to uncover to what extent the training sessions themselves are responsible for those improved results.

Acknowledgements

The authors would like to acknowledge the support from the following people with this research—from the Open University: Matthew Taylor, Caroline Barratt, and all members of the Live Engagement team (past and present); and Elaine Sykes from Liverpool John Moores University, for the peer review support.

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Richard Nurse is senior library manager at The Open University library and leads the digital services and metadata team that manages library websites, library search tools, and metadata. Previous work includes projects on library data analysis and the development of a library recommender tool. He has published and presented on aspects of library data.

Helen Clough is a senior library manager at The Open University library and the library's key customer relationship manager for the faculty of wellbeing, education and language studies. Her remit includes leading the team of librarians who deliver live engagement activities via Adobe Connect and social media. She is a fellow of the Higher Education Academy and has presented and published on delivering online information literacy teaching to distance learners.

Endnotes

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Appendix

Overview of the five generic training sessions provided by The Open University Library and their learning outcomes

Introduction to Library Services

Presented as “Information” in Figures 1 and 2

Learning Outcomes:

- Be able to confidently navigate the library website
- Be able to access resources relevant to your study
- Be able to access help and support provided by the library

Using Library Search for your assignment

Presented as “Search” in Figures 1 and 2

Learning Outcomes:

- Know how to use Library Search to find particular items
- Know how to use Library Search to find items on a particular topic
- Know where to go for help and support

Smart searching with library databases

Presented as “Smart” in Figures 1 and 2

Learning Outcomes:

- Identify key search terms from your research topic and expand these using synonyms
- Understand how to use effective search techniques, such as Boolean searching, in building a search statement
- Understand the functionality offered by databases in filtering, saving and exporting your results

Picking the best information for your assignment

Presented as “Information” in Figures 1 and 2

Learning Outcomes:

- Be able to use a framework to assess the reliability of information
- Be able to assess the reliability of information
- Be able to assess the usefulness of information

The why and how of referencing

Presented as “Referencing” in Figures 1 and 2

Learning Outcomes:

- Know why referencing is important
- Know what to reference when writing your assignments
- Know how to construct references