Consolidating Library Data with PowerBI

A Case Study from UWTSD Library

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Introduction

In 2021, the Library and Learning Resources team at the University of Wales Trinity Saint David (UWTSD) launched a project to consolidate data across the service. The project was initiated to address inconsistencies in reporting and improve measurement of service impact. UWTSD is a diverse, multi-campus university with a library presence across Wales and England in Swansea, Carmarthen, London, Birmingham and Lampeter. Library and Learning Resources is a professional services department with four distinct functional teams, Academic Services, Collections, Customer Services and Special Collections and Archives, with staff in each team based across our geographically dispersed campuses. The department has grown over the last decade to incorporate new services, with both the number of staff and the range of expertise within the team expanding as a result.

Prior to the project, our data collection was siloed and ad-hoc, relying heavily on our Alma Library Management System which primarily captures data on collection usage and does not represent our full range of services such as digital skills provision, open access compliance, and interactions with our specialist and front-line staff. We aimed to create a consistent and comprehensive in-house reporting solution that would aid us in the performance measurement of all our services, both including and beyond the usage of our collections, illustrating the breadth of interaction with the library across all four teams using existing tools available to us at no additional cost. Microsoft PowerBI was chosen due to its availability through our University IT service, and for compatibility with other Microsoft software widely in use at the University.

This paper will outline our experience and progress so far over the first three years of the project.

Why consolidate our data?

When considering how to report on library services for measuring performance, many professionals would naturally turn to their Library Management System (LMS). After all, the LMS was originally developed to manage the acquisition, cataloguing and circulation of traditional printed resources (Tedd, 2007) and, in many libraries, including UWTSD, analytical reporting responsibilities lie with the Systems Librarian and similar roles.

While the LMS has evolved into cloud-based Library Services Platforms in recent years with products such as Ex Libris Alma and FOLIO now including functionality designed for managing large scale collections of e-resources (Breeding, 2024), reporting capabilities still reflect traditional library functions. Since 2016, our library service has expanded to incorporate functions such as open access publishing, digital skills provision, online Library Chat for remote support, digital exhibitions for our Special Collections and Archives, and online reading lists. Of these new services, only reading lists are managed through our LMS. Others, such as Library Chat, are managed through third-party products which maintain their own data, and many, such as open access and digital skills, have no single, central data source. With these new activities divided between our four specialist teams within a growing professional service department, data capture became siloed, stored in spreadsheets on Sharepoint folders, personal OneDrive accounts and within proprietary systems outside of the LMS.

As a result of the Covid-19 pandemic, our collections shifted significantly from print to electronic between 2020 and 2022. UWTSD also now operates several satellite campuses with no physical print library or lending service and where course provision is solely electronic. Our LMS provides us with a great deal of granular data on print circulation but, with this now accounting for only a small fraction of interaction with the Library, using such data to inform service-wide decisions would be

increasingly misleading. While data on electronic resources usage is available within the LMS, this is far more complex to maintain than print circulation data: although reporting on electronic collections and titles is possible, this requires connections to third parties through the SUSHI protocol or the use of services outside of the LMS such as JUSP[1]. Accurately reporting on users who engage with electronic content while ensuring confidentiality is more challenging, requiring appropriate groups to be configured within our OpenAthens or EZproxy authentication services with external assistance from our IT department. As a result, while we have a grasp on *what* content is being used, it has become far more challenging to identify exactly *who* is using our resources and our services and, perhaps more importantly, who is *not* engaging with the Library and why.

In recent years we have also been required to provide evidence to justify our expenditure and to support business cases for our staffing needs in the context of the financial pressures on higher education in Wales and the wider UK (Kett *et al.*, 2024). Prior to the project, we would run ad-hoc reports each time such data was required, leading to a significant volume of customised reporting, often with little advanced notice, putting additional pressure on a small number of staff with reporting access and experience.

Outside of ad-hoc reporting, our library data has historically been collated annually for the SCONUL Statistical Return[2]. While the SCONUL return is a valuable tool for long-term sector benchmarking to inform service development, as the statistical data is collated each autumn for the previous academic year, it is less beneficial for short-term intervention. We wanted the ability to monitor trends in service usage and enable the team to be proactive and address issues much more quickly: for example, to rectify content access issues in the event of insufficient licences or technical problems, or to manage staff capacity in the event of an increase or decrease in the use of a particular service.

A project is born!

To address these challenges, a Data Project Group was formed in Autumn 2021 consisting of interested staff from across the whole LLR service. To ensure a representative group, membership included staff at all levels, from our Library Leadership Team through to Library Assistants, and from our four departmental teams. The group included experts with previous experience at handling library data and non-experts who were keen to learn more: there were no pre-requisites to joining, other than an interest in working together to improve data collection and reporting, and we wanted to include all levels and teams for staff to 'buy in' to the project.

The group were tasked with reviewing data collection, analysis and visualisation across the service, with a view to identifying and prioritising key datasets which underpin our Library and Learning Resources Strategy and annual action plan. Ahead of the initial meeting, members were asked to review the datasets most frequently requested for their service area, how data was being collected, stored and analysed, and how easy it was to share with colleagues when required, while also ensuring appropriate confidentiality and security. This initial scoping activity led to four project goals:

1. Identifying and prioritising key datasets
2. Reviewing chosen datasets for processing, ensuring they are stored in a 'machine-readable' format
3. Producing a suite of reports which process and display the data automatically in the most appropriate form
4. Producing a dashboard, or set of dashboards, to bring together reports into categories to illustrate performance of our services

Tools

At the first meeting, the group agreed to focus on Microsoft products, with PowerBI chosen as our data visualisation tool. There were several reasons for this: firstly, group members were familiar with the Microsoft Office suite and most had experience using Excel for data processing; secondly, PowerBI was available to the service without additional cost and integrated with existing University services such as Sharepoint and

Microsoft Teams, which we had recently adopted as our 'go-to' communications tool for online working during the pandemic; and finally, the project lead had some previous experience using PowerBI.

A dedicated Teams site was created at the beginning of the project, with the intention of using the built-in Sharepoint functionality to host all internal reporting data. This was based on previous experience collaborating with other libraries across WHELF (Wales Higher Education Libraries Forum)[3], where different PowerBI licences and account permission levels across member institutions acted as a barrier to data sharing. It was felt that starting from scratch would be simpler than trying to modify existing reports to work effectively with PowerBI, and that storing our source data in one central Sharepoint space for group members would help to eliminate permissions issues and allow for service-wide reporting across teams in future, while also making it easier to manage security.

We also used Power Automate to set up scheduled reporting from external data sources which cannot directly connect to PowerBI. One example of this is our Alma LMS; analytics reports within Alma are scheduled to be delivered automatically by email, and Power Automate is then used to copy the data from the relevant email attachments to an appropriate folder in the Teams Sharepoint site, with PowerBI pointed at Sharepoint as a data source. While this does reduce real-time reporting capabilities, as Alma Analytics itself is only refreshed on a nightly basis, it was not felt to be a retrograde step.

We also agreed to adopt Microsoft Forms as standard for manual data collection. This is used both for user feedback and surveys, such as the evaluation form for our digital and information skills sessions, and as a data entry tool to reduce reporting errors, for example when performing 'head counts' of users in our library buildings at predefined times. Microsoft Forms integrated with PowerBI, automatically creating a spreadsheet from the inputted data which could be used as a source for reports and visualisations without the need for manual editing. This worked well until early 2025: recent changes to the synchronisation

process in Microsoft Forms have caused problems and we are currently considering alternatives.

Improving data quality

With much of our data previously being siloed and manually collected, we quickly identified several data quality issues which had the potential to cause problems and decided to focus on improving data collection practice as a priority. Rather than using complex formulae to interpret our existing spreadsheets in PowerBI, we decided to create new data source files where possible. This allowed us to start using PowerBI at a very basic level, with confidence in our source data, and to future-proof our reporting while keeping open the potential to link reports together in the longer term.

Recreating internal reports from scratch led to the disadvantage of some datasets not being comparable to measure performance on a 'like for like' basis. We felt, however, that the benefits of this approach outweighed the drawbacks, and that taking a radical look at all our data at the same time would result in more effective benchmarking in the future. We chose a 'go live' date of 1 August 2022 for new reporting practice as our long-term reporting is most frequently done to academic year timescales, and this allowed data to be comparable across the full academic year. This also meant that the first few months of the project were focussed on reviewing data collection, formatting and storage methods rather than on the, perhaps more enjoyable, task of data visualisation within PowerBI.

In practice, this meant setting up new Microsoft Forms to capture data which were previously collected manually, and ensuring fields likely to be used across multiple reports were consistent: references to our Institutes (Faculties) and Academic Disciplines of study; our types of user (student, staff, external); level and modes of study, etc. We also wanted to ensure that any data collected manually could link to automated data held on our Alma LMS and elsewhere: this meant, for example, ensuring references to user types and modes of study matched the coding used in our Alma student record import and could therefore be cross-referenced with reports created in Alma Analytics.

Creating new Forms from scratch also provided the opportunity for us to host the source data in the new group Sharepoint site, allowing colleagues across the project access to connect to this data should the need arise in future. One significant benefit to automating data collection via Forms is a reduction in data input error. This has reduced the need for manual intervention: e.g. previously, on spreadsheets to record information literacy training, dates and times had been entered in different formats (e.g. 12-hour / 24-hour clock, and the addition of 'am' and 'pm' suffixes), requiring manual correction to be processed in a meaningful way. The simple data entry restrictions available through Forms has reduced the need for correction or complex data validation rules within Excel and in some cases, removed manual data entry entirely; for example, Forms can capture signed-in user details automatically.

As a result, we have recently removed personal data fields from many surveys and forms, instead using Microsoft Forms to capture users' University ID through their login and then linking this within PowerBI to a central scheduled user report from Alma Analytics which is refreshed twice weekly. This ensures that no personal information other than the University ID is stored with survey data, improving confidentiality, and allows us to automatically link students with their relevant Academic Discipline of study without asking them for their ID number or programme details, both of which could be subject to inconsistency and error when manually entered.

Our experience in this work has led to the creation of a set of Data Collection Standards for the LLR service which now forms part of the Terms of Reference for the data group, aiming to ensure future reporting will align with existing practice. Our Head of Academic Services reflected on the time saved through improvements in data quality processes: "I have saved hours, if not days, of my time by not having to correct data that has been manually entered into Excel and then in manipulating and visualising the data for internal reporting purposes".

Focus on staff development

Our library service does not currently have a dedicated data analysis post, with this instead being included within the job descriptions of several staff members, notably our Systems and Digital Content Librarian. One of the objectives of the project has been to improve data literacy skills across the whole team, providing a forum for sharing experiences and development through the project group, and empowering staff to develop their knowledge of data through practical experience and support from colleagues.

Several group members joined the project with an interest in learning about data visualisation while also admitting to feeling intimidated by the software and technical jargon involved. A dedicated Teams site was created at the beginning of the project to allow group members to discuss their experiences, ask colleagues for advice, and share their reports. Using Teams has proved particularly valuable in maintaining group cohesion given the difficulty in arranging meetings due to colleagues being spread across the service, time pressures from other work and the geographically distributed nature of our campuses. Teams has been used to share training resources such as articles, YouTube videos and webinars, and has been beneficial in quickly introducing newer colleagues to the project who were not employed with us at the beginning.

One Library Assistant involved in the project commented how informative the project had been in providing wider context to their work: "beyond the data I helped to collect in my front-line role, I was unaware of how much data the library collects altogether, what kinds of areas this data covers, and the extent to which it influences decision-making", and that "working with the data this side has made the actual data collection I help with more meaningful".

One of the most beneficial outcomes of the work has been the growth in confidence across the team in using PowerBI. With colleagues in the group taking their experience back to their own teams, PowerBI reports have become the standard across the service which has led to the wider LLR staff becoming familiar with navigating data visualisation. Parallel to

the project, the University has adopted PowerBI more widely for central reporting and the experience gained through the widespread use of LLR PowerBI reports has enabled our staff to more confidently interact with and interrogate University level data, such as student demographics, giving a greater understanding of our user base to ensure we align our service provision with our student body and academic curriculum. Our Executive Head of LLR reflected on this: "being able to share data in PowerBI… aligns with how data is visualised across the University, so aligns with wider strategic direction of travel".

Our Executive Head of LLR also recognised the value of the project in raising the profile of the service as a whole: "by being able to share the data via PowerBI, we have highlighted the skills and expertise of the team, and in doing so advocating for the position and role of the service within the Institution, as well as the individuals within the team".

Extending access to service insights

One benefit derived from the project is the ability to extend access to insights on performance of our services more widely. Prior to the project, providing access to data outside of the LLR team would involve either screenshots of static charts or additional manual work, since access to metrics were controlled within proprietary systems. While it is possible to create dashboards within the Analytics package of our Alma LMS, for example, users require specific login permissions within Alma to access these. Likewise, providing access to any data held outside of Alma would require separate access permissions to be set on a different system, such as the interfaces for our resource providers.

Through this project, we have been able to automate reporting from many third-party systems, with data being sent to us regularly through scheduled emails, then being processed automatically via Power Automate to be stored on our data group Sharepoint. We can then point PowerBI at Sharepoint as a source for datasets from third-party resource providers and provide access to relevant reports within PowerBI. Individuals or groups of staff external to LLR can access these via single sign-on with their UWTSD account without requiring any access to source

systems or manual account creation. Our Head of Customer Services has valued the ability to combine datasets in a single place: "by combining data from different sources (feedback, usage data, enquiry data), it can help us spot patterns or service gaps not obvious from individual reports".

As well as sharing individual PowerBI reports, we have created a Library and Learning Resources PowerBI app, which hosts key reports from across the service in one single place. The app features pre-existing PowerBI reports and can be modified to remove or add new reports. Permissions can be set to allow different user groups access to different reports through the app, with external users receiving access to a smaller range of high-level reports and internal users receiving access to more granular data to help with day-to-day work activities.

Collating data in this way also allows for consistency of reporting. We have set up PowerBI templates using our Library and Learning Resources branding, to give a consistent visual look and feel to our dashboards, and for these to integrate well with other LLR communications. Adopting a standard template also allows users to quickly navigate reports using a familiar interface. Our Archives and Records Assistant, who has learned to create visualisations within PowerBI through the project group, reflected on the value of this: "for our team it has been useful to visually present the information in an easy user-friendly way. I think this helps give the data more meaning because it makes it easier to interpret".

Initial use cases

Initial PowerBI reports produced by the group focussed on data which was previously collated manually: visitor numbers and head counts for our campus libraries, uptake of our information and digital skills training (Figure 1), and user enquiries. These have helped to demonstrate the value of the service and provided evidence to justify recruitment of new and replacement staff roles in a visually engaging way.

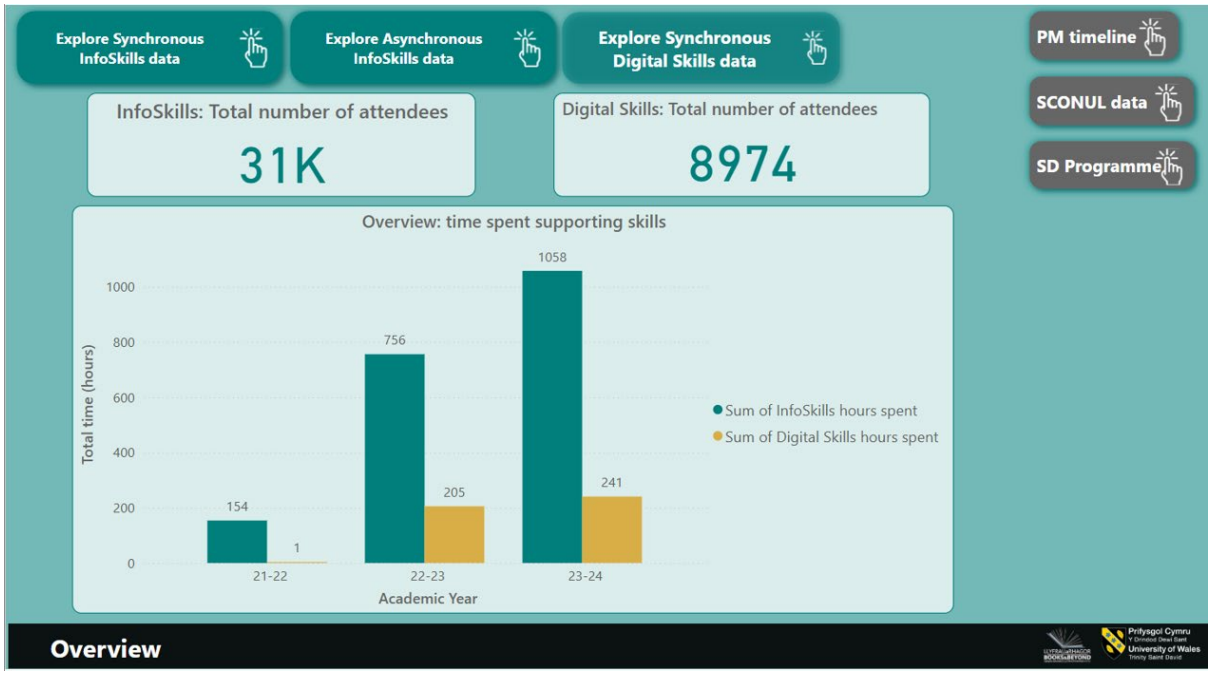

Figure 1: PowerBI dashboard monitoring skills training

Our Customer Services team have recently attained the Customer Service Excellence Award and felt that the data gathered through the project supports the team's overall goal of continuous service improvement, helping to monitor services and gather evidence for Customer Service Excellence reviews and assessments. Our Head of Customer Services commented that the use of dashboards "show and track customer satisfaction ratings and pick up any issues" and "provide evidence if we have anecdotal feedback of something not working or working well" (see Figure 2).

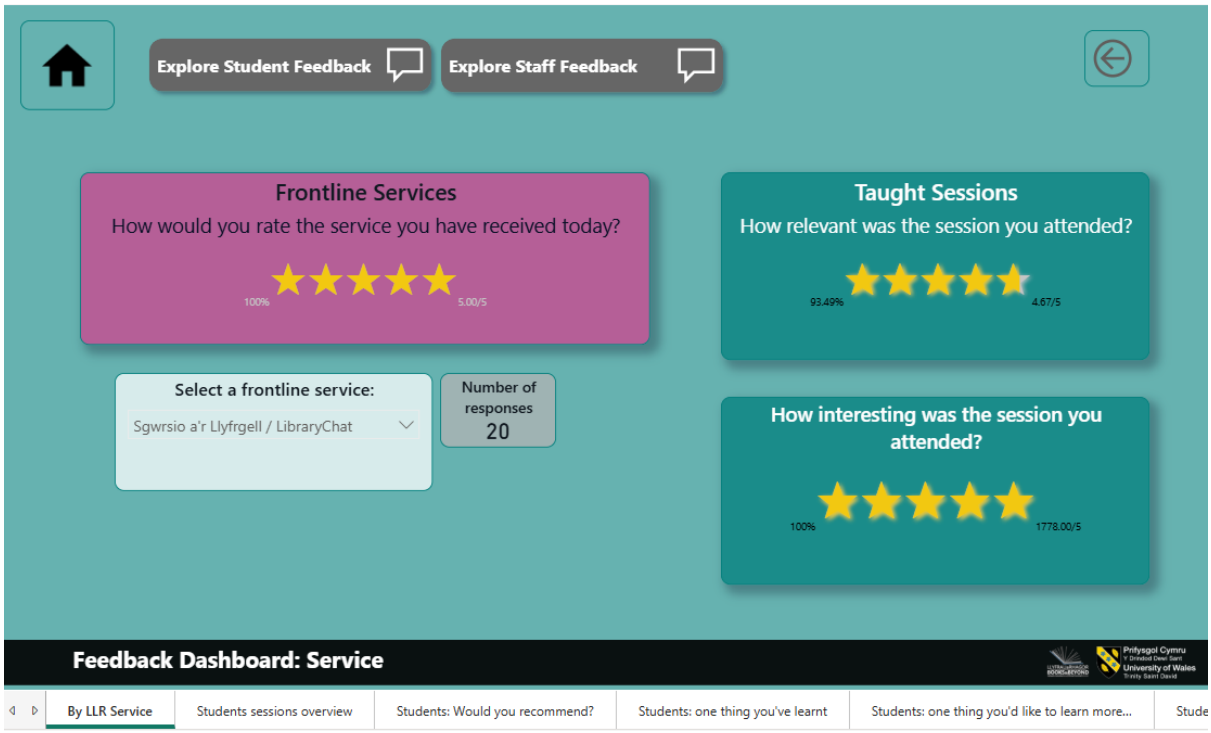

Figure 2: PowerBI dashboard for cross-service feedback

Reporting on our collections was already established in Alma Analytics, however key reports were migrated to PowerBI in 2022-23, particularly on resource usage. New reports were created to support the rollout of the Leganto reading list software and associated purchase requests generated by the system for new resources. These reports track the number of requests received, accepted and rejected each month (Figure 3), and have been particularly useful for monitoring pressures on acquisitions staff at busy times and visualising the impact of the delay in receiving our annual resources budget at the start of the academic year, as well as ensuring value for money.

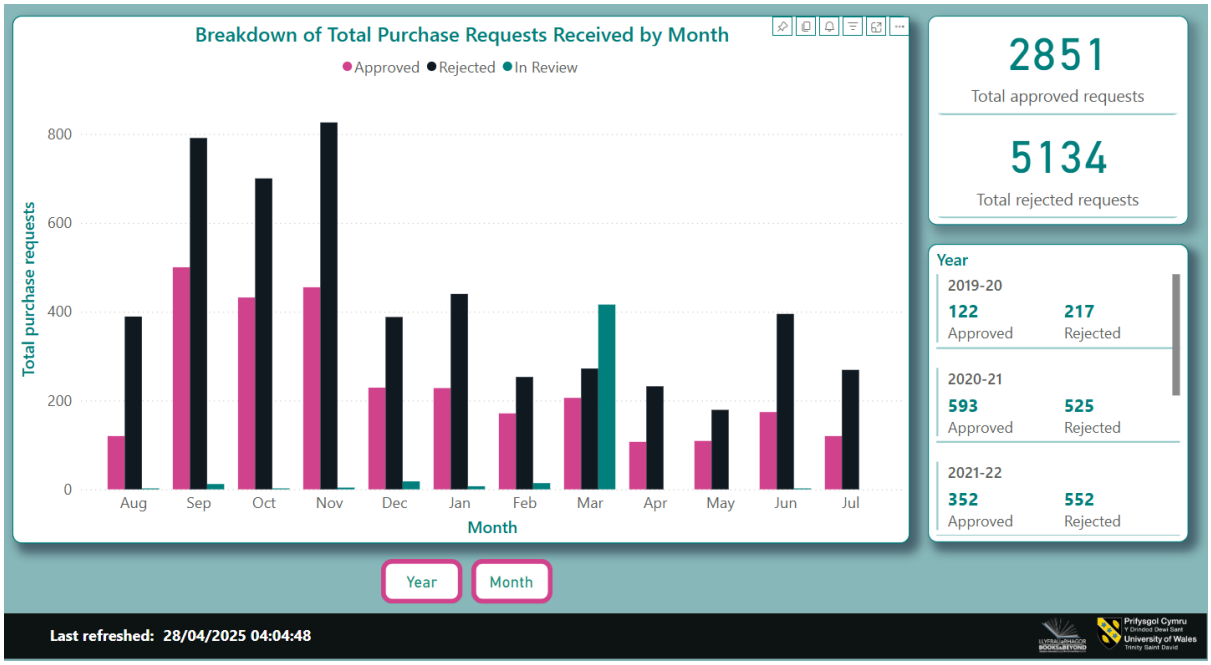

Figure 3: PowerBI report monitoring purchase requests

We have also taken advantage of PowerBI to report on aspects of the service which were previously difficult. Open access is one such area: we are required to regularly report on compliance of deposits to our Research Repository with the REF Open Access Policy[4] and need to monitor deposits of electronic theses and dissertations. Previously, this was managed on an ad-hoc basis through the manual download of a compliance report within Eprints; we have now been able to connect Eprints as a data source within PowerBI and create reports which refresh automatically on a twice-weekly basis and capture a much wider range of interaction with open access research and publishing, while also monitoring REF compliance (Figures 4,5).

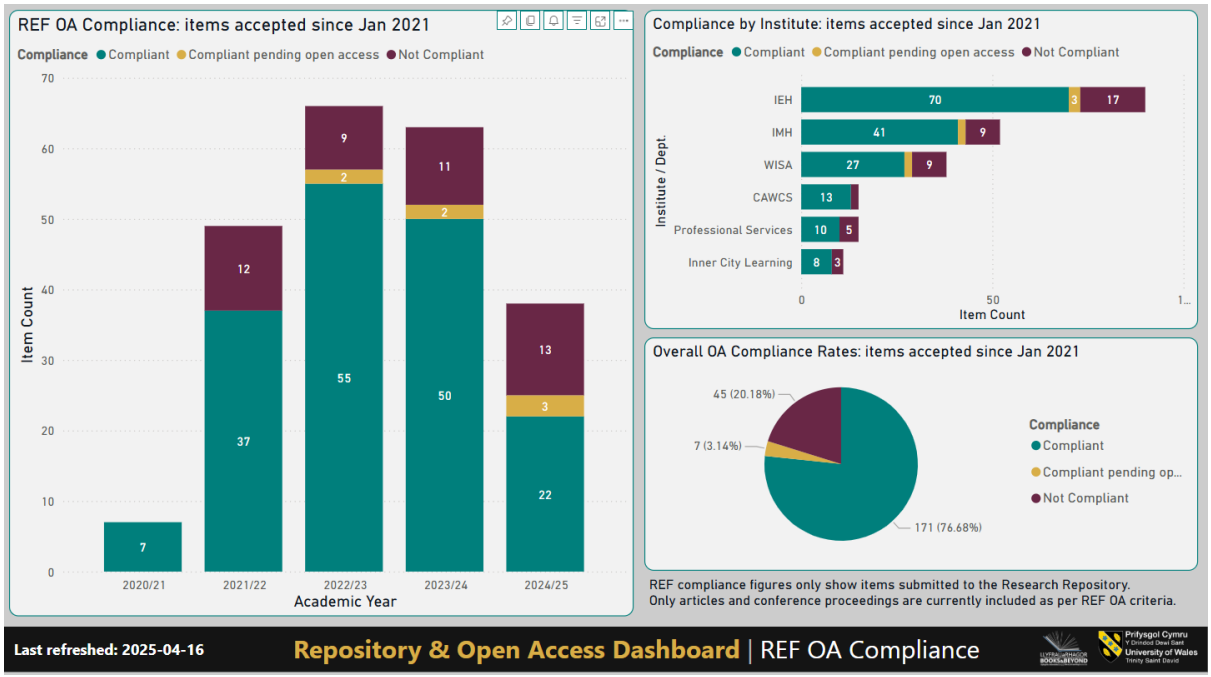

Figure 4: PowerBI report measuring REF Open Access compliance

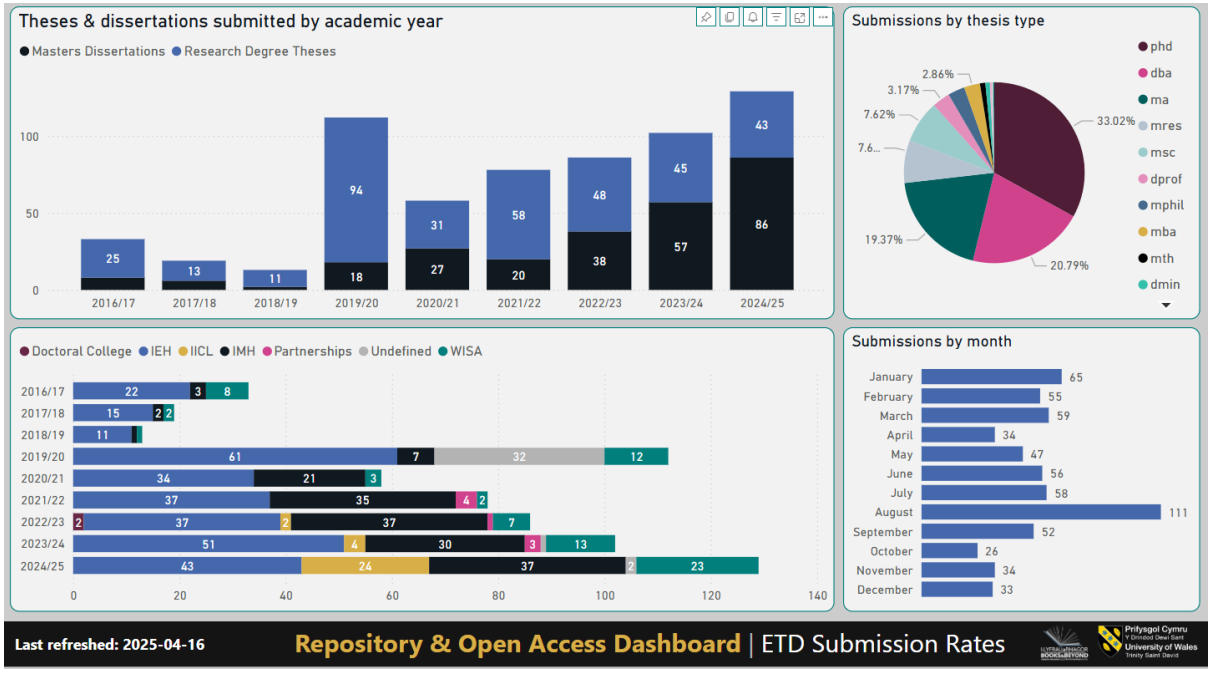

Figure 5: PowerBI report monitoring theses and dissertation submission

Another such area is records management; our Special Collections and Archives team have created dashboards to monitor records management training activity among university staff (Figure 6).

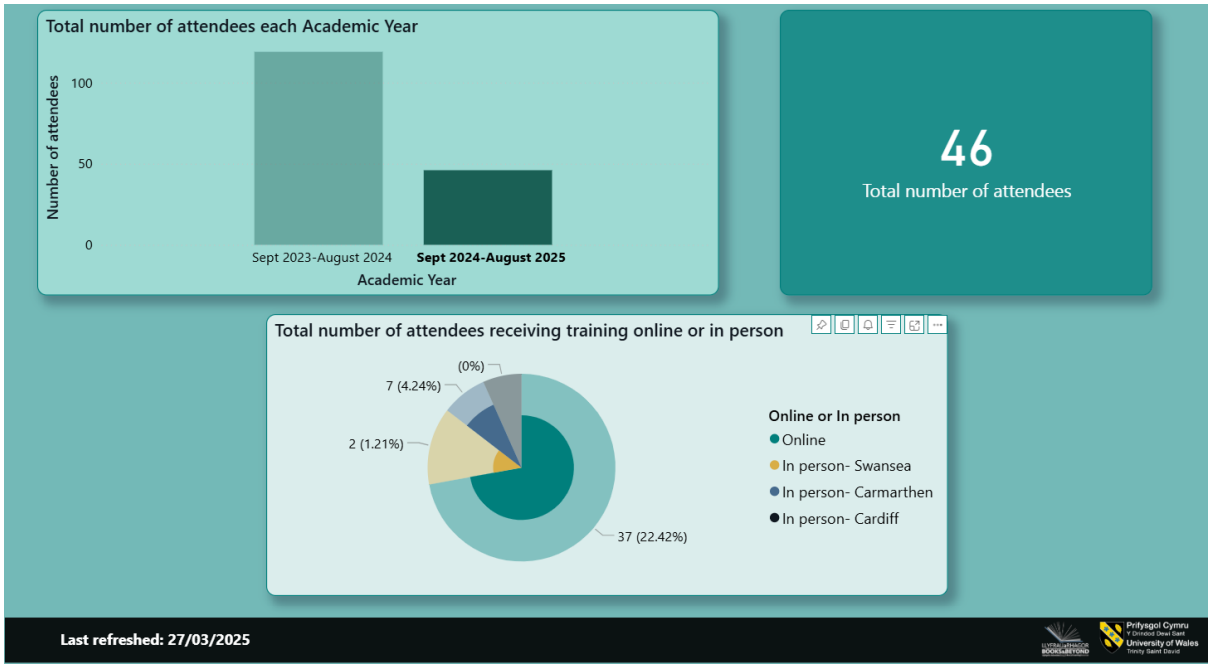

Figure 6: PowerBI report for records management training activity

The project has also enabled us to respond to survey data more effectively: we can now use our own data on library engagement and development opportunities in response to our UK National Student Survey[5] results to pinpoint areas for development and highlight possible reasons for success. In 2024, our NSS score for library resources rose to its highest level since the current LLR service was introduced in 2016.

Lessons learned

While there have been many positive outcomes to the project, there have been several challenges along the way. Despite our intention to set up everything as effectively as possible from scratch, access permissions have still caused several problems. Most of these have occurred where staff outside of the core project group have been tasked with reviewing or updating source data and have been easily resolved with no impact on security. As the project has progressed, however, we have started linking reports together using the data from one report as the source for another report, and this has led to more complex permissions issues. In addition, granting access outside the University to colleagues with no PowerBI licence has been challenging; in doing work with other Welsh libraries, we have discovered that a recipient's ability to view a PowerBI dashboard can

depend on the availability and type of PowerBI licences at both host's and recipient's institution. We would like to publicly publish a dashboard of metrics on our compliance with our Customer Service Standards and this has not been possible to date with the PowerBI licence we hold.

While bringing together a wide range of staff across different areas of the service has worked well for development and cross-team communication, this has led to other challenges. With people working in different teams and at different levels, arranging face-to-face meetings with everybody present has been difficult and, after the initial enthusiasm for the project had reverted to 'business as usual', other priorities quickly took over. Using Microsoft Teams has helped to maintain a sense of project cohesion and given team members an opportunity to 'touch base' with colleagues, however inconsistencies have emerged as people have been learning at their own pace and starting from different points with varying experience working with data. Some colleagues have forged ahead with reporting in their areas, while others have found learning PowerBI to be more challenging. This has particularly been the case where changes in staffing have resulted in new colleagues joining with limited experience of data handling and visualisation who have inherited reports which require modification. Despite enthusiasm from across the whole service, some of the more complex challenges have fallen on more experienced staff to resolve, and the passage of time has led to a smaller, more focussed group of interested users.

Another challenging aspect of the work has been maintaining our reporting practices: inevitably, as we have learned more about PowerBI and data visualisation, we have wanted to further improve our data collection to make best use of the features available. Making changes to live Microsoft Forms has proved difficult, for example: Forms can create a new spreadsheet to record entries if changes are made to a live form template, leading to data being stored in separate source files.

Another example is our Eprints Research Repository: the Eprints data refresh to PowerBI failed due to changes in underlying database table structures after our hosting provider upgraded Eprints to the latest

version in Autumn 2024. While we had expected to spend time at the beginning of the project refining our practices to work effectively using PowerBI, we underestimated the amount of time and technical knowledge required to maintain data sources after 'go live' in August 2022.

Recent developments and next steps

The University is currently going through a period of significant change and, as a result, work on the project stalled during 2024 due to competing priorities. As of Spring 2025, work is underway to revisit the project and transform the group into an ongoing community of practice to support 'business as usual' activity across the service.

In December 2024, a survey was circulated to group members to capture current skills and future training needs. Recognising that staff require different skills depending on their work, a role-based approach was taken, with colleagues divided into 3 categories: data creator, for staff whose role requires the creation or manipulation of source data; visualisation creator, for staff who use PowerBI to analyse data and create visualisations; and strategic, for staff in leadership and management roles who are end-users of PowerBI reports and use and interpret the data to inform development of our services.

Survey results demonstrated a range of knowledge and experience across group members, with the greatest confidence reported in creating Microsoft Forms, creating basic PowerBI reports and publishing these to the project workspace. Members reported less confidence in using DAX queries and accessibility features in PowerBI. Members were also asked to report on training sources used for relevant personal development outside of the group, with YouTube videos being the most frequently used resource, followed by dedicated external PowerBI webinars.

The results of the survey will help to inform development of a self-directed training resource, which is intended both for existing group members to build on their skills, and to help new members joining the group in future to quickly build up their knowledge. The training is likely to focus on a combination of Microsoft training resources, freely available web resources such as YouTube videos, resources available through

University subscriptions such as LinkedIn Learning, and material available within the Library's collections. Completion of part of this training is likely to be a pre-requisite for new members wishing to join the group in future to ensure a basic level of understanding.

Conclusion

Consolidating our data across the service using a visualisation tool has not been without significant work and challenges but has proved beneficial in many ways. As well as providing us with a greater insight into our services and reducing the need for ad-hoc manual reporting, it has enabled us to share data outside of the Library more effectively to proactively advocate for our service and provided staff with an opportunity to collaborate across teams and develop valuable skills in data literacy, analytics and visualisation.

Our experience working on this project has highlighted the importance of adaptability, with improvements to data collection, updates to source systems and staffing changes requiring ongoing attention to maintain automated reporting successfully. While we are still learning the most effective ways of using it, PowerBI has lost its novelty and is rapidly becoming just another tool in our day-to-day work, like our Alma LMS, Excel and Word. Over three years on, we now wonder how we ever managed without it!

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[3] https://whelf.ac.uk/
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