

## **IMU Moodle-Based Library Portal: its Impact on the Librarians and Users at IMU University**

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### **Abstract**

This paper introduces an innovative Moodle-based library portal at IMU University, emphasising its transformative impact on librarian empowerment and student engagement in online learning environments. Functioning as a comprehensive hub for library resources, the portal integrates seamlessly into the university's digital learning ecosystem. Developed through collaboration among librarians, IT specialists, students, and faculty, it effectively addresses the diverse needs of the academic community. Key findings reveal that user feedback highlights the portal's user-friendliness, efficiency in resource retrieval, and a significant reduction in reliance on librarian assistance, indicating that students can navigate resources independently. Additionally, the portal's dynamic features such as interactive guides, adaptive quizzes, and podcast integration enhance the learning experience, fostering greater engagement with library resources. The paper concludes that the Moodle-based library portal is not merely a technological advancement; it is crucial for promoting information literacy and supporting academic success. By facilitating self-directed learning and minimising barriers to resource access, the portal enriches the educational experience and aligns with the broader objectives of the academic community. These findings provide a valuable framework for other libraries considering the adoption of Moodle as their library portal platform.

*Keywords: Moodle, library portal, online education, collaborative learning, information literacy, user engagement*

### **Introduction**

The digital transformation of education has prompted institutions like IMU University to adopt innovative technologies to enhance learning and resource accessibility. One such initiative is the implementation of a Moodle-based library portal, designed to streamline access to library resources and foster collaborative learning. This paper provides a comprehensive overview of IMU University Library's journey in adopting and leveraging the Moodle-based library portal to enhance online education.

The introduction of the Moodle-based library portal represents a significant advancement in the service capabilities of IMU University Library. Conceived and deployed in 2021, this innovative platform is a testament to the collaborative efforts of librarians, IT professionals, students, and faculty members. Through meticulous design and development, the portal has been tailored to effectively address the diverse needs of the university community.

Utilising Moodle's open-source infrastructure offers multifaceted benefits, as a cornerstone for optimising library operations. Firstly, it acts as a centralised hub for librarian training, providing a cohesive platform for skill development and knowledge dissemination. Additionally, the portal streamlines administrative tasks, empowering librarians to focus more on core responsibilities. Moreover, it fosters seamless communication and collaboration among

librarians and users, creating an enriched academic environment with shared knowledge and expertise.

This paper addresses the following research questions: What are the key features and benefits of the Moodle-based library portal at IMU University? How has the portal impacted user engagement and librarian effectiveness? What challenges were faced during its implementation, and what recommendations can be made for future enhancements? By exploring these questions, this paper aims to provide insights into the effectiveness of the Moodle-based library portal in supporting online education and fostering information literacy.

### Integration of Moodle in Library Services

IMU University's adoption of Moodle as the foundation for its library portal is driven by the platform's adaptability and versatility in accommodating diverse pedagogical methodologies. The integration of library resources within Moodle courses facilitates seamless access for students and faculty, promoting collaboration between the library and academic programmes. The Moodle-based library portal serves as a beacon of knowledge with its multifaceted nature, by highlighting its dynamic collection of E-books, E-journals, online databases, videos, and interactive modules.

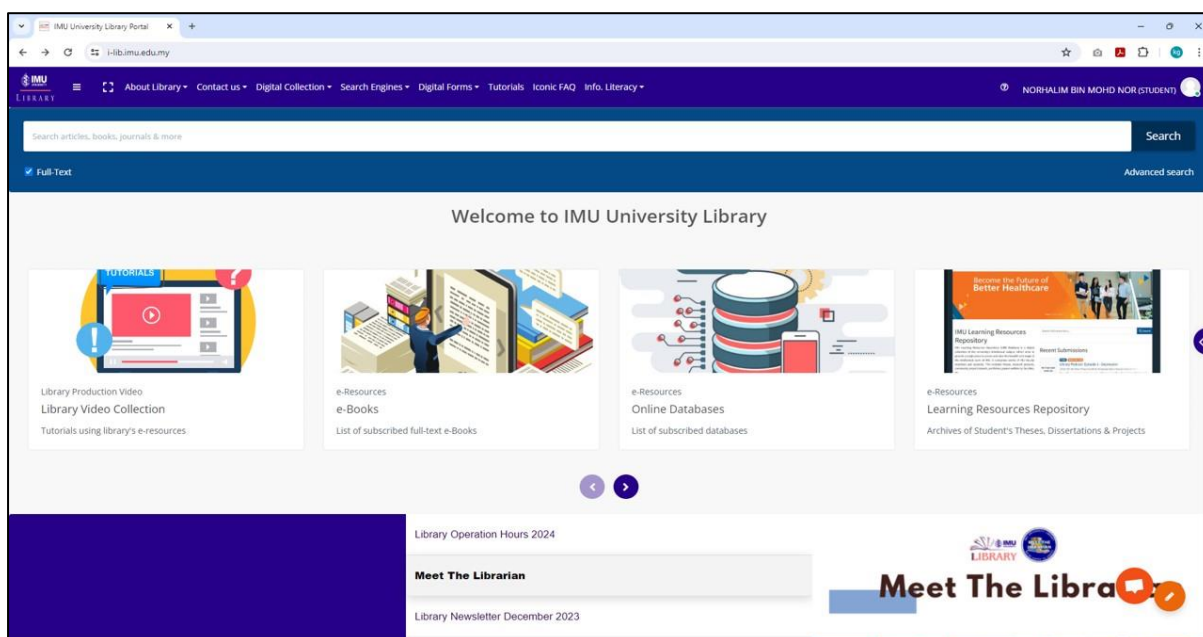


Image 1: Landing Page of IMU University Moodle-Based Library Portal

### Why IMU University Library uses Moodle as its Portal Platform

#### 1. Comparative Analysis

In the selection of a Learning Management System (LMS), IMU University Library evaluated various platforms before identifying Moodle as the most fitting option, primarily due to its robust features specifically designed for educational contexts. A comparative study by Georgieva M. (2024) highlights the advantages of Moodle in contrast to other LMSs such as Canvas, TalentLMS, Blackboard Learn, D2L Brightspace, Schoology, and Docebo.

Moodle stands out for its extensive flexibility and customisation options that are available at no cost. In comparison, Canvas offers a user-friendly interface and mobile application, but charges for advanced functionalities. TalentLMS, while appealing to small- and mid-sized businesses with its gamification tools, does not match Moodle's intuitive design.

In addition, Blackboard Learn and D2L Brightspace provide comprehensive features suitable for large institutions but often involve complexities and higher costs. Schoology caters primarily to K-12 and higher education yet lacks the customisation capabilities that Moodle supports. Docebo focusses on corporate training, emphasising multimedia integration but falls short in the educational features that Moodle excels in.

The study by Kampa (2017) revealed that libraries are often underrepresented within E-learning platforms. They proposed that library resources could be effectively integrated using either macro or micro methods. This insight guided IMU University librarians in their approach to designing a Moodle-based library portal.

An evaluative study by Kumar & Yadav (2020) on the efficiency of library portals in Indian universities provided additional recommendations for features to incorporate into the IMU University Library Portal. The choice of Moodle is particularly beneficial for IMU University as it accommodates a range of pedagogical approaches. By merging the macro and micro integration methods suggested by Kampa & Kaushik (2016), IMU University librarians developed a tailored Moodle-based library portal. This open-source platform facilitates seamless integration with other educational tools, creating a centralised hub for librarian training, improving administrative processes, as well as fostering collaboration between librarians and users.

Research by Hasan (2018) on student perceptions of Moodle's features and usability further informed the design of the library portal. By embedding library resource blocks directly within Moodle courses, students gain easy access to subject-specific materials without disrupting their online learning experience. This cohesive integration of features and flexibility reinforces Moodle's status as the optimal LMS for the IMU University Library.

To our knowledge, no other library in Southeast Asia has implemented Moodle as a portal-based solution. While some institutions may utilise Moodle for E-learning, they typically do not incorporate library resources as a core component. This gap underscores the innovative nature of IMU University Library's initiative, establishing it as a pioneer in this domain. By adopting Moodle, IMU University Library not only enhances its service delivery but also sets a benchmark that could encourage other institutions in the region to pursue similar advancements.

## 2. **Innovative Features and User Experience**

At IMU University, librarians have embraced a transformative role by actively participating in online instruction through the Moodle platform. The Moodle-based library portal is equipped with an array of innovative features such as interactive guides,

adaptive quizzes, and podcast integration. These tools are meticulously designed to enhance user experience and foster information literacy thus enabling students to tailor their educational journeys and engage with resources in a variety of formats that accommodate diverse learning styles.

The primary objective of the IMU University Library Portal is to enrich students' learning experiences through intuitive interfaces and straightforward navigation. By offering a comprehensive array of educational resources, as exemplified in *Images 2* and *3* below, the portal acts as a reliable companion in students' academic endeavours. Whether they are pursuing foundational knowledge or exploring advanced subjects, the portal provides a rich assortment of resources to meet varied learning needs. From novice learners to seasoned scholars, all users of the IMU University Library find invaluable support within the Moodle-based library portal, enhancing their educational experience and promoting academic excellence.

Before launching the Moodle-Based library portal officially in 2021, librarians conducted a two-month pilot test to gather insights and feedback. The input collected from IMU University students and faculty via the Library Feedback Form has been instrumental in illustrating the practical application of these features. Below are samples of the feedback received, which the librarians utilised to refine the portal's design and functionality:

- a. **User-Friendly Navigation:** "The i-lib portal is quite user-friendly, but I suggest adding an icon on the homepage that scrolls directly to the bottom, allowing students to quickly glance through the entire page upon entry. Additionally, the left side of the homepage appears empty; toolbars or search engines could be beneficial there."
- b. **Clarification on Booking Form:** "I am curious whether the entrance booking form applies to all IMU libraries or just the BJ main library. It would be more convenient to include a selection of locations (e.g., Seremban) and specify options based on those locations (e.g., Collaboration Room, Discussion Room, Computer Lab)."
- c. **Venue Separation in Booking:** "For the Library Entrance Booking Form, I recommend separating booking venues based on BJ and clinical campuses (Seremban, Kuala Pilah, Kluang, Batu Pahat) so that students in clinical settings can easily select their desired venue. The other forms are well-designed."
- d. **Interface Suggestions:** "For the interface, I propose using the IMU E-learn portal as a reference since most of us are familiar with its functionality. For instance, the currently empty menu could feature icons linking to external pages such as the dashboard, home, forms, timetables, and a chat box with a library E-assistant. This would simplify and declutter the main page, making the FAQ button redundant."
- e. **Prominent Display of Library Hours:** "Library opening hours could be displayed more prominently, perhaps on the left sidebar of the homepage. Overall, the other functions are well-executed."
- f. **Overall Impressions:**  
 "The interface is lively and user-friendly, with comprehensive add-ins."  
 "The IMU Library website is easy to navigate, and I appreciate how simple it is to explore the library."

This constructive feedback has been instrumental in guiding the continuous improvement of the IMU University Moodle-Based Library Portal, ensuring it remains a vital resource for all students.

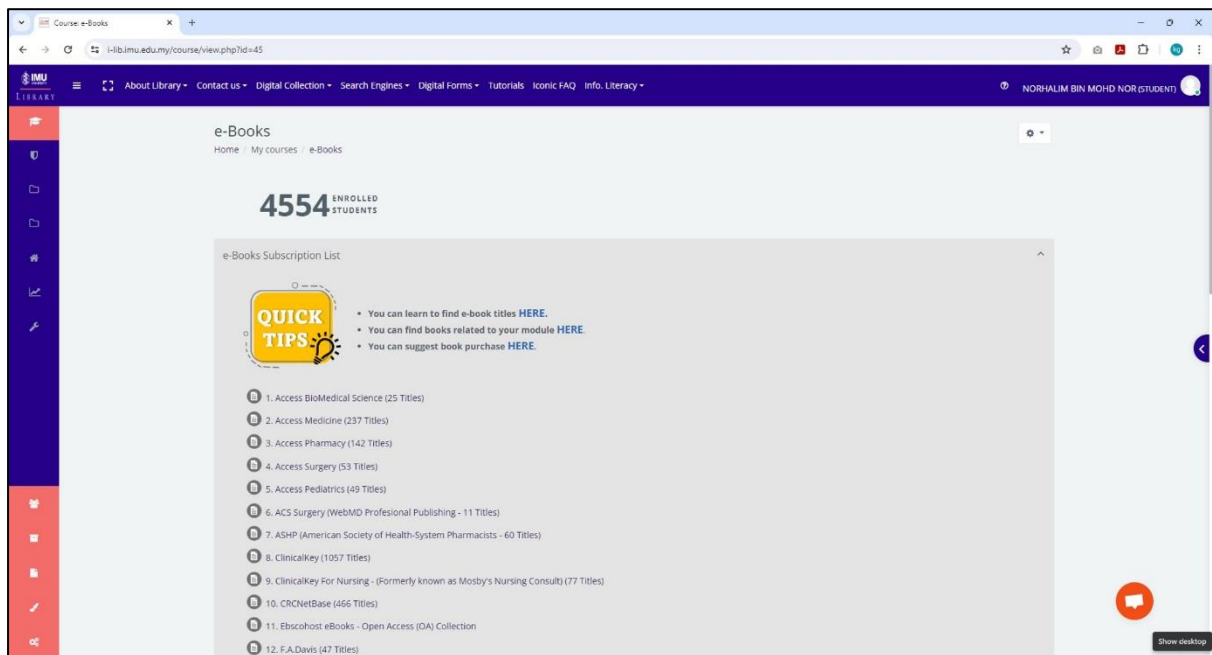


Image 2: Gateway to the E-books within the Moodle-based Library Portal

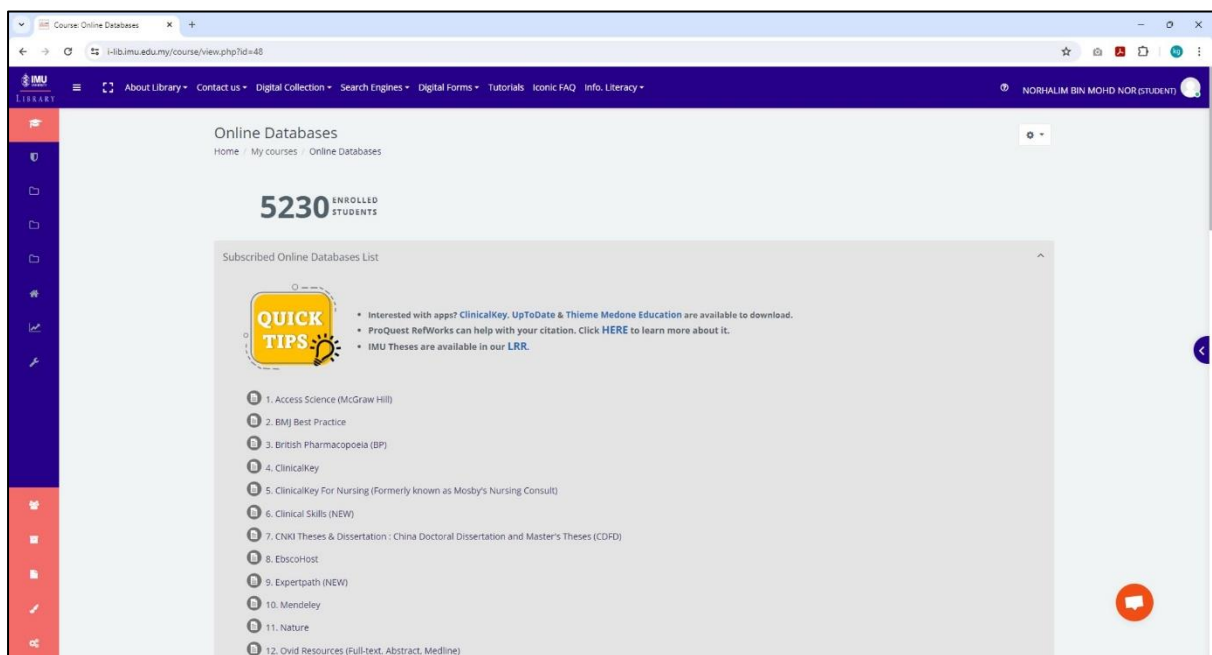


Image 3: Gateway to the Online Databases within the Moodle-based Library Portal

The IMU University librarians strategically leveraged the Moodle-based library portal as a dynamic promotional platform. Through this medium, they disseminated visually engaging posters spotlighting a range of library initiatives and events such as announcements for forthcoming workshops, updates on the annual online Knowledge Challenge, and informative highlights on newly introduced platform interface features. Image 4 is a sample of an announcement:

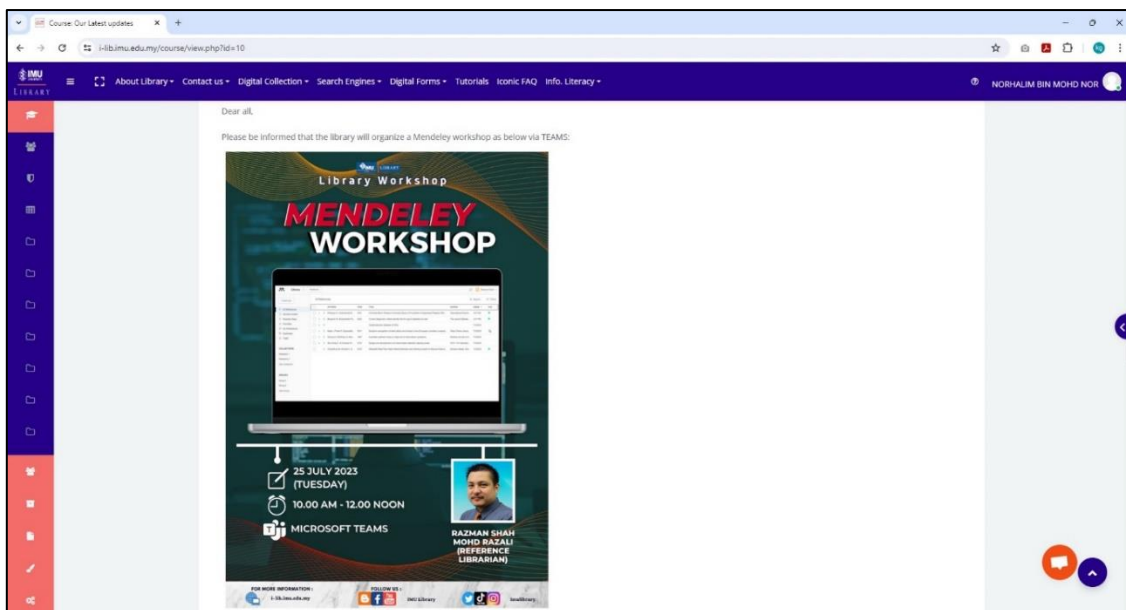


Image 4: Example of Announcement of Upcoming Workshop within the Library Portal

The Moodle-based library portal at IMU University empowers students to customise their learning journeys according to their individual preferences and requirements. With its capacity to host a rich variety of learning resources in diverse formats—ranging from text documents to videos, interactive simulations, quizzes, and visually engaging Frequently Asked Questions (FAQs) developed using Articulate Storyline 360, the portal caters to a broad spectrum of learning styles. *Image 5* shows a sample of interactive and engaging FAQs on the IMU University Moodle-based library portal which also serves as an interactive guide.

These guides serve as indispensable tools for students and other library users, facilitating effortless navigation of the portal to access their desired learning materials.

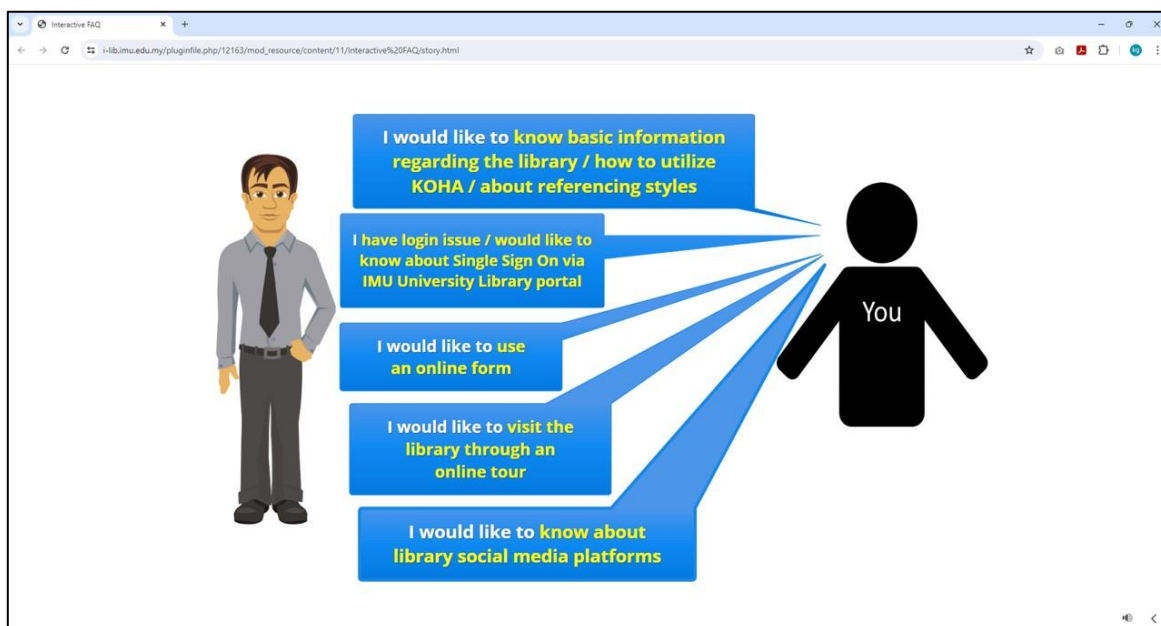
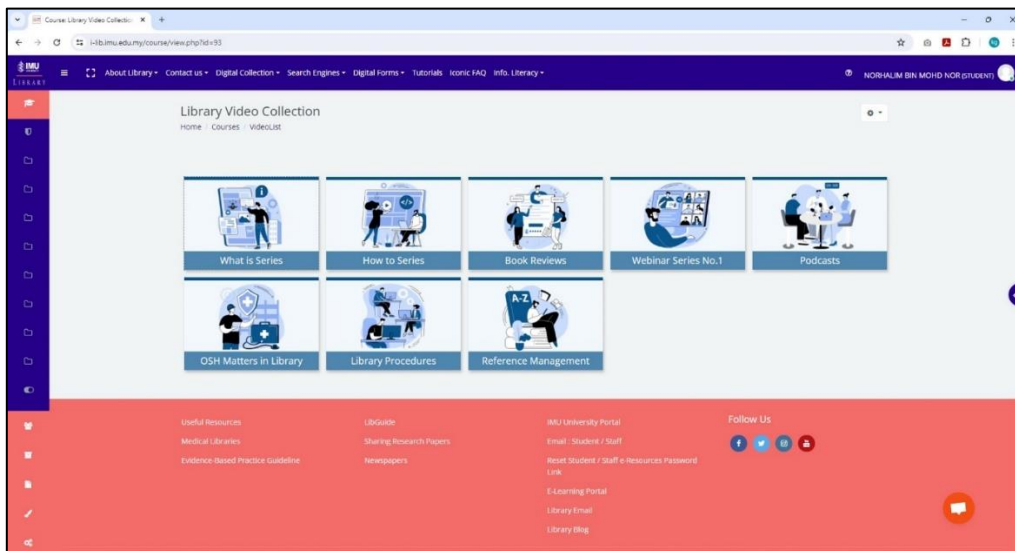


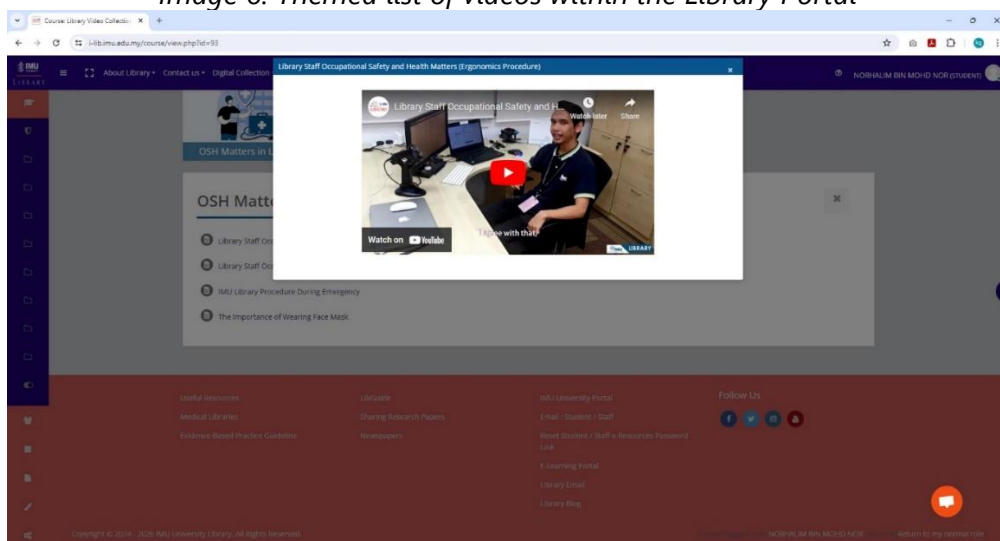
Image 5: Frequently Ask Questions (FAQ) within the Library Portal

When students face challenges in grasping specific topics, the quizzes, interactive guides, and videos meticulously developed by librarians on the Moodle-based library portal become invaluable resources. These tools not only enhance understanding but also allow students to progress at their own pace. The portal's inherent flexibility in self-paced learning accommodates diverse learning speeds, ensuring equitable access to educational resources and fostering an environment that supports academic success.

IMU University librarians have curated a comprehensive collection of over one hundred videos covering a wide range of themes, including 'Book Reviews,' a How to Series,' 'What is Series,' and an extensive guide on occupational safety and health, as depicted in *Image 6*. A notable feature of these videos is their seamless integration into the Moodle-based library portal. This integration allows users to access content directly without the need to visit external sites, ensuring a cohesive and user-friendly viewing experience. *Image 7* provides a screenshot of one of the embedded videos within the IMU Moodle-Based Library Portal.

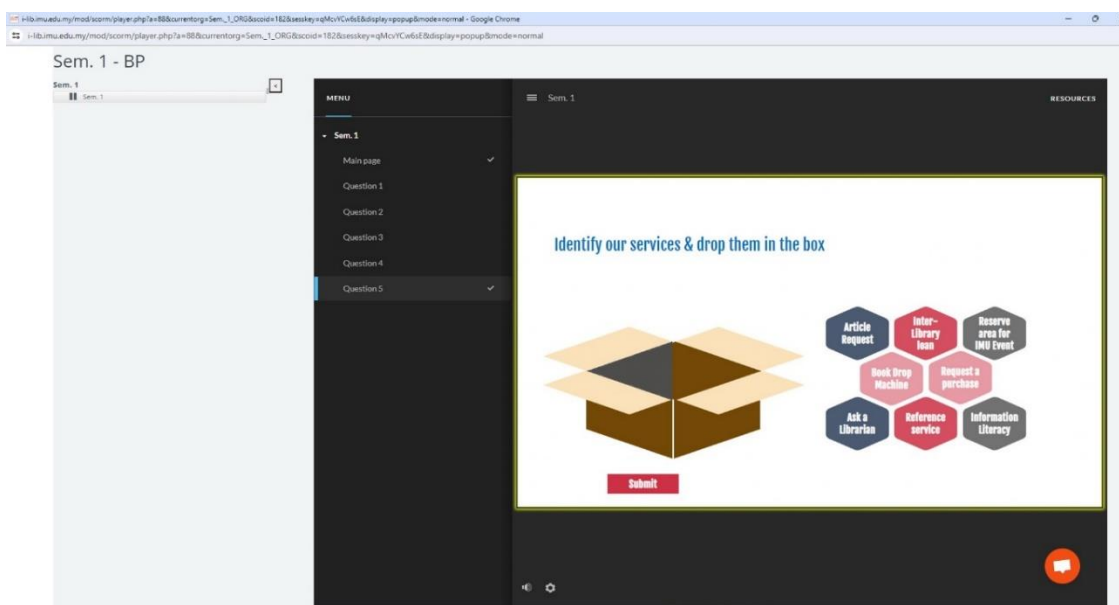


*Image 6: Themed list of videos within the Library Portal*



*Image 7: Sample of video embedded in Moodle-based Library Portal*

During IMU University's Media and Information Literacy sessions, librarians have seamlessly integrated adaptive and interactive quizzes into the Moodle-based library portal. These quizzes are meticulously designed to dynamically adjust their difficulty levels based on students' responses, showcasing a sophisticated approach to personalised learning. By employing this adaptive strategy, the quiz system intelligently tailors question sequences to match each student's performance level. Correct answers lead to progressively challenging questions, while incorrect responses prompt the presentation of more accessible inquiries. This personalised quiz experience not only optimises engagement but also cultivates deep knowledge retention among students, aligning with the educational standards upheld by IMU University. A sample of an interactive quiz question is shown in the *Image 8*:



*Image 8: Sample of Interactive Quiz within the Library Portal*

The IMU University librarians initiated a pioneering podcast project, augmented by interactive discussion forums, to nurture peer-to-peer learning since Quarter 2, 2023. This groundbreaking endeavour involved the creation and distribution of podcast episodes designed to facilitate the exchange of knowledge and collaborative learning among students. The accompanying discussion forums provided platforms for substantive discourse and knowledge interchange centred around the podcast themes. Through robust participation in these forums, students were spurred to share insights, engage in lively discussions, and collectively enhance their learning experience. This dynamic peer-to-peer learning environment significantly enriches the educational landscape, underscoring the innovative spirit at IMU University. The podcast sessions were recorded and published on the IMU University Moodle-based library portal to allow everyone to repeatedly listen and view the topics discussed. A sample of one of the podcasts posted on the Moodle-based IMU University Library Portal is shown in *Image 9*.



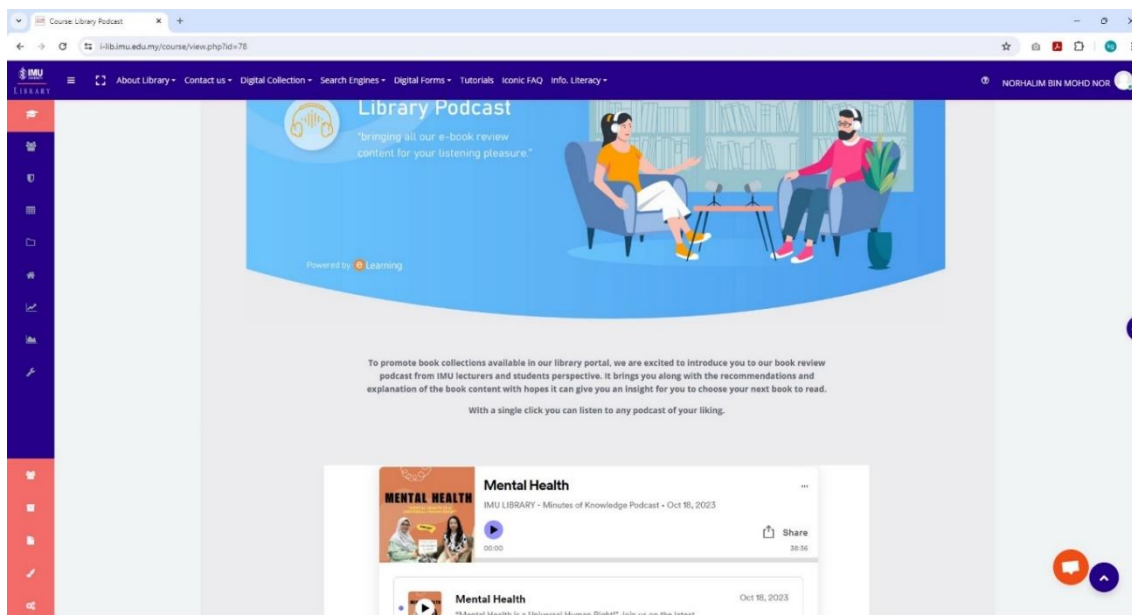


Image 9: Podcast within the Library Portal

The Moodle-based library portal at IMU University incorporates essential functionalities for monitoring and analysing students' progress. This encompasses advanced tracking tools utilised during self-paced individual learning sessions in the Media and Information Literacy programme. Each student's projects are meticulously recorded to assess their engagement with library resources. Image 10 shows a sample of the instructions for self-learning.

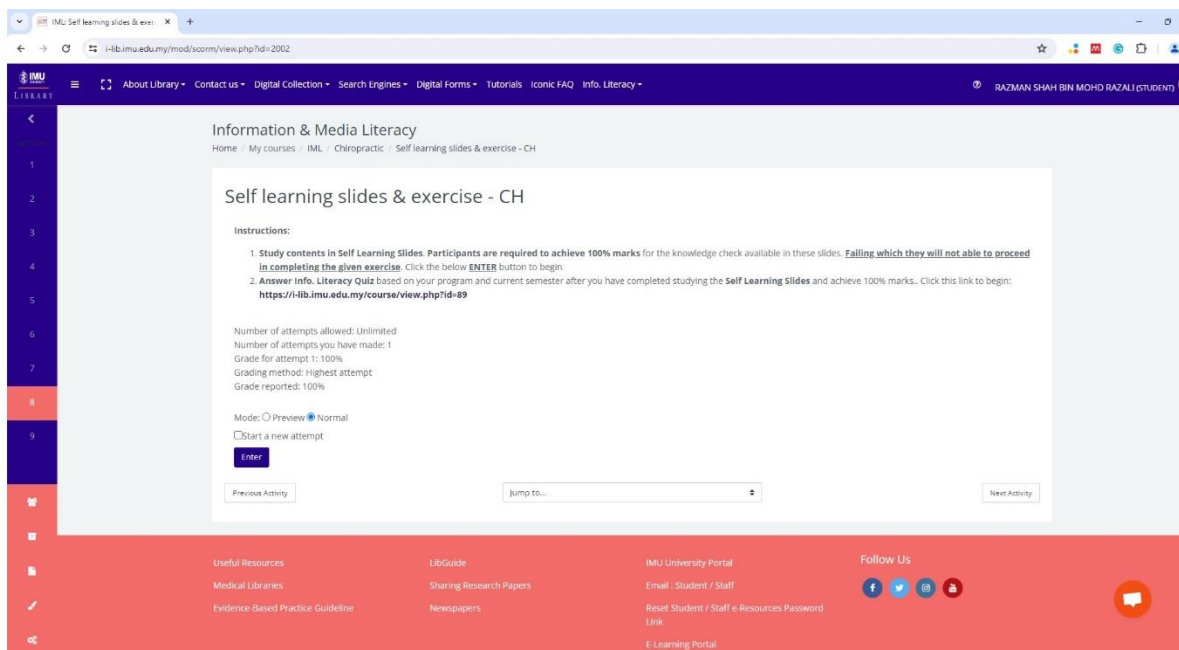


Image 10: Example of Self-Learning Exercise for Student

Upon completing each module in the Media and Information Literacy programme, students can view their progress on the landing page dedicated to Media and Information Literacy within the IMU Moodle-based library portal as shown in Image 11.

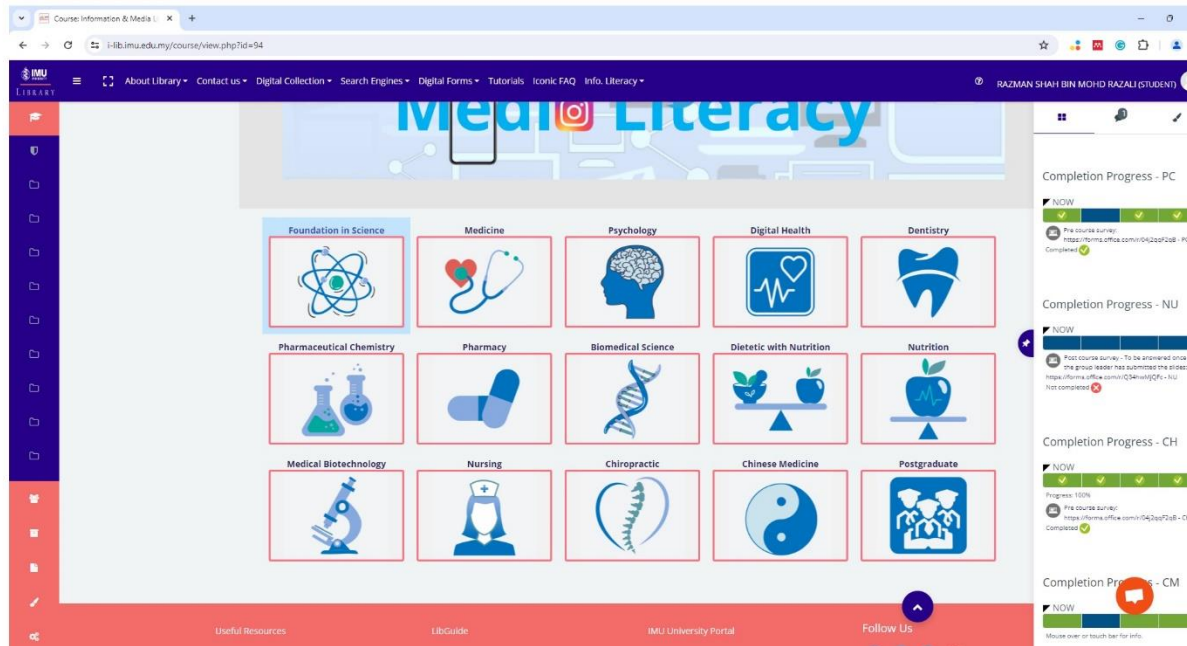


Image 11: Example of Students' Completion Progress

In 2023, the IMU University Library began generating data from its Moodle-based library portal dashboard. Through personalised learning data analysis, faculty members gain invaluable insights into individual students' engagement levels and usage patterns. *Image 12* is a sample of student engagement and resource usage patterns. This data-driven approach empowers faculty to identify areas requiring additional support, facilitating targeted interventions, and ultimately enhancing the overall learning experience. However, empirical evidence regarding the direct impact of this portal on student performance, specifically in terms of engagement with library resources, remains limited.

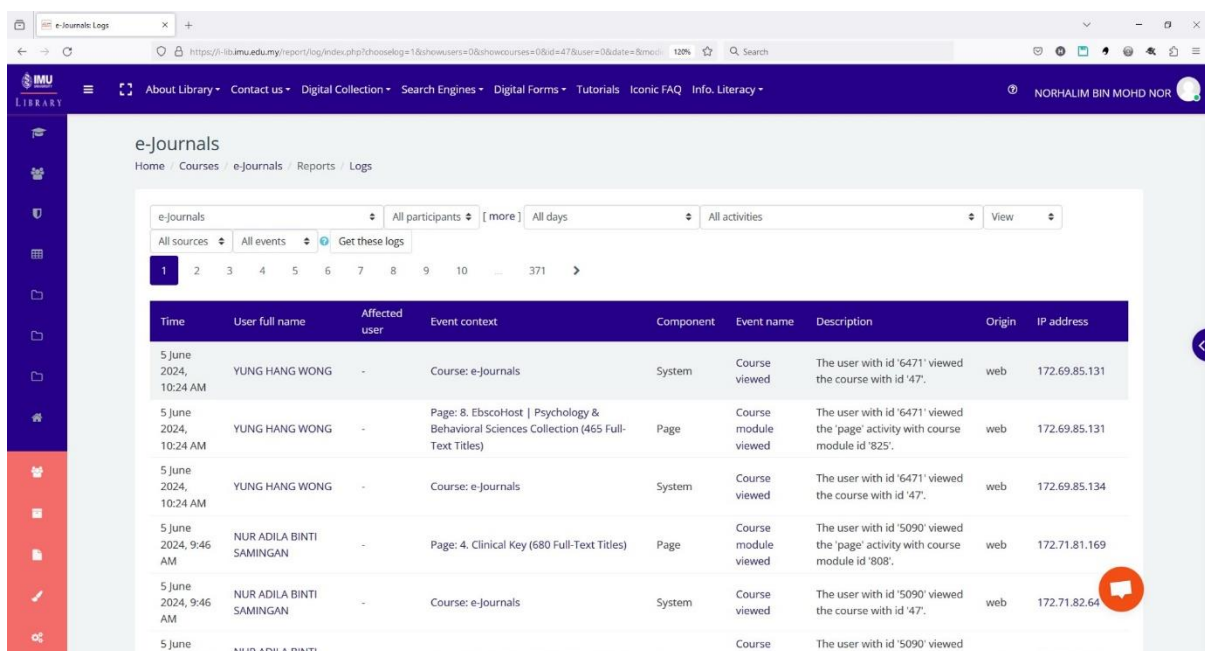


Image 12: Personalised Learning Analytic

### **Impact on the Librarians**

At IMU University, the integration of Moodle has empowered librarians to significantly expand their roles by creating and managing interactive content within the platform. This enhancement has improved user engagement and learning outcomes. A notable example is the development of information literacy tutorials that incorporate gamification elements, specifically designed to cultivate critical digital literacy skills among students.

To assess the effectiveness of these initiatives, a library user survey was conducted to gather empirical data regarding their experiences and satisfaction levels. The survey results indicated that 85% of respondents found the Moodle-based resources "very helpful" in enriching their learning experience, demonstrating a positive shift in user engagement. Additionally, narrative feedback underscored the value of librarian support, with comments such as, "The librarian was very patient and explained everything I wanted to know," highlighting the importance of personalised assistance in navigating digital resources. However, some users noted technical challenges, suggesting that while the service is generally satisfactory, improvements in the library portal's functionality are needed.

Moreover, the integration of Moodle has equipped librarians with vital data analysis tools, enabling them to generate tailored reports that inform decision-making. This data is essential for evaluating the impact of library services and for enhancing offerings to better meet users' needs. Notably, users reported streamlined access to resources and improved communication channels through integrated tools like Crisp Chat, leading to a reduced reliance on librarian assistance.

Overall, the evolution of librarianship at IMU University reflects a commitment to adapting to technological advancements and positioning librarians as educational partners. The combination of qualitative feedback and quantitative survey data offers a comprehensive perspective on the positive impacts on librarians and users alike, illustrating the effectiveness of this paradigm shift.

### **Impact on the Users**

The integration of Moodle with IMU University's library resources has transformed how students access subject-specific materials for their online courses. Continuous collaboration between IMU librarians and faculty ensures that library resources are regularly updated to meet the diverse needs of students across various disciplines. Referred to as Course Reserves in the university's library portal, as shown in *Image 13*, this integration serves as a crucial tool that directly connects students to relevant resources for their courses, thereby facilitating significant time savings and enhancing accessibility.

By eliminating the need to navigate multiple platforms, this streamlined approach enhances the user experience, increases efficiency, and allows students to focus more on their studies. The positive survey feedback also reflects this enhanced experience, as users have reported the resources to be "very helpful" and emphasised the supportive role of librarians. This user-centric approach ultimately fosters a more supportive learning environment, contributing to better academic outcomes for students.

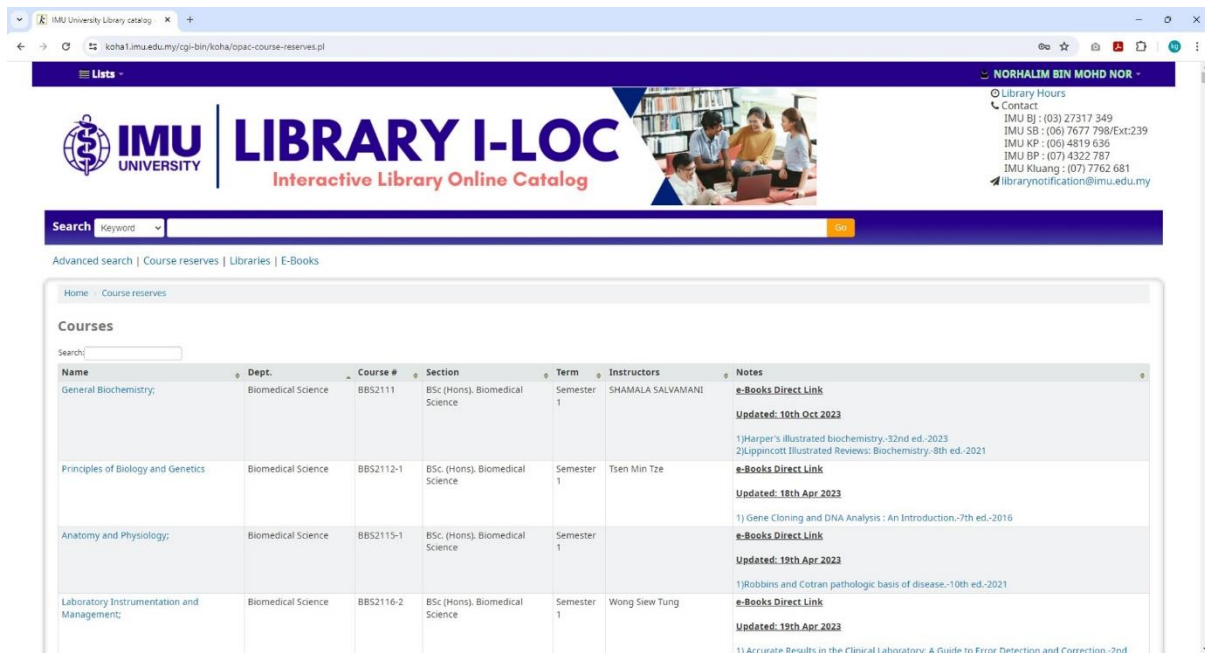


Image 13: Landing Page of the Course Reserves module within the Library Portal

### User Support and Guidance

Comprehensive manuals provide essential instructions for navigating the library system and accessing its resources effectively. A prime example is the "Guide to Access the Learning Resources Repository" shown in Image 14, which serves as an invaluable tool for users. This guide offers detailed, step-by-step instructions that empower users to fully utilise the system's features. By simplifying complex processes, these instructional materials significantly enhance the learning experience, allowing users to confidently and efficiently access a wide range of educational resources. Ultimately, this user-friendly support not only facilitates comprehension but also maximises the portal's capabilities, ensuring that students can leverage the library's offerings to their fullest potential.

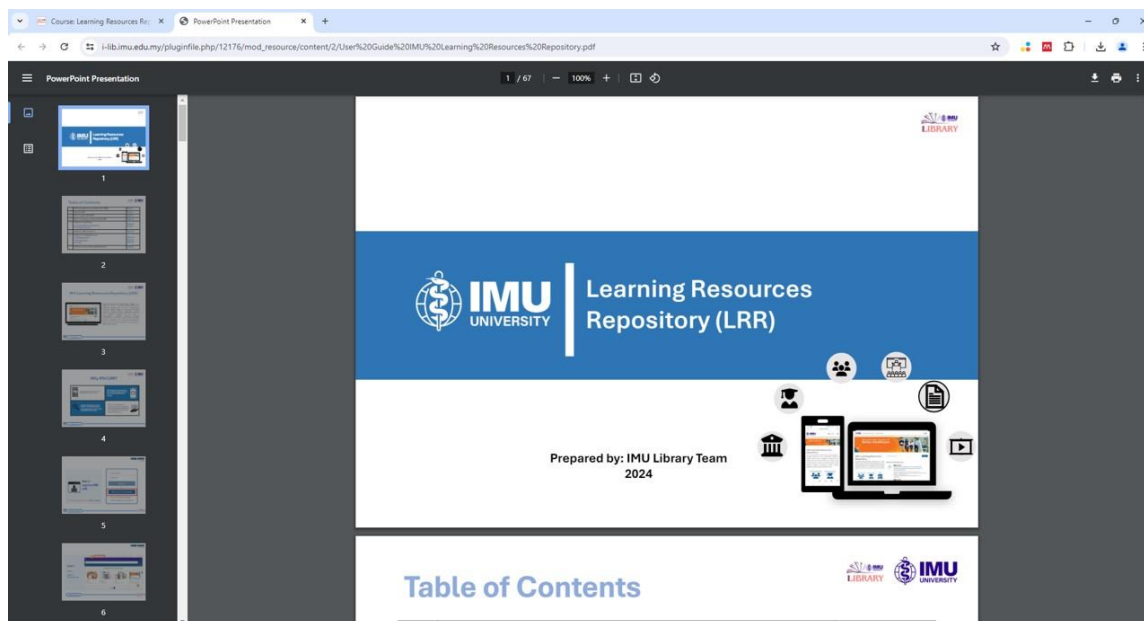


Image 14: Guide to Access the Learning Resources Repository within the Library Portal

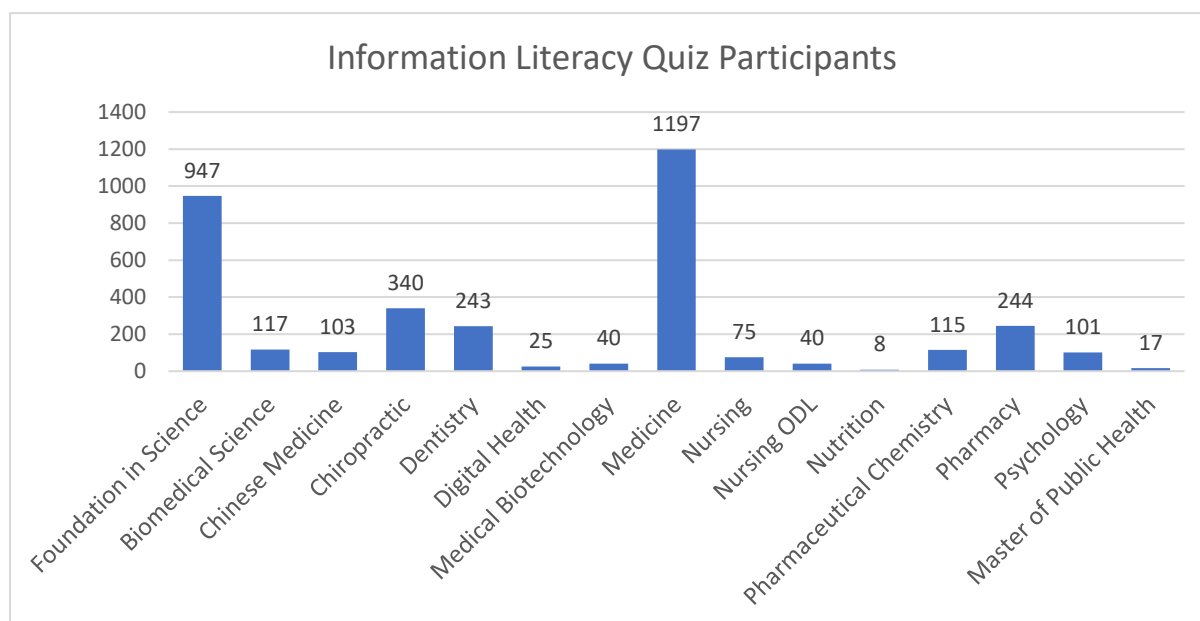
### Improved Communication and Feedback

The Moodle-based library portal has markedly improved communication and information sharing among users, especially students and faculty. Librarians can now post announcements and updates directly on the portal, ensuring students remain informed about library activities and resources. Additionally, the integration of Crisp Chat, an online communication tool, further elevates user support by enabling real-time discussions. This feature allows librarians to address queries promptly and provide immediate assistance. User feedback underscores the positive impact of these enhancements, with comments reflecting high satisfaction levels:

- "Very helpful librarian. So far is all good."
- "The librarian explained everything I wanted to know."
- "All good, fast response to solve the issue."
- "I am very happy with the prompt service of our Library."

### Engagement in Information Literacy

Data collected from the Moodle-Based library portal, as illustrated in *Image 15*, indicates a notable increase in student participation in quiz sessions during information literacy classes conducted by librarians from January to June 2024. The quizzes were designed to allow students the flexibility to engage at their convenience throughout the year. This active participation underscores the portal's effectiveness in promoting essential information literacy skills among students. Moreover, the results suggest a positive correlation between class size and participation rates, with larger cohorts yielding higher engagement in the Information Literacy Quiz sessions.



*Image 15: Information Literacy Quiz Participation: Jan-Jun 2024*

### New Services and Communication

In 2024, the introduction of the "Meet the Librarian" session created a valuable platform for users to engage directly with library staff. Data collected from January to September 2024 demonstrates a growing interest in this initiative, emphasising its importance in enhancing user support and fostering a sense of community within the library. As depicted in *Image 16*, a significant number of faculty members participated in the "Meet the Librarian" sessions

during the first quarter of 2024, outpacing student attendance and highlighting the programme’s broad appeal across the academic spectrum.

Moreover, feedback from participants indicates a high level of satisfaction, with the majority expressing that they were very satisfied with the service, while a smaller group reported being satisfied. Notably, none of the users conveyed dissatisfaction, as illustrated in *Image 17*. This positive response further reinforces the initiative’s success in meeting the needs of the library community.

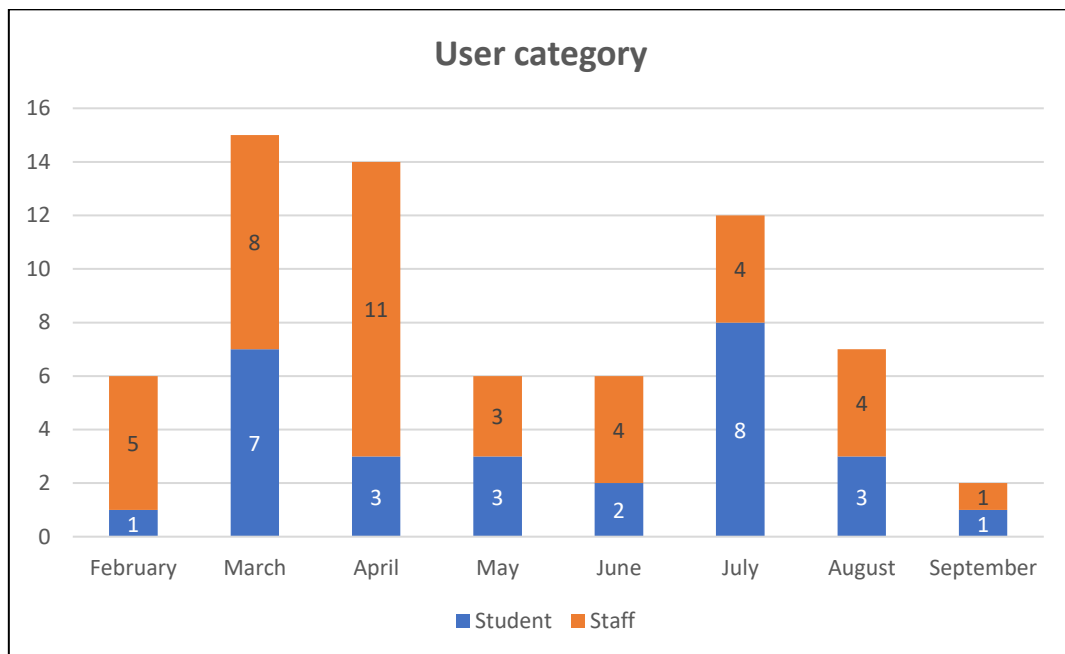


Image 16: Two categories of users engaged in “Meet the Librarian” sessions

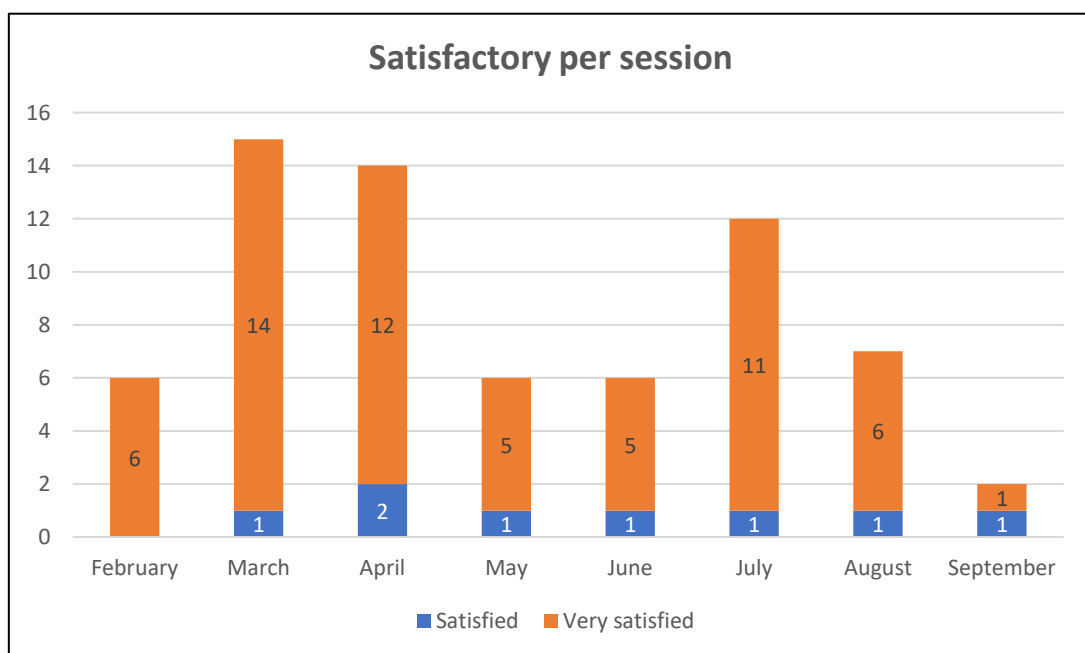


Image 17: Level of Satisfaction for “Meet the Librarian” sessions

### Usage Statistics of IMU University Library E-books Collection and Online Databases

Access to the E-books and online databases subscribed to by the IMU University Library is facilitated through the Moodle-Based library portal. Users are required to log in with a valid Identification Number assigned to either students or staff. The IMU University librarians have meticulously collected and analysed usage statistics to assess the portal's effectiveness. For comparative purposes, usage data from January to October over three years have been reviewed. The analysis reveals an upward trend in resource usage over the three years, as illustrated in *Images 18* and *19*. Specifically, the total number of E-book accesses increased from 17,644 in 2022 to 18,815 in 2024, despite a slight dip in 2023 (15,153). Similarly, usage statistics for the online databases demonstrate strong engagement, with total accesses reaching 26,129 in 2024, compared to 20,857 in 2023, though slightly lower than the 27,617 accesses recorded in 2022, as depicted in *Figures 1* and *2*.

Although direct evidence linking increased resource usage to improved academic outcomes is still under investigation, the upward trend suggests that the Moodle-based portal is playing a key role in fostering a more engaged and resource-rich learning environment. Continuous data collection and in-depth analysis will be essential in determining how engagement with library resources correlates with student achievement. By leveraging these insights, the IMU University Library can refine strategies to optimise access to E-books and online databases, ultimately enhancing academic performance. Moreover, the portal's integration of communication tools further enriches the learning experience by facilitating collaboration and providing users with easy access to support and information about available resources.

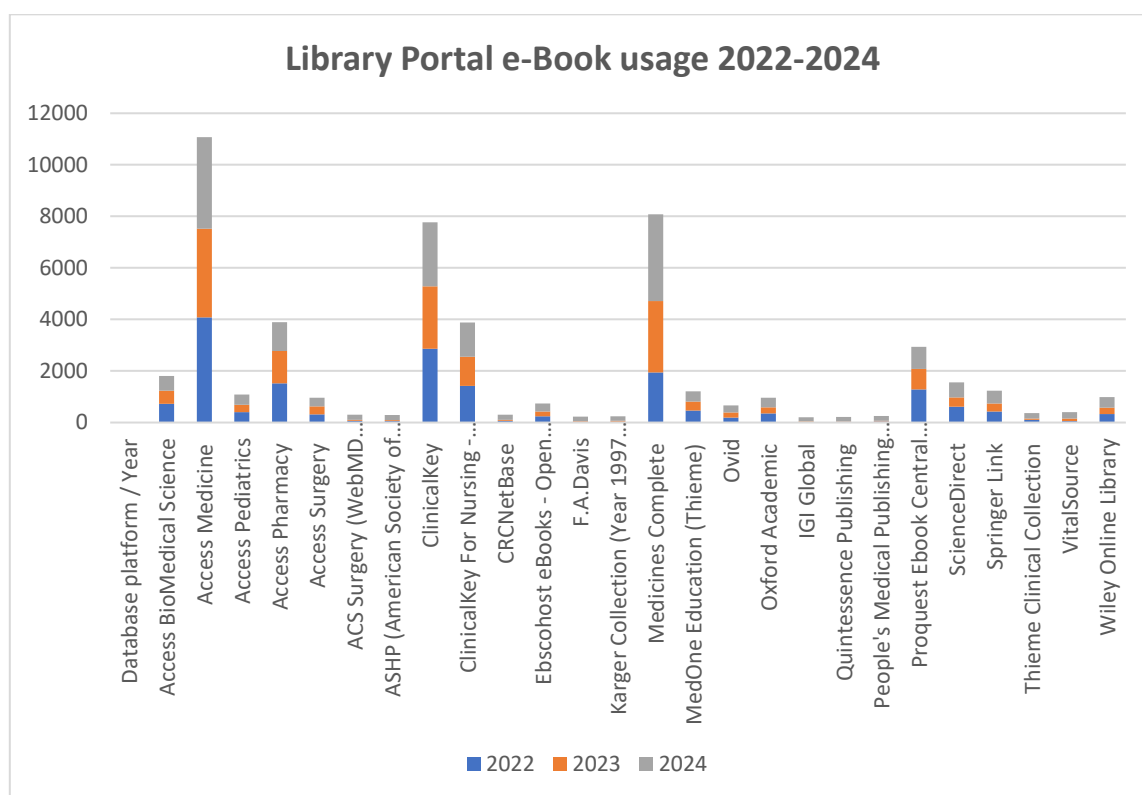


Image 18: E-book Usage: 2022-2024

<b>E-books platform / Year</b>	<b>2022 (Jan-Oct)</b>	<b>2023 (Jan-Oct)</b>	<b>2024 (Jan-Oct)</b>	<b>Grand Total</b>
Access BioMedical Science	731	506	572	1809
Access Medicine	4076	3449	3548	11073
Access Pediatrics	406	279	400	1085
Access Pharmacy	1523	1248	1121	3892
Access Surgery	319	312	337	968
ACS Surgery (WebMD Profesional Publishing)	59	43	198	300
ASHP (American Society of Health-System Pharmacists)	48	41	199	288
ClinicalKey	2863	2425	2484	7772
ClinicalKey For Nursing - (Formerly known as Mosby's Nursing Consult)	1380	1131	1335	3846
CRCNetBase	67	38	194	299
Ebscohost eBooks - Open Access (OA) Collection	241	185	312	738
F.A.Davis	31	19	182	232
Karger Collection	33	28	175	236
Medicines Complete	1939	2772	3363	8074
MedOne Education (Thieme)	471	341	402	1214
Ovid	191	196	281	668
Oxford Academic	357	234	374	965
IGI Global	23	14	167	204
Quintessence Publishing	24	14	179	217
People's Medical Publishing House	44	26	184	254
Proquest E-book Central (Formerly known as Ebrary)	1289	797	847	2933
ScienceDirect	614	355	594	1563
Springer Link	429	311	491	1231
Thieme Clinical Collection	97	49	215	367
VitalSource	54	96	253	403
Wiley Online Library	329	244	408	981
<b>Grand Total</b>	<b>17644</b>	<b>15153</b>	<b>18815</b>	<b>51612</b>

*Figure 1: Numerical value of E-book Usage: 2022-2024*



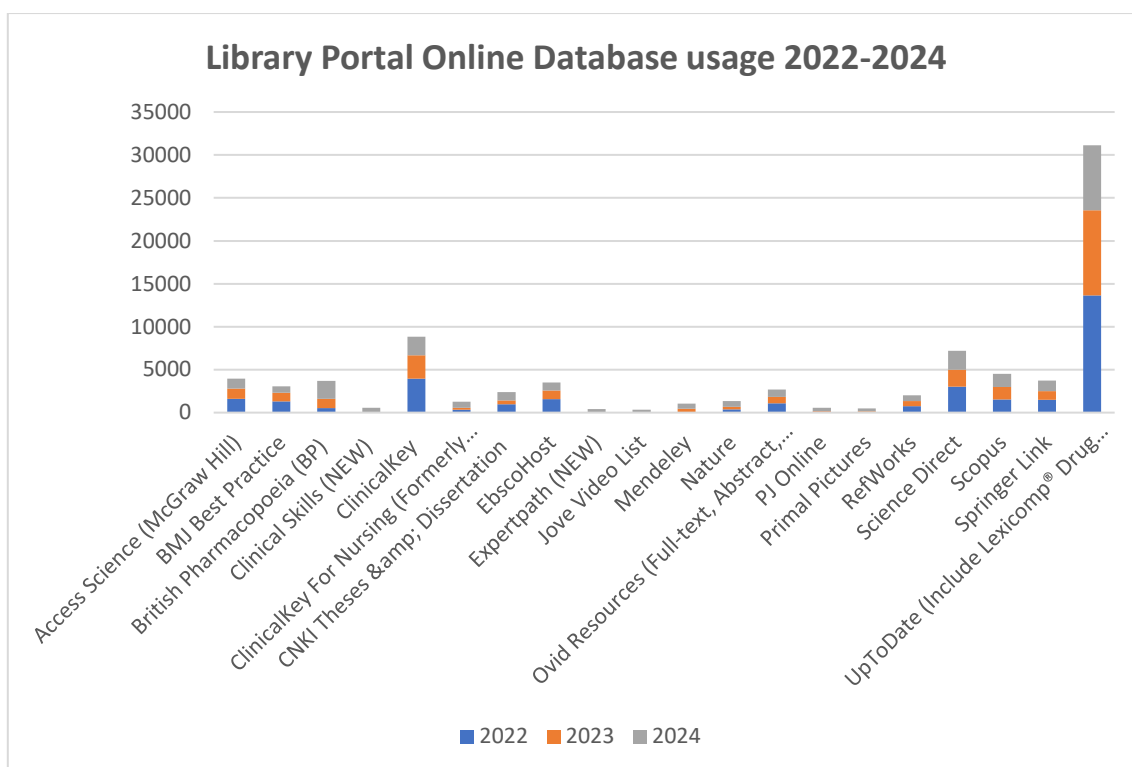


Image 19: Online Databases Usage: 2022-2024

Online databases platform / Year	2022 (Jan-Oct)	2023 (Jan-Oct)	2024 (Jan-Oct)	Grand Total
Access Science (McGraw Hill)	1214	1020	1141	3375
BMJ Best Practice	1193	854	731	2778
British Pharmacopoeia (BP)	427	916	2079	3422
Clinical Skills (NEW)	6	0	559	565
ClinicalKey	3466	2327	2165	7958
ClinicalKey For Nursing (Formerly known as Mosby's Nursing Consult)	289	190	693	1172
CNKI Theses & Dissertation	824	381	977	2182
EbscoHost	1291	913	987	3191
Expertpath (NEW)	0	0	419	419
Jove Video List	16	15	323	354
Mendeley	0	382	626	1008
Nature	320	269	639	1228
Ovid Resources (Full-text, Abstract, Medline)	915	625	878	2418
PJ Online	92	71	355	518
Primal Pictures	80	58	330	468
RefWorks	641	532	671	1844
Science Direct	2786	1694	2175	6655
Scopus	1283	1284	1551	4118
Springer Link	1297	895	1269	3461
UpToDate (Include Lexicomp® Drug Interactions)	11477	8431	7561	27469
<b>Grand Total</b>	<b>27617</b>	<b>20857</b>	<b>26129</b>	<b>74603</b>

Figure 2: Numerical Value of Online Databases Usage: 2022-2024

### Challenges and Recommendations

While the integration of the Moodle-based library portal at IMU University has yielded numerous benefits, several significant challenges have arisen, particularly in the technical domain, especially for librarians with limited technical expertise.

Notably, user-related challenges were minimal, largely due to the system's inability to effectively track learning progress and course completion during the initial implementation phase. The below table outlines the specific challenges encountered by IMU University librarians, who also served as Web Administrators:

<b>Challenge 1: Integration with External Systems</b>	
Specific Technical Issue	Configuration of SAML2 for Single Sign-On (SSO)
Description	The integration of Shibboleth with IMU University Office 365 using SAML2 required meticulous management of multiple files, including metadata, certificates, and configuration XML files. Any misstep in this configuration could disrupt authentication.
Solution	The librarians ensured that all necessary SAML2 configuration files (metadata.xml, sp.xml, idp.xml) were correctly set up and regularly updated. Rigorous testing was essential to confirm the integrity of the authentication process.
Detailed Strategy for Overcoming the Challenge	<p>1.1 Establish a Dedicated Integration Team: Form a team with technical experts, including system administrators and IT staff, who are responsible for managing SAML2 configurations. This ensures focussed attention and expertise on integration tasks.</p> <p>1.2 Create Comprehensive Documentation: Develop comprehensive documentation outlining the configuration process for SAML2. Include detailed instructions for managing metadata, certificates, and configuration files. This will serve as a reference for both current and future team members.</p> <p>1.3 Implement Version Control: Use version control systems (e.g., Git) to manage configuration files. This allows for tracking changes, easy rollbacks, and collaborative editing, reducing the risk of misconfigurations.</p> <p>1.4 Conduct Thorough Testing: Develop a structured testing protocol that includes both unit tests (individual components) and integration tests (complete system functionality). Simulate various scenarios to ensure robust authentication across different user cases.</p> <p>1.5 Schedule Regular Updates and Reviews: Establish a schedule for regularly reviewing and updating SAML2 configurations. This proactive approach helps accommodate any changes in underlying systems (like updates from Office 365) and minimises disruptions.</p> <p>1.6 User Training and Support: Provide training sessions for librarians and staff on managing user accounts and</p>

	troubleshooting common SSO issues. A well-informed team can quickly address problems as they arise.
<b>Challenge 2: Plugin Compatibility Issues</b>	
Specific Technical Issue	Incompatibility of Moodle-based Library Portal Plugins
Description	The initial selection of the Essential and Classic Themes, a popular plugin for customising Moodle, led to significant functionality issues as they became incompatible with updates to the Moodle core.
Solution	The librarians decided to remove the Essential and Classic Themes to prevent errors and maintain system stability.
Detailed Strategy for Overcoming the Challenge	<p>2.1 Conduct Regular Compatibility Audits: Implement a routine audit process to evaluate the compatibility of plugins with the latest version of Moodle. This should include testing plugins after each Moodle update to identify potential issues before they impact users.</p> <p>2.2 Maintain an Approved Plugin List: Create and maintain a list of approved plugins that are known to work with the current Moodle version. This will guide future plugin selection and avoid the use of unsupported or outdated plugins.</p> <p>2.3 Engage with the Moodle Community: Actively participate in Moodle forums and user groups to stay updated on plugin developments and community recommendations. This can provide early warnings about potential compatibility issues and alternative solutions.</p> <p>2.4 Invest in Custom Development: If necessary, consider investing in custom plugin development or updates for critical functionality. Collaborating with experienced developers can ensure that plugins meet institutional needs without compromising system stability.</p> <p>2.5 Document the Removal Process: Establish a clear process for removing or replacing incompatible plugins, including steps for notifying users and providing alternatives. This transparency can minimise confusion and support a smoother transition.</p> <p>2.6 User Communication: Regularly communicate with users (in this case the faculty members and the students) about the status of plugins and any changes that may affect their experience. Providing updates on alternative solutions and enhancements fosters trust and user engagement.</p>
<b>Challenge 3: Challenges in Learning and Structuring Content</b>	
Specific Technical Issue	3.1 Selecting an Appropriate Theme
Description	Librarians faced difficulties choosing a suitable theme from Moodle's extensive options. Initially opting for the Essential and Classic Themes, they soon found these did not support mobile responsiveness and offered limited customisation capabilities.
Solution	The librarians transitioned to the Edwiser RemUI theme, compatible with Moodle 3.9 and above, which automatically

	adapts layout and navigation for various devices, enhancing user experience. (Refer to Image 20)
Detailed Strategy for Overcoming the Challenge	<p>3.1.1 Conduct Theme Trials: Institutions such as IMU University Library should conduct trials with multiple themes by creating a sandbox environment. This allows librarians to test functionality and responsiveness across devices before selecting.</p> <p>3.1.2 User Feedback Sessions: Involve a diverse group of end-users (students and faculty) in feedback sessions during the trial phase. Their input can highlight preferences and usability issues that may not be apparent to the library staff.</p> <p>3.1.3 Documentation and Training: Provide detailed documentation on theme customisation options and offer training sessions for the team members of this project. This will enable librarians to make informed decisions and adapt the theme to better fit the institution's branding and user needs.</p>
Specific Technical Issue	3.2 Understanding Moodle's Content Structure
Description	The librarian being a new web administrator struggled with Moodle's hierarchical content organisation, often leading to cluttered course layouts that hindered student navigation.
Solution	They adopted instructional design principles, utilising Moodle's built-in features such as labels, sections, and groupings to create a clear and navigable course structure. (Refer to <i>Image 21</i> )
Detailed Strategy for Overcoming the Challenge	<p>3.2.1 Workshops on Instructional Design: Host workshops focussed on instructional design principles tailored for Moodle. These workshops should cover best practices in organising content, using Moodle's features effectively, and designing user-friendly layouts.</p> <p>3.2.2 Mentorship Programmes: Pair experienced librarians with newer staff to provide mentorship on best practices in content structuring. This hands-on guidance can help new users grasp Moodle's structure more quickly.</p> <p>3.2.3 Develop Standardised Templates: Create standardised course templates that incorporate recommended organisational strategies. These templates can serve as a starting point for librarians, making it easier to maintain consistency across courses.</p>
Specific Technical Issue	3.3 Managing Course Completion and Progress Tracking
Description	The initial setup of course completion criteria and progress tracking were confusing for librarians, resulting in instances where completed courses were not marked as such in the system.
Solution	The librarians leveraged Moodle's course completion tracking feature, ensuring a clear and consistent approach to monitoring student progress. (Refer to <i>Image 22</i> )

Detailed Strategy for Overcoming the Challenge	<p>3.3.1 In-depth Training on Tracking Features: Provide comprehensive training sessions for Project team members focussed specifically on Moodle's course completion tracking features. Include hands-on practice with real courses to help librarians become proficient.</p> <p>3.3.2 Create Clear Guidelines and Checklists: Develop clear guidelines and checklists for setting up course completion criteria. This documentation should outline common pitfalls and troubleshooting steps to ensure that librarians can effectively manage progress tracking.</p> <p>3.3.3 Implement Regular Review Processes: Establish regular review meetings where librarians can discuss tracking issues, share experiences, and collaboratively resolve challenges. This peer support can foster a culture of continuous improvement and shared learning.</p>
<b>Challenge 4: Technical Upgrades and Maintenance</b>	
Specific Technical Issue	4.1 Moodle Version 3.9
Description	The Moodle-based library portal running version 3.9 was nearing its maximum capacity for accommodating future security patches and plugin updates.
Solution	Upgrade the Moodle-based library portal to the latest stable version to ensure compatibility with new patches and plugins.
Detailed Strategy for Overcoming the Challenge	<p>4.1.1 Regular Upgrade Schedule: Establish a routine for reviewing and upgrading the Moodle platform, ideally every six months or whenever a new stable version is released.</p> <p>4.1.2 Testing Environment: Create a separate testing environment to trial upgrades before implementing them in the live system. This allows for identifying and resolving issues in advance.</p> <p>4.1.3 User Training: Provide training sessions for all students and staff of IMU University on new features and changes post-upgrade to ensure smooth transitions.</p>
Specific Technical Issue	4.2 Urgent Patch Management
Description	An urgent security risk flagged by the IMU University IT Department necessitated an immediate update of jQuery from version 3.4.1 to 3.7.1.
Solution	Implement a regular patch management plan to prepare for urgent updates, ensuring a comprehensive response strategy.
Detailed Strategy for Overcoming the Challenge	<p>4.2.1 Monitoring System: Implement a monitoring system that tracks security updates and vulnerabilities for all components, including jQuery.</p> <p>4.2.2 Emergency Protocols: Develop a clear protocol for urgent updates, outlining steps to take, responsible parties, and communication strategies to inform users of potential downtime.</p>

	4.2.3 Documentation: Maintain thorough documentation of patch management processes to ensure continuity and knowledge transfer among staff.
Specific Technical Issue	4.3 Compatibility Risks with jQuery Updates
Description	Direct updates to jQuery presented risks, requiring the library to strategise backups and potential data restoration if errors arose.
Solution	Establish contingency measures, including data restoration protocols and version control, to prevent system disruptions.
Detailed Strategy for Overcoming the Challenge	<p>4.3.1 Version Control System: Use a version control system to keep track of changes and easily revert to previous versions if issues occur.</p> <p>4.3.2 Backup Procedures: Schedule regular backups of the library portal to ensure that data can be restored quickly in case of a failed update.</p> <p>4.3.3 Thorough Testing: Conduct extensive testing of the system after each update to catch compatibility issues early, involving both technical staff and end-users for feedback.</p>
Specific Technical Issue	4.4 Manual File Replacement
Description	jQuery updates were performed manually through backend file replacement, with old files renamed to prevent conflicts.
Solution	Develop standardised procedures for manual file updates when automatic updates are not viable or cause compatibility issues.
Detailed Strategy for Overcoming the Challenge	<p>4.4.1 Standardised Procedures: Create a detailed guide for manual updates, including step-by-step instructions and best practices for file replacement.</p> <p>4.4.2 Training Workshops: Organise workshops for the project team members to familiarise them with the manual update process and troubleshoot common issues.</p> <p>4.4.3 Automation Tools: Explore options for automation tools or scripts that can help streamline the manual update process where possible, reducing the risk of human error.</p>

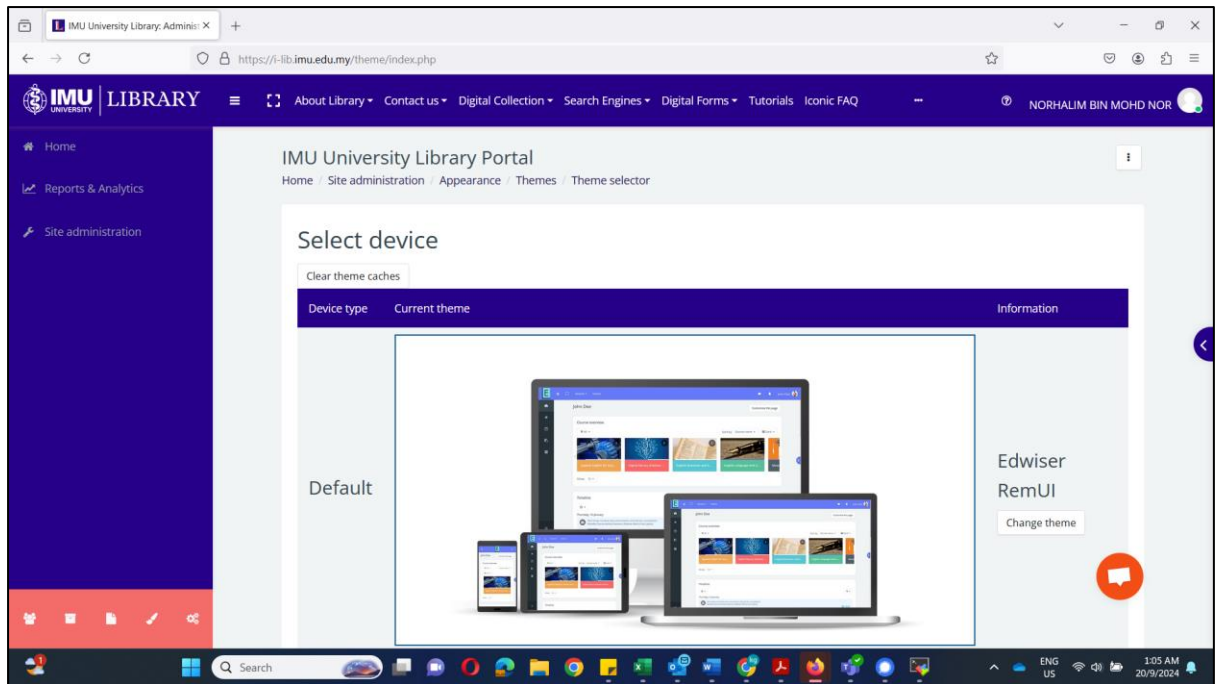


Image 20: Sample of the Edwiser RemUI Theme as default Theme applied in IMU Moodle-based Library Portal

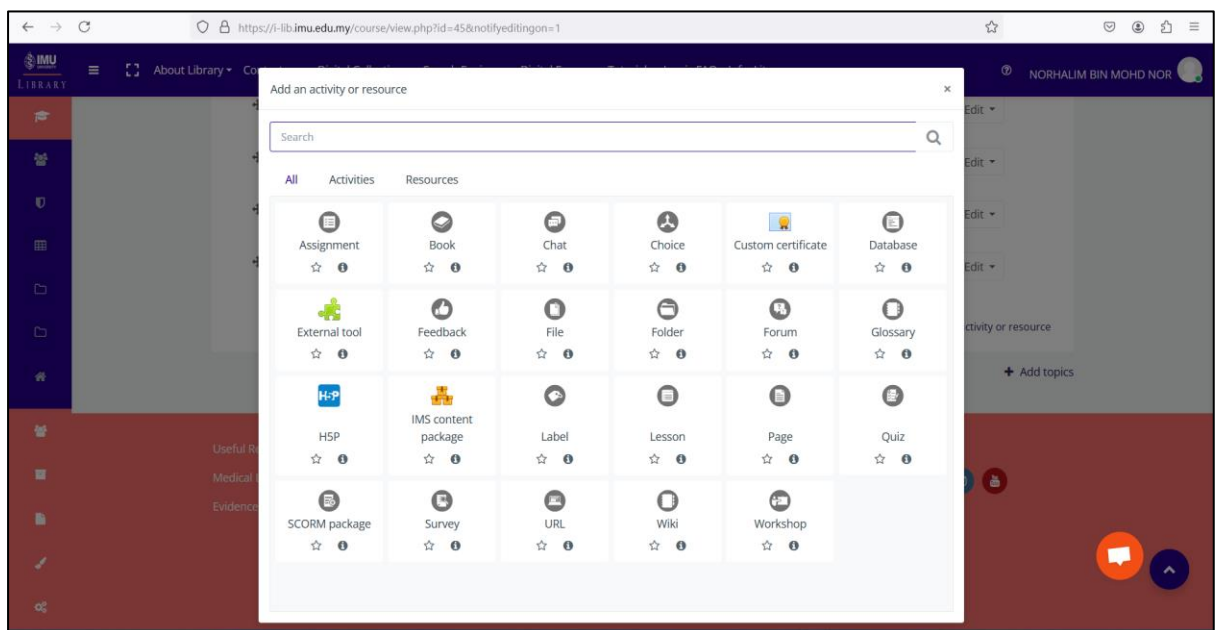


Image 21: Sample of Label Activity/Resource to create well-structured, easily navigable course content such as E-books and E-journals in Moodle-based Library Portal.

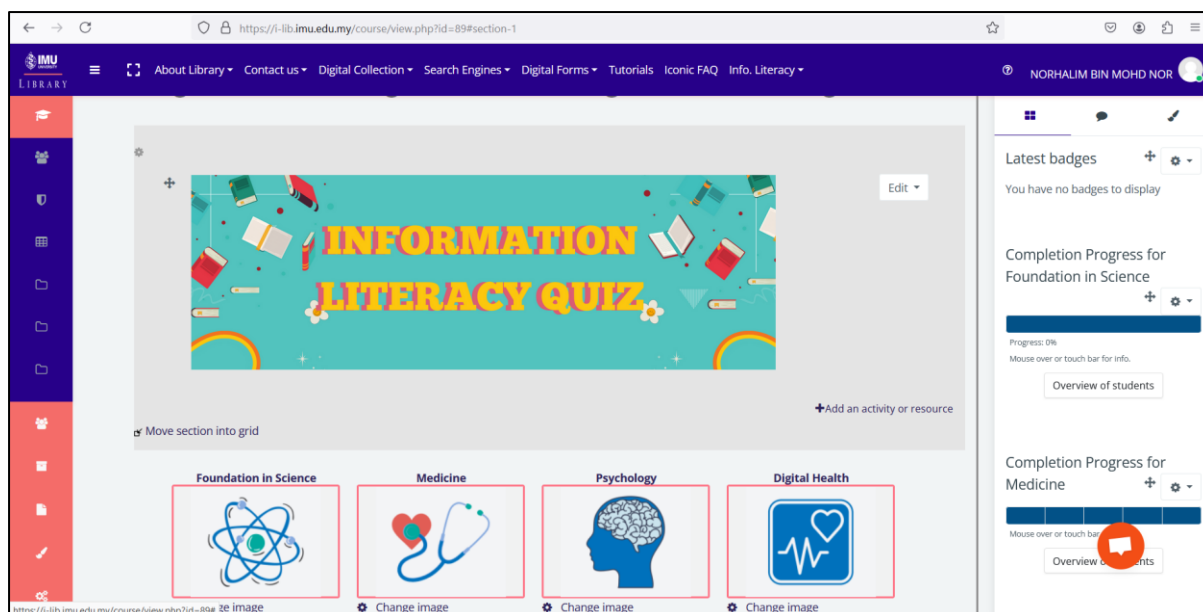


Image 22: Sample of Managing Course Completion and Tracking Learning Progress in Moodle-based Library Portal.

Meticulous planning and collaboration between librarians, IT department staff, and faculty are essential to address these challenges and optimise the portal's effectiveness.

### Future Upgrades and Migration Planning recommendations

In light of the technical challenges faced by the IMU University librarians in designing and developing the Moodle-Based library portal, the team proposes the following strategies for future upgrades and migration planning. These recommendations may serve as a valuable guide for other libraries pursuing similar initiatives:

Future Upgrades and Migration Planning	
Specific Technical Issue	1. Server Migration
Description	To maintain continuous security compliance and benefit from the latest updates, the IT department has recommended a transition to a new server.
Solution	Schedule a comprehensive server upgrade and plan for Moodle updates every two to three years to accommodate new features, plugins, and security patches.
Detailed Strategy for Overcoming the Challenge	1.1 Conduct a Needs Assessment: Evaluate current server performance and identify specific requirements for future growth. 1.2 Choose Reliable Hosting Solutions: Select a reputable hosting provider that guarantees uptime, security, and support for Moodle. 1.3 Implement a Migration Timeline: Develop a detailed timeline for the migration process, ensuring minimal disruption to library services.



	1.4 Run Parallel Systems: During migration, operate both the old and new servers temporarily to facilitate troubleshooting and ensure data accuracy.
Specific Technical Issue	2. Automated Updates for Stability
Description	Manual updates, such as those for jQuery, are susceptible to errors and can complicate system management without proper oversight.
Solution	Incorporate automatic updates and upgrades as part of the server migration strategy to minimise manual intervention and reduce downtime.
Detailed Strategy for Overcoming the Challenge	2.1 Utilise Automation Tools: Implement automated scripts or tools for managing updates, ensuring that all components are regularly checked and updated. 2.2 Establish a Testing Protocol: Create a testing environment where updates can be applied first to identify potential issues before going live. 2.3 Schedule Regular Maintenance Windows: Set aside specific times for automatic updates to occur, ideally during low-traffic periods, to minimise user impact.
Specific Technical Issue	3. Comprehensive Data Migration
Description	The data migration process must ensure the full transfer of all data, plugins, themes, and custom features without loss.
Solution	Develop a migration strategy with the IT team to ensure data integrity and a seamless transfer of databases while enabling new features.
Detailed Strategy for Overcoming the Challenge	3.1 Create a Data Inventory: Catalogue all existing data, plugins, and customisations to create a clear picture of what needs to be migrated. 3.2 Create a Data Backup Plan: Implement a robust backup strategy before migration, including snapshots of the database and file system. 3.3 Test the Migration Process: Conduct pilot migrations to identify potential issues and refine the process before the final migration. 3.4 Post-Migration Validation: After migration, perform thorough checks to ensure all data and functionalities are intact and operational.
Specific Technical Issue	4. Upgrade the system every two to three years.
Description	Regular upgrades are crucial to prevent obsolescence and to maintain the library portal's security and efficiency.
Solution	Schedule routine system updates and server upgrades in alignment with the Moodle stable release cycle to keep the library portal functional and compliant.

<p>Detailed Strategy for Overcoming the Challenge</p>	<p>4.1 Establish a Routine Update Schedule: Create a calendar that outlines key upgrade milestones and deadlines based on Moodle's release cycle.</p> <p>4.2 Involve Stakeholders in Planning: Engage librarians and IT staff in the planning process to gather insights on needs and concerns regarding system updates.</p> <p>4.3 Monitor Emerging Technologies: Stay informed about new technologies and features in Moodle that could enhance the library portal, preparing for integration during upgrades.</p> <p>4.4 Documentation and Training: Ensure thorough documentation of the upgrade process and provide training for staff on new features and best practices.</p>
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### Other Recommendations

Librarians should collaborate closely with faculty to guide students through the process of locating relevant library resources, such as digital collections tailored to their specific programmes at IMU University. This partnership ensures that students can efficiently access accurate information for their courses and assignments. Additionally, the module can be adapted for self-directed learning, allowing students the flexibility to study at their convenience.

To further enhance resource accessibility, librarians can develop subject-based E-resources pages that compile essential content in one centralised location. These resources can be enriched with interactive elements, such as gamification, quizzes, and assessments available through Moodle's Activity/Resource modules, making the learning experience more engaging. This initiative will be an ongoing effort, as content development will need to evolve in line with the programmes offered.

Continuous evaluation and timely updates are crucial to addressing challenges and ensuring that the portal remains relevant, efficient, and effective for both users and librarians. Therefore, the university must commit to investing in the portal's ongoing development and support, encouraging consistent use among all users. This dedication to continuous improvement will enable IMU University to fully harness the portal's potential, ultimately enhancing the academic experience and providing valuable resources.

Moreover, research is needed to assess the portal's effectiveness in supporting information literacy instruction and improving learning outcomes. Librarians and faculty members should conduct evaluations of learning outcomes before and after the portal's implementation.

Additionally, IMU University librarians should periodically improve user interfaces and offer clearer navigation instructions. Exploring the integration of emerging technologies, such as artificial intelligence and machine learning, could further enhance the portal's functionality and overall effectiveness.

## Conclusion

In summary, the Moodle-based library portal at IMU University stands as both a technological advancement and a testament to a holistic approach towards enhancing library services. Its comprehensive collection of resources, coupled with a steadfast commitment to currency and accessibility, underscores its significance in supporting the academic community. User feedback highlights the portal's user-friendly interface, innovative features, and seamless integration with Moodle courses, all of which contribute to facilitating access to library resources and promoting information literacy. This user-centric design enhances time efficiency, empowering users to swiftly locate the materials they require. Moreover, the portal's intuitive functionality has led to a notable reduction in the need for librarian assistance, reflecting its efficacy in meeting user needs.

In addition to its technological prowess, the Moodle-based library portal embodies a philosophy centred on user empowerment and engagement. By offering a streamlined interface and intuitive features, the portal encourages active participation and self-directed learning among users. This user-driven approach fosters a culture of independence and exploration, enabling students to navigate the vast array of resources with ease. Furthermore, the reduced reliance on librarian assistance signifies not only the portal's intuitive design but also its ability to support users in their academic endeavours. As such, the Moodle-based library portal serves as a cornerstone for fostering information literacy and empowering users to excel in their scholarly pursuits.

The sustained use and advancement of the Moodle-based library portal at IMU University are vital for enhancing information technology and library services. This platform has the potential to revolutionise resource delivery, elevate the learning experience, and facilitate information literacy instruction. By providing seamless and user-friendly access to resources, the portal fosters increased engagement, collaboration, and improved learning outcomes.

In light of this, the IMU University librarians propose the following actionable recommendations for other institutions:

1. **Conduct a Needs Assessment:** Before implementation, institutions should perform a comprehensive needs assessment involving key stakeholders, including librarians, faculty, and students. This will help tailor the portal's features to meet specific user requirements and enhance overall effectiveness.
2. **Invest in Training:** To maximise the benefits of the portal, it is crucial to provide thorough training for librarians and staff on using and managing the system. This not only boosts technical proficiency but also empowers them to assist users more effectively.
3. **Prioritise User-Centric Design:** Emphasising a user-friendly interface is vital. Institutions should involve end-users in the design process through surveys or focus groups to gather feedback on functionality and aesthetics, ensuring the portal meets user expectations.
4. **Implement Continuous Feedback Mechanisms:** Establish ongoing feedback channels for users to report their experiences and suggestions. Regularly reviewing this feedback will help institutions adapt and enhance the portal over time.
5. **Promote Digital Literacy:** Institutions should integrate information literacy training into their curriculum to empower users to make the most of the resources available through the portal. This can foster a culture of self-directed learning and exploration.

6. Monitor and Evaluate Outcomes: Regularly assess the portal's impact on user engagement and learning outcomes. This evaluation will inform further developments and demonstrate the portal's value to stakeholders.

By focussing on these actionable steps, other institutions can not only replicate the successes observed at IMU University but also enhance their library services in the digital landscape.

The Moodle-based library portal at IMU University represents a significant leap forward in library services, underscoring the importance of user engagement and information literacy. Through careful planning, continuous improvement, and a commitment to user needs, institutions can transform their library offerings and empower their academic communities.

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