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PAPER

The Effectiveness of Laboratory Digitalization for 21st Century Learning

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ABSTRACT

Learning resources are crucial and strategic elements that impact the accessibility of easy, fast, accurate, and affordable information in the era of Society 5.0. Learning resources must be adaptable to technological advancements. The history laboratory is a learning resource that must be transformed and adapted to address the aforementioned needs and problems as a solution. The extensive collection of owned items has the potential to support this. This paper describes the creation of a digital laboratory by utilizing collections from the UM History Department. The research employed the Research and Development (R&D) method, utilizing the ADDIE model, which includes the stages of analysis, design, development, implementation, and evaluation. The study presents findings on the importance of digitizing laboratories as educational resources and digital laboratory products for the UM History Department. This digital laboratory product consists of several features, including an e-book (book catalog), an e-repository (final project catalog), an e-museum (museology collection catalog), tool lending, and graduate assessment. The results of the validation and implementation tests demonstrate that the criteria are highly valid and extremely effective. These results demonstrate that the digital laboratory serves as a more effective and efficient learning resource that is easily accessible and usable for civil society 5.0.

KEYWORDS

learning resources, laboratory, digital, history

1 INTRODUCTION

The development and progress of the times continue to undergo significant changes. In the 21st century, people's lives are entering a new era known as Society 5.0. The concept of Society Era 5.0 is a continuation of Society Era 4.0, which emphasizes digitization [1]. Meanwhile, the 5.0 era emphasizes the way humans coexist with technology [2–4]. These changes encourage humans to adapt more rapidly, particularly when accessing information. Access to information will be more easily obtained by anyone, anytime, and anywhere, regardless of social status [2], [5–8].

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Society in the 5.0 era is closely intertwined with technology [9]. This is because all problems and challenges can be addressed by leveraging existing technology and innovation [7], [10]. The primary focus of this era is society's ability to optimize the use of technology and its innovations, including: 1) Internet of Things (IoT), 2) artificial intelligence, 3) big data, and 4) robotics and machine [2], [4], [10], [11]. In this era, people's lives require several skills commonly known as the 4Cs, including communication, collaboration, critical thinking and problem solving, creativity, and innovation [11], [12].

The demands and challenges mentioned above necessitate people to adapt in all aspects of life, particularly in education. Adaptation and transformation must be carried out continuously to enhance the quality of education [13–15]. Education is one of the most important factors that serves as the cornerstone for controlling and sustaining progress. With a solid education, a country can develop high-quality human resources capable of advancing their country with the knowledge they possess [16], [17].

Given the significance of adapting and transforming education, there is a need for an affordable and easily accessible source of information without any limitations. The availability and accessibility of this information are essential for the general public. In the field of education, sources of information are known as learning resources. Learning resources refer to all materials that can be used in the learning process [18], [19].

Learning resources consist of people, materials, environments, tools, and activities. The purpose of learning resources is to stimulate and increase interest in the learning process, aiming to create effective, efficient, and interactive learning [18], [19]. This learning resource emphasizes the need for transitioning and adjusting to technology in order to align with current conditions and address existing needs. One of the many learning resources found in the environment is (revised). Learning resources for environmental studies encompass laboratories, classrooms, natural sites, workplaces, museums, transportation facilities, and more [20].

The majority of these environmental learning resources are designed and implemented in the field of education. Laboratories are widely recognized as essential learning resources, serving the main function of providing a wealth of information and knowledge necessary for learning [21]. In this case, the UM History Department Laboratory is a learning resource that houses numerous collections containing valuable information. The history laboratory collection includes both indoor and outdoor exhibits. Indoor collections include books, archives, scientific publications, artifacts, and other items. While outdoor collections include replicas of relief panels, inscriptions, and the Kidal Temple.

Given the numerous possibilities mentioned above, it is essential to employ the appropriate strategy to effectively convey information and knowledge using integrated technology. These efforts represent urgent and essential adaptations and transitions in the field of education. One innovation that could be presented is a digital laboratory. This represents the utilization of existing potential and innovation, specifically the integration of technology.

The digital laboratory within historical collections aims to provide information for students and the general public. This is also an attempt to present history in an appealing and visual manner. Digital laboratories are both a solution and a necessity in the era of Society 5.0, serving as an essential adaptation to the existence of laboratories as a learning resource [8].

Various studies indicate that digital laboratories are necessary in the midst of technological developments. Digital laboratories can enhance learning activities to be more interactive, dynamic, and enjoyable [22]. Other research indicates that digital laboratories have a significant positive impact. The procurement of digital laboratories can save maintenance costs, be more time-effective, and offer flexibility in terms

of location [9], [23]. The results of previous research further strengthen the existing potential. In this case, the collections owned by the History Department Laboratory have the potential to be utilized as a relevant learning resource in the midst of technological developments. The concept of digital laboratories has been widely adopted in various exact sciences, including physics, chemistry, and biology. This research will introduce a novel concept: the creation of a Digital History Laboratory.

In this paper, the author describes the results of research and development carried out with the primary product in the form of a Digital History Laboratory. This History Digital Laboratory product is designed to present solutions to existing problems and harness integrated potential through the use of technology. Building on the background provided above, this article will explore the topic of "The Impact of Laboratory Digitalization on 21st Century Learning."

2 METHOD

The research method used in this study is research and development (R&D). This method contains a series of systematic and procedural steps to produce a feasible, valid, practical, and efficient product that can be accounted for [24]. In this study, the R&D method used is the analysis, design, development, implementation, and evaluation (ADDIE) model. Dick and Carey introduced the ADDIE development model was introduced in 1996 [25], [26]. The product in this research and development project will be prepared in stages, following the development steps of the ADDIE model. The ADDIE model was selected because it is a procedural and descriptive model that presents clear and careful steps, making it easy to understand and implement. Furthermore, this stage aligns with the fundamental standardization of the development research stage [27]. The method consists of five stages: ADDIE, as shown below (Figure 1) [26], [28], [29].

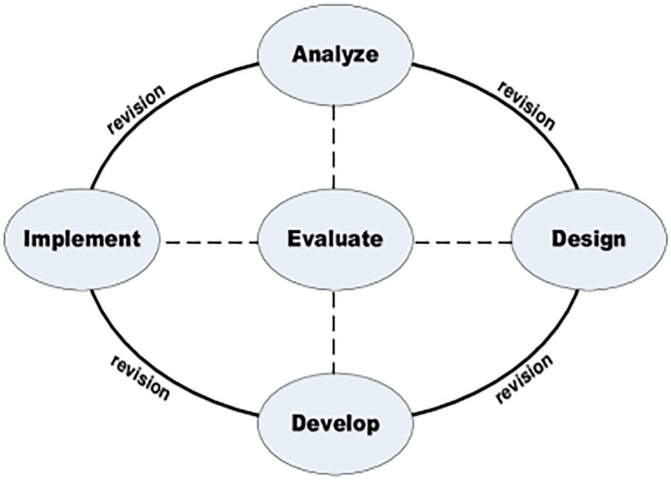


Fig. 1. Stages of ADDIE model development [30]

The initial stage in this study involved analyzing the potential, problems, and needs through a preliminary study of the history laboratory, supported by a review of relevant literature. Literature study is conducted using reference sources as citations [31]. The sources utilized in this study includes books, literature, notes, research reports, articles, scientific works, and other pertinent references. Information and data obtained from these sources are carefully reviewed, studied, and analyzed to obtain refined insights. The analysis results are then described to maximize their effectiveness [27].

The second stage involves designing the structure of a digital laboratory product. The design is finalized by adjusting the results of the preliminary analysis [27]. The next stage is the development stage. This stage involves turning the design into a complete and finished product. During the development stage, field studies were conducted to explore the data and compile content for laboratory collections. The results of the development are then validated for product validation. After that, the implementation stage involves conducting product trials and testing the feasibility of digital laboratory products. The final stage involves evaluating the product, making improvements, and refining it (Figure 2) [32].

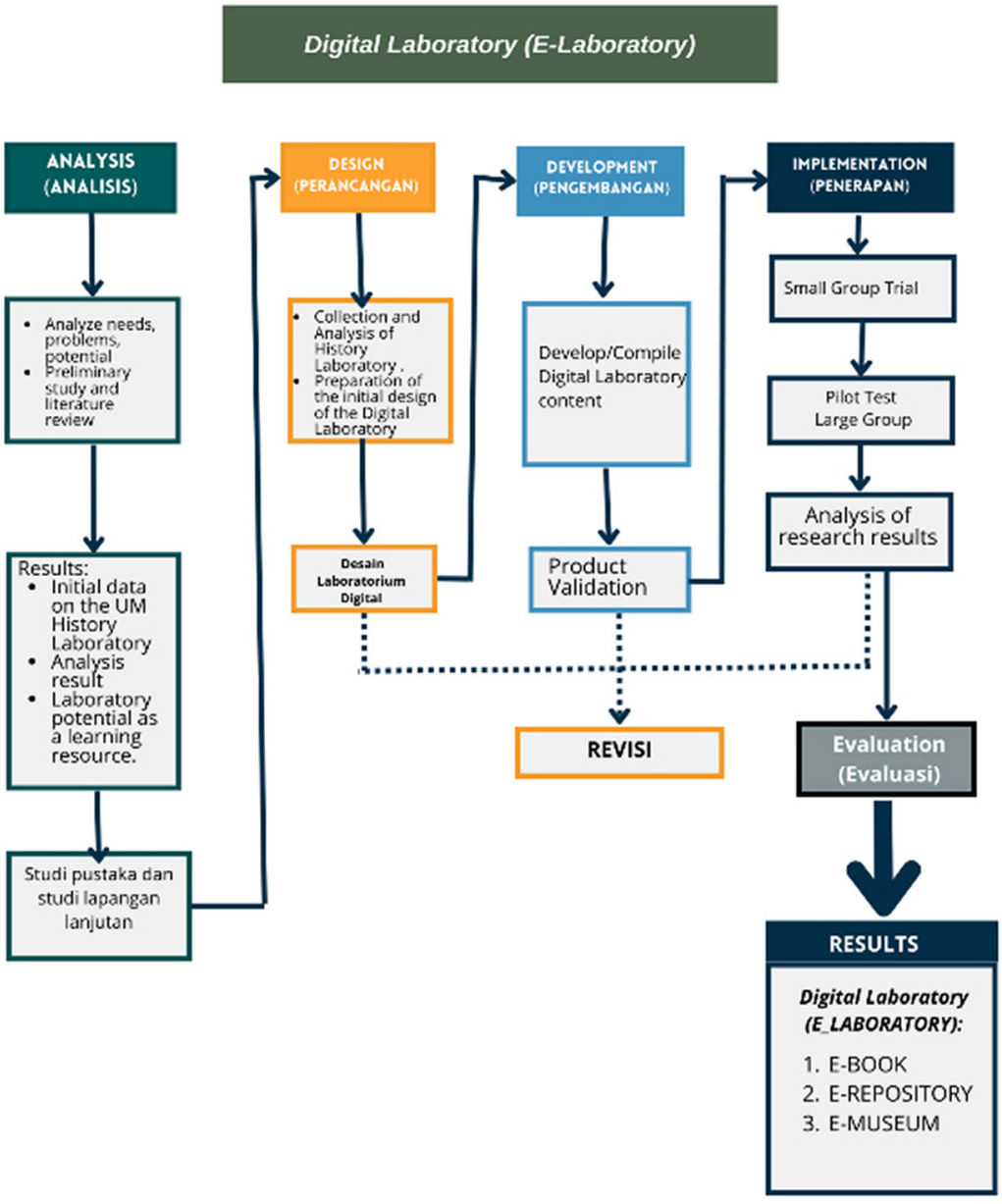


Fig. 2. Stages of digital laboratory development

The object of study in this research is the History Department Laboratory at Jalan Semarang No. 5, Malang City, East Java Province. The resulting product is a digital laboratory comprising a digital catalog, museology collection, and videography

(see Figure 3). This product digitizes collections owned by history laboratories using technology. The structure of this study is as follows:

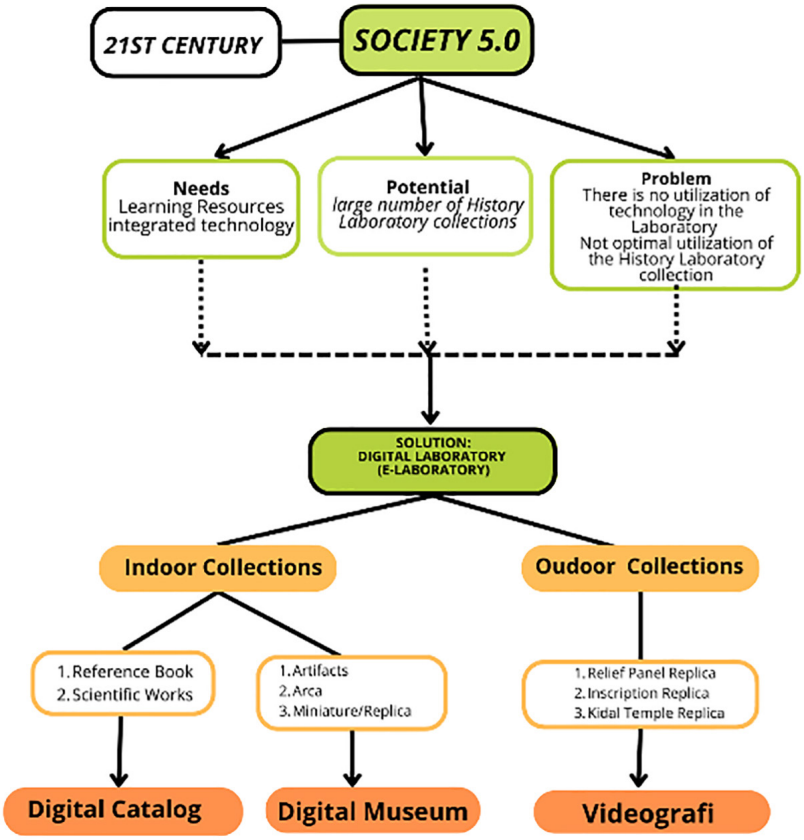


Fig. 3. Research framework

3 RESULT AND DISCUSS

3.1 Product development visualization

Result and Discussion

A) The urgency of digitizing the history laboratory collection

A laboratory is a facility used for conducting controlled experiments, testing, and analysis [33], [34]. The laboratory is designed as a learning environment that offers students direct learning experiences and opportunities to interact with existing facilities. In the laboratory, it is possible to integrate concepts and theories into a tangible form [33], [35].

Given the significance of laboratories, the government has endeavored to construct well-equipped facilities with various instruments and amenities to enhance the quality of education [9], [34]. Good management is essential to enhancing the efficiency and effectiveness of the laboratory. In its development, the laboratory is not only designed and developed for the field of exact sciences, such as chemistry, physics, and biology. Laboratories are also being developed in the field of social sciences, including history.

A history laboratory is a facility, place, or used house that stores valuable historical value that reconstruct the past and ways of life [36]. The history laboratory

houses numerous collections in the form of objects, libraries, and mock-ups. This is different from typical laboratories, which contain liquid chemicals, medicines, and other substances. The history laboratory serves as a valuable learning resource, providing a wealth of information and knowledge essential for learning.

In this study, the focus is on the historical laboratory, including the collection equipment. The collections include indoor and outdoor items. The indoor collection includes books, reference materials, scientific works, ancient manuscripts, classic maps, archives, artifacts, mock-ups, and various other collections. While outdoor collections include replicas of relief panels, inscriptions, and the Kidal Temple. These collections can be used as educational resources in the learning process.

In the era of Society 5.0, people are inseparable from technology on a continuous basis. So, it is necessary to adapt and transition, particularly through digitalization efforts in various aspects of life. Digitalization is implemented to ensure that information sources can be easily and affordably accessed by anyone, anytime, and anywhere, without restrictions [7], [37].

Digitalization is the process of transitioning from analog (manual) to digital using an automated computerized system [15]. According to Sukmana [38], digitization is the process of converting and managing media from print, manual, audio, and video to digital or electronic [39]. This digitization process involves creating digital document archives using computer equipment, scanners, and supporting software. The process of digitization can enhance the accessibility of digital data and information sources, aligning with technological advancements in creating, transferring, storing, and analyzing digital data [37], [40].

There are several reasons why digitization is important, including reducing paper usage, saving storage space, durability, protection from damage, accessibility, and affordability [39], [40]. According to Deegan and Tanner in their book "Digital Futures," there are several advantages of digitization, including: fast and easy access; elimination of the need for printing; wide dissemination of information; collaborative use; display of substitute objects that can be accessed; enhanced search capabilities; integration of various media (images, audio, video, etc.); and reduced management costs [7], [39].

From the description above, it can be understood that digitization aims to expand the utilization and ease of access to owned collections. Digital collections can be simultaneously accessed through remote by multiple users [41]. In order to serve as an information source provider, the laboratory needs to play a role in enhancing the quantity and quality of services, particularly by offering digital and electronic collections [39]. The digitization of the historical laboratory collections can be utilized by students and the general public to address the need for accessible sources of information and knowledge.

Learning resources encompass all the elements that can be utilized in the learning process, including people, materials, environment, tools, and activities [18], [19]. In line with this opinion, Andi Prastowo suggests that learning resources encompass everything that can contribute to the learning process, including objects, data, facts, ideas, and people [42]. Learning resources aim to stimulate and increase student interest in the learning process in order to create effective, efficient, and interactive learning [21]. Given the significance of educational materials, it is essential to adapt to technology and align with current conditions and requirements, particularly in the era of Society 5.0, to ensure accessible learning resources.

Based on the explanation above, it is evident that the history laboratory has great potential for development through innovative technology applications. This can be achieved by creating a digital history laboratory and digitizing the owned collections. This rationale serves as the foundation for researchers to establish a digital history laboratory. This study aims to present information to the general public in

a way that is widely and affordably accessible. This study aims to visually present history in an appealing format and make use of its existing potential. In order to have an impact on students' learning and create effective learning experiences. Digital laboratories are a modern adaptation to maintain the relevance of laboratories as a learning resource in the 21st century.

B) Digitization of the History Department Laboratory collection

Analysis

The digital laboratory was developed based on the analysis conducted during the preliminary and literature studies. The preliminary study has revealed the potential, problems, and needs that exist. It was reinforced by a literature review of various reference sources [31]. The information and data obtained from these sources were carefully reviewed, studied, and analyzed to obtain comprehensive insights.

The preliminary study was conducted with 80 respondents who are students in the Department of History. The results of the preliminary study on needs and potential analysis are described in Table 1.

Table 1. Results of potential and needs analysis

Availability of Laboratory Collection	Availability of Technology Devices and Supporting Facilities	Urgency of Digital Laboratory	Learning Resources Needs
90%	88%	96%	92%

Table 1 illustrates the conclusion drawn from the results of the needs analysis, highlighting the significant potential for the development of the digital laboratory.

The indicator for the availability of laboratory collections shows a fairly high percentage of 90%. This indicates that the extensive array of history department laboratories has the potential to be developed into a digital laboratory. The collection includes indoor and outdoor items. The indoor collection consists of books, reference materials, scientific works, ancient manuscripts, classic maps, archives, artifacts, models, and various other items. The outdoor collection includes replicas of relief panels, inscriptions, and the Kidal Temple. The second indicator is the availability of technological devices. This indicator has a lower percentage compared to the other three indicators. This occurs due to the limited availability of video shooting equipment, such as drones and cameras.

The third indicator pertains to needs analysis. The urgency of digital laboratory development is indicated by a 96%. This indicates the necessity of digitalization to transition from traditional laboratories to digital ones, enabling access at any time and from any location. The final indicator pertains to the need for learning resources. This indicator shows a 92%, indicating a high demand for learning resources in the era of Society 5.0. This occurs due to the need to keep up with technological developments and the proliferation of less credible and reliable information. The four indicators above suggest a strong potential for the development of digital laboratories. This aligns with the purpose of developing this digital laboratory.

After receiving the results of the preliminary analysis, additional observations were conducted at the History Department Laboratory laboratory (see Figure 4). In this activity, the content for this digital laboratory will be collected from the collection. After being collected, an inventory of the equipment owned by the History Department's laboratory was carried out. The results of the inventory and data collection are then categorized and mapped based on the type of collection, which includes book collections, collections of student final project scientific papers, indoor museology collections, outdoor collections, and collections of tools.

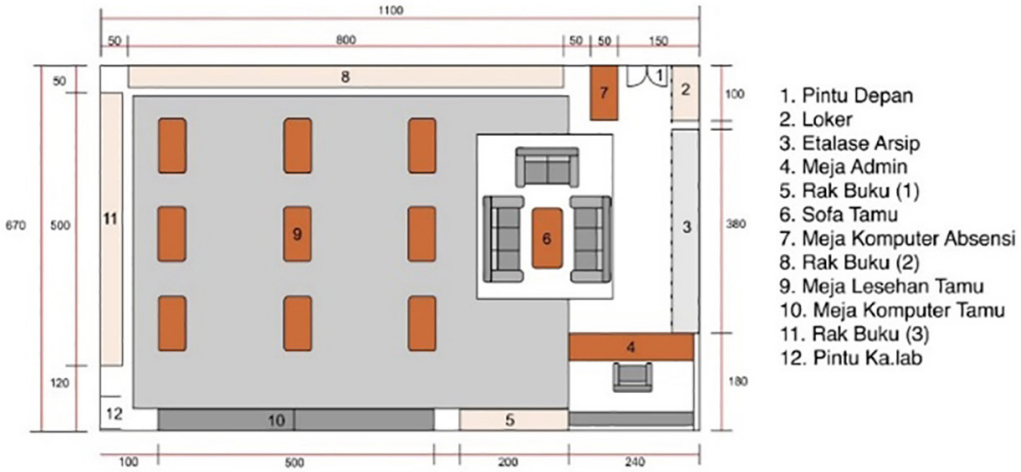


Fig. 4. History department's laboratory floor plan

Design

The design stage is the second phase of this development research. At this stage, the digital laboratory design is based on the analysis of potential, needs, and problems identified in the preliminary study. The design of this digital laboratory is depicted in the following flowchart (Figure 5).

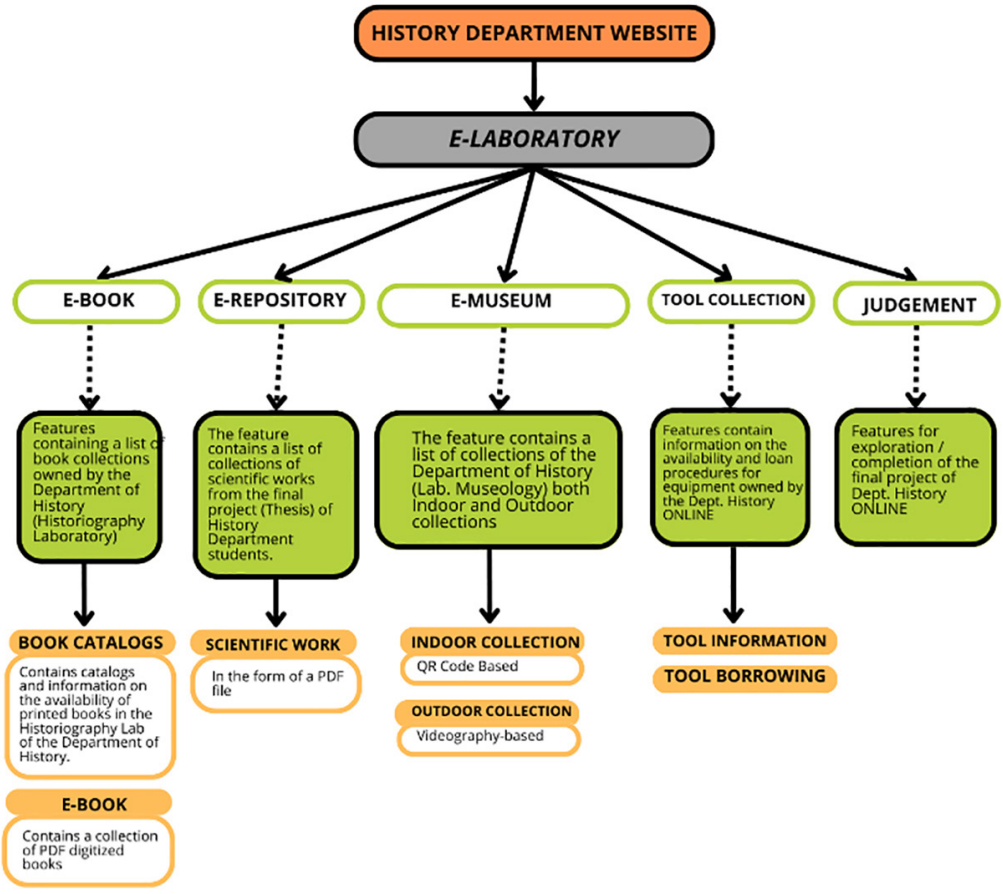


Fig. 5. Design of digital laboratory

This digital laboratory was developed as a website and is accessible through the UM History Department's website. This digital laboratory has five features that contain and fulfill the functions of the History Department Laboratory as a learning resource for students and the general public. These features include book collections, scientific works, museology collections, tool collections, and exploration.

The first feature is the e-book feature (book collection), which includes a list of book collections owned by the History Department Laboratory. There are two types of collections in this digital library: printed books and digital books (e-books). The printed book contains information about the book's identity and availability in the History Department Laboratory. An e-book is a digital version of a printed book that can be accessed, read, and downloaded online. It is typically presented in the form of a PDF file extension.

The second feature is the e-repositary, a collection of scientific work containing the final project (thesis) results of UM History Department students from the period 2012–2023. This feature is presented in the form of a PDF file, accessible to the online users.

The next feature is the e-museum feature, which focuses on museology collections. This feature includes a list of laboratory collections, comprising both indoor and outdoor collections. Indoor collections, such as artifacts, mock-ups, and statues, are presented in the form of a QR code. The QR Code will be integrated with information that explains an object. Meanwhile, the outdoor collection will be presented in the form of videography with integrated YouTube videos. The outdoor collection includes replicas of relief panels, inscriptions, and the Kidal Temple.

The fourth feature is the tool loan functionality, provided by the Department of History Laboratory. This feature includes a list of laboratory-owned tools and their availability, along with procedures for borrowing the equipment. The final feature is the exploration feature, which outlines the process for completing the final project (thesis) for History Department students. This can be done online, eliminating the need to visit the laboratory. The above design is then further improved and revised to achieve the best possible design.

Development

From the above design, it was then developed into a digital history laboratory media product. The development was carried out in stages and carefully to achieve optimal results.

a) E-BOOK (Book Collection)

The books owned by the history laboratory are collected, recorded, classified, and then digitized by scanning. The results of the PDF scan are then uploaded to Google Drive. While books that cannot be digitized will be scanned and assigned unique identifiers. The results of the data collection and identification are then entered into the Google Spreadsheets database (see Figure 6). The database will be showcased on the website, providing information about the availability of books in the Historiography Laboratory of the Department of History.

KATALOG BUKU
LABORATORIUM HISTORIOGRAFI
UNIVERSITAS NEGERI MALANG

Tanggal	No. Register	ama Pengaran	Judul Buku	Tempat Penerbit	Penerbit	hun Terb	Cetak Ke-	Jumlah	Asal Buku	Bahasa				
										Ind	Ing	Jawa	Dutch	France
20/03/13	0001	Thomas F King	Doing Archeology: A Cultural Resource Management	America	Left Coast Press	2005	1	1 Exp	PHK		√			
20/03/13	0002	Woodrow W	Professional Microsoft Office Sharepoint Designer 2007	America	Wrox Publishing	2009	1	1 Exp	PHK		√			
20/03/13	0003	George J Posner	Analyzing The Curriculum	America	Mc Graw Hill	2004	3	1 Exp	PHK		√			
20/03/13	0004	Peter W Airasian	Classroom Assessment	America	Mc Graw Hill	2008	6	1 Exp	PHK		√			
20/03/13	0005	John G Ruscher	The Closing of The Frontier: A History of The Marine Fisheries of	Singapore	KITLV Press	2004	1	1 Exp	PHK		√			
20/03/13	0006	MC Ricklefs	Polarising Javanese Society: Islamic and Other Visions	Belanda	MC Ricklefs	2007	1	1 Exp	PHK		√			

Fig. 6. Book catalog preparation for E-BOOK features

b) E-REPOSITORY (Final Thesis)

The final project files (theses) of History Department students from 2012–2023 were categorized by program (History and History Education) and year. The files have been uploaded to Google Drive and data collection is managed through a database on Google Spreadsheets (see Figure 7).

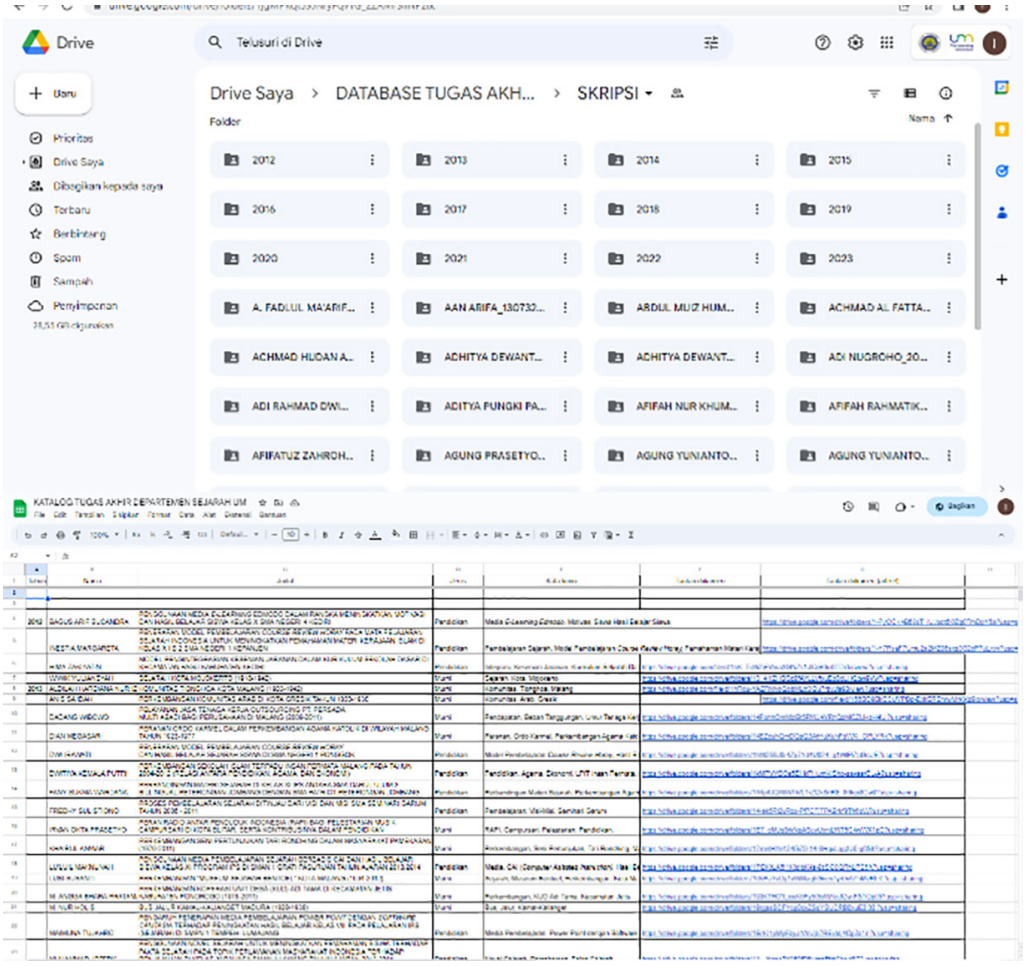


Fig. 7. Preparation of final project catalog for E-REPOSITORY feature

c) E-MUSEUM (Museology Collection)

The development of the E-MUSEUM feature is carried out in several stages based on the type of collection available. For indoor collections, the process involves photographing the collections, providing QR codes, and assigning collection identities. The results of the data analysis are uploaded to Google Drive (see Figure 8). Outdoor collections involve shooting, editing, organizing, and uploading videos to the YouTube channel.

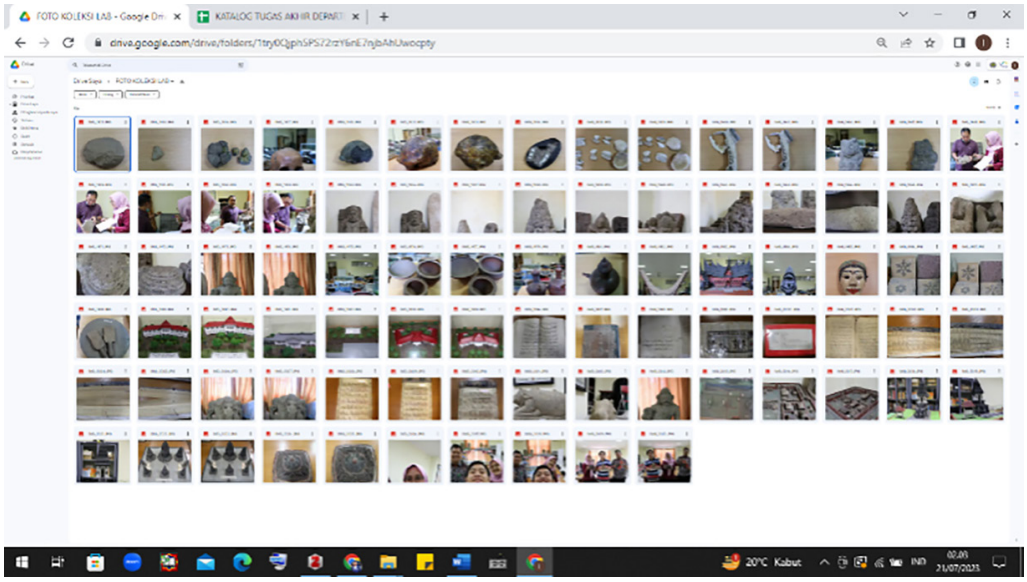
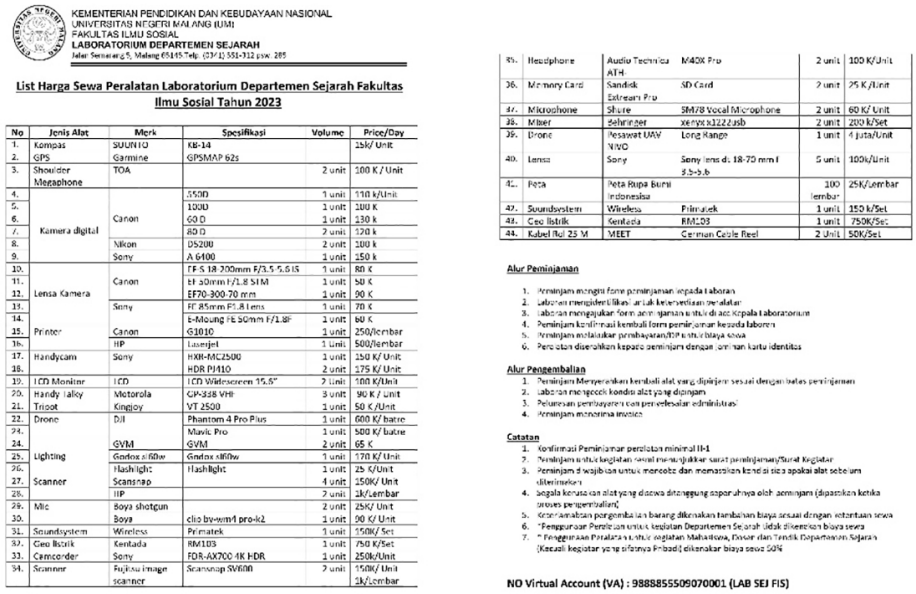


Fig. 8. Preparation of museology collection for E-MUSEUM feature

d) Tool Collection

The development of this feature involves collecting data on the tools owned by the History Department Laboratory. In addition, a system for borrowing equipment online was established (see Figure 9).



KEMENTERIAN PENDIDIKAN DAN KEBUDAYAAN NASIONAL
UNIVERSITAS NEGERI MALANG (UM)
FAKULTAS ILMU SOSIAL
LABORATORIUM DEPARTEMEN SEJARAH

List Harga Sewa Peralatan Laboratorium Departemen Sejarah Fakultas Ilmu Sosial Tahun 2023

No	Jenis Alat	Merk	Spesifikasi	Volume	Price/Day
1.	Kompas	SUUNTO	KB-14		15k/ Unit
2.	GPS	Garmine	GPSMAP 62s		
3.	Shoulder Megaphone	TOA		2 unit	100 K / Unit
4.	Kamera digital	Canon	550D	1 unit	110 k/Unit
5.			100D	1 unit	100 K
6.			60 D	1 unit	130 k
7.			80 D	2 unit	120 k
8.		Nikon	D5200	2 unit	100 k
9.		Sony	A 6400	1 unit	150 k
10.	Lensa Kamera	Canon	EF-S 18-200mm F/3.5-5.6 IS	1 unit	80 K
11.			EF 50mm F/1.8 STM	1 unit	50 K
12.			EF70-300-70 mm	1 unit	90 K
13.		Sony	FE 85mm F1.8 Lens	1 unit	70 K
14.			E-Mount FE 50mm F/1.8F	1 unit	60 K
15.	Printer	Canon	G1010	1 unit	250/lembar
16.		HP	Laserjet	1 Unit	500/lembar
17.	Handycam	Sony	HXR-MC2500	1 unit	150 K/ Unit
18.			HDR PJ410	2 unit	175 K/ Unit
19.	LCD Monitor	LCD	LCD Widescreen 15.6"	2 Unit	100 K/Unit
20.	Handy talky	Motorola	GP-338 VHF	3 unit	90 K / Unit
21.	Tripot	Kingjoy	VT 2500	1 unit	50 K /Unit
22.	Drone	DJI	Phantom 4 Pro Plus	1 unit	600 K/ batre
24.			Mavik Pro	1 unit	500 K/ batre
24.		GVM	GVM	2 unit	65 K
25.	Lighting	Godox x600w	Godox x600w	1 unit	170 K/ Unit
26.	Scanner	Hashlight	Hashlight	1 unit	25 K/Unit
27.		Scansnap		4 unit	150K/ Unit
28.		HP		2 unit	1k/Lembar
29.	Mic	Boya shotgun		2 unit	25K/ Unit
30.		Boya	clio by-wm1 pro-k2	1 unit	90 K/ Unit
31.	Soundsystem	Wireless	Primatek	1 unit	150K/ Set
32.	Ceo listrik	Kentada	RM103	1 unit	750 K/Set
33.	Camcorder	Sony	FDR-AX700 4K HDR	1 unit	250k/Unit
34.	Scanner	Fujitsu image scanner	Scansnap SV600	2 unit	150K/ Unit
					1k/Lembar
35.	Headphone	Audio Technica ATH	M40X Pro	2 unit	100 K/Unit
36.	Memory Card	Sandisk Extream Pro	SD Card	2 unit	25 K/Unit
37.	Microphone	Shure	SM78 Vocal Microphone	2 unit	60 K/ Unit
38.	Mixer	Behringer	xenyx1222usb	2 unit	200 k/Set
39.	Drone	Pesawat UAV VIVO	Long Range	1 unit	4 juta/Unit
40.	Lensa	Sony	Sony lens di. 18-70 mm f 3.5-5.6	5 unit	100k/Unit
41.	Peta	Peta Rupa Bumi Indonesia		100 lembar	25K/Lembar
42.	Soundsystem	Wireless	Primatek	1 unit	150 k/Set
43.	Ceo listrik	Kentada	RM103	1 unit	750K/Set
44.	Kabel Roll 25 M	MEET	German Cable Reel	2 Unit	50K/Set

Alur Peminjaman

1. Peminjam mengisi form peminjaman kepada Laboran
2. Laboran mengidentifikasi ketersediaan peralatan
3. Laboran mengajukan form peminjaman untuk di acc Kepala Laboratorium
4. Peminjam konfirmasi kembali form peminjaman kepada laboran
5. Peminjam melakukan pembayaran/DP untuk biaya sewa
6. Peralatan diserahkan kepada peminjam dengan jaminan kartu identitas

Alur Pengembalian

1. Peminjam Menyerahkan kembali alat yang dipinjam sesuai dengan batas peminjaman
2. Laboran mengecek kondisi alat yang dipinjam
3. Pelunasan pembayaran dan penyelesaian administrasi
4. Peminjam menerima invoice

Catatan

1. Konfirmasi Peminjaman peralatan minimal 1h1
2. Peminjam untuk kegiatan sekolah menunjukkan surat peminjaman/Surat Kegiatan
3. Peminjam diwajibkan untuk mengecek dan memastikan kondisi atau apakah alat sebelum diterimakan
4. Segala kerusakan alat yang disewa ditanggung sepenuhnya oleh peminjam (dipastikan ketika proses pengembalian)
5. Keterlambatan pengembalian barang dikenakan tambahan biaya sesuai dengan ketentuan sewa
6. *Penggunaan Peralatan untuk kegiatan Departemen Sejarah tidak dikenakan biaya sewa
7. * Penggunaan Peralatan untuk kegiatan Mahasiswa, Dosen dan Tendik Departemen Sejarah (Kecuali kegiatan yang sifatnya Pribadi) dikenakan biaya sewa 50%

NO Virtual Account (VA) : 988885550970001 (LAB SEJ FIS)

Fig. 9. List of laboratory equipment history and loan flow

e) Exploration

The development of this feature involved creating an exploration flow as one of the stages for completing studies at the Department of History, which can be completed online. In addition, templates were also created for the assessment form, biodata of History Department student graduates, and graduate assessment process cards (see Figure 10). The templates were then uploaded to Google Drive. An online assessment form was created and integrated with Google Forms and Google Spreadsheets.

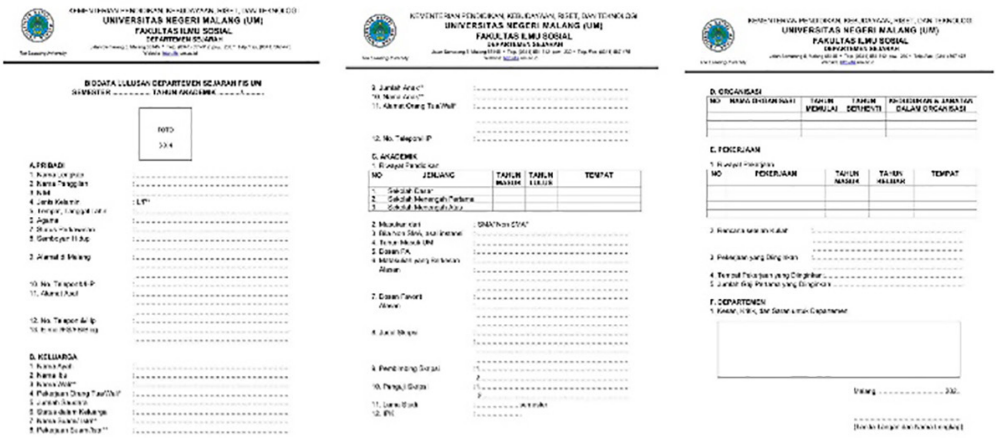


Fig. 10. Template preparation and exploratory flow

From the features mentioned above, they are integrated and visualized on the Department of History's website platform as a unified Digital Laboratory (E-Laboratory), as depicted in Figure 11.

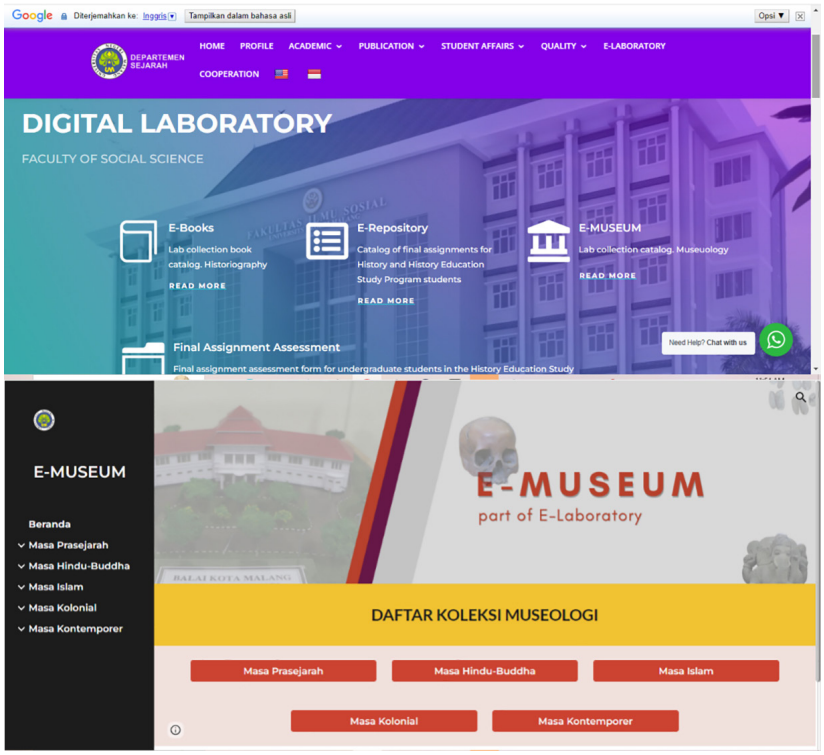


Fig. 11. The initial view of the E-Laboratory (digital laboratory)

Implementation and Evaluation

The implementation and evaluation stages are the final steps in this research and development process. This stage aims to assess the feasibility and effectiveness of the product based on the development results. Product effectiveness testing involves validating digital products, including platform and content validation. This stage is utilized by researchers to assess the level of product validity, ensuring that its implementation is feasible for testing. The results of material and media validation can be seen in Figure 12.

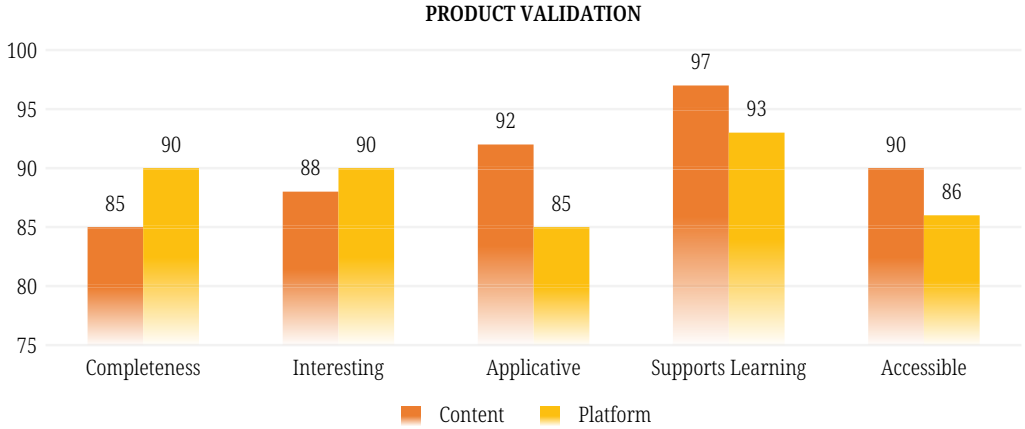


Fig. 12. Data recap of content and platform validation results

From the results shown in Figure 12, the average scores for digitalization products are deemed highly valid. Judging from the average content validation results, which reached 90.4, and platform validation, which reached 88.8. Based on the Likert scale range, the product falls within the "very valid" category, indicating its suitability for implementation testing.

In the next phase, an implementation test was conducted with a limited sample of 20 participants, including students and members of the general public. Implementation-testing activities are conducted using various syntaxes. First, participants were provided with an explanation of digitalization products. Second, they were given a link to access the product online. Third, they accessed the digital laboratory by trying all the available menus. Finally, they provided an evaluation of their digital laboratory access. From the assessments provided by the respondents, the following data were obtained:

Table 2. Table of implementation test results

Indicator	Score	Criteria
Digital laboratory access is effective and efficient	97%	Very good
Completeness of the digital content presented	92%	Very good
The design is attractive and stimulates visitors	88%	Very good
Worthy of use as a learning resource platform	90%	Very good
In accordance with the learning needs of civil society 5.0	95%	Very good

From the evaluation results at the implementation test stage in Table 2, it shows the average data from the responses given by users. In a closed questionnaire,

respondents provided an assessment of the product based on five main indicators detailed in 30 statement items. The results indicate that this digitalization product has an overall average score of 92.4%. The highest rating from respondents was on the first indicator, specifically 97%, which was related to the effective and efficient elements of the product. The product development platform is web-based and easily accessible, which contributes to high ratings for many of its elements. Meanwhile, the lowest assessment is in the third indicator, which is related to the layout design of the digital display. This serves as an evaluation for the research team to revise and redesign based on the suggestions provided by respondents. Overall, the average assessment results of these respondents, based on product effectiveness criteria, fall within the 5th range, indicating very effective criteria. These results answer the fundamental question of this research, demonstrating that the establishment of a digital laboratory is effective as a learning resource for civil society 5.0.

4 CONCLUSION

As a fundamental aspect of learning, learning resources are important and must be continually innovated and improved. This pertains to the urgency and necessity for easy, fast, accurate, and affordable information presentation in the era of Society 5.0. Integrating learning resources with technology can provide a solution to address these needs and problems. The vast number of underexplored laboratory collections represents significant untapped potential. In this study, the E-Laboratory (digital laboratory) is the resulting product. Collaborating between laboratory collections and technology in the digitization process. The UM History Department Laboratory is the facility used in this research. The outcome of this research is a digital laboratory product for the UM History Department. This digital laboratory product consists of several features, including an E-Book (book catalog), an E-Repository (final project catalog), an E-Museum (museology collection catalog), borrowing tools, and graduate exploration. This digital laboratory represents a transformation and adaptation to ensure the laboratory's continued existence. This laboratory is highly affordable and easily accessible, making it an effective and efficient learning resource with accurate information.

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