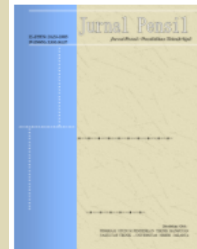


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## DEVELOPMENT OF A WEB-BASED MATERIAL MANAGEMENT SYSTEM FOR A WOODWORKING WORKSHOP

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### Abstract

This research and development (R&D) study aimed to create a website for managing materials in the Woodworking Workshop of the Civil Engineering and Planning Education program and to evaluate its feasibility in terms of content and media. The development process adhered to the waterfall model, progressing through the stages of analysis, design, coding, testing, and maintenance. The development yielded a web-based material management application. The initial analysis phase identified the core problem: the absence of a proper material information system, which hampered need analysis and identification. The application was developed using hardware (a laptop with 8GB RAM and an AMD processor) and software including Google Site, Appsgeyser, MySQL, PHPMyAdmin, and relevant frameworks. Following the design and coding phases, the application underwent rigorous testing. The feasibility testing produced excellent results. Validation by a content expert resulted in a score of 97.22% (average 3.90), deemed "Feasible." A media expert validation yielded a score of 96.67% (average 3.87), also "Feasible." User assessment showed a score of 92.78% (average 3.73), categorized as "Feasible." Additionally, co-existence and device compatibility tests both achieved a 100% feasibility rate. Performance efficiency testing recorded an average load time of 0 seconds. In conclusion, the developed web-based material management application is highly feasible and met the "Very Satisfied" criterion based on all validation and testing results.

P-ISSN: [2301-8437](#)  
E-ISSN: [2623-1085](#)

#### ARTICLE HISTORY

Accepted:

30 May 2025

Revision:

25 September 2025

Published:

30 September 2025

ARTICLE DOI:

[10.21009/jpensil.v14i3.55750](https://doi.org/10.21009/jpensil.v14i3.55750)



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**Keywords:** development; application program development; web-based material management application

## **Introduction**

The management of facilities and infrastructure, including procurement, supervision, storage, organization, and disposal, requires effective management to ensure that the learning activities are conducted smoothly and can make an optimal and meaningful contribution to the teaching and learning process. This is because the availability of adequate tools or practice equipment can assist and simplify the implementation of practical work (Muhqofi & Iranto, 2020). This aligns with the view of Sinta, 2019 who stated that the lack of practice materials used by students adds complications in conducting practical sessions. The Woodworking Workshop at PTSP FT UNY has successfully implemented planning, execution, and evaluation of practical activities; however, there are still deficiencies in the equipment and hazard identification indicators.

Several pieces of equipment, particularly the machines in the workshop, are no longer complete as they were initially, which could potentially pose hazards (Hidayat & Wahyuni, 2016). At certain times, this leads to work accidents due to a lack of understanding and inadequate Health and Safety (K3) infrastructure in the woodworking workshop. Facilities such as posters can be used to convey information, work procedures, personal protective equipment for specific tools, learning products, and the importance of health and safety information (Wahyuni & Hidayat, 2019). This is also emphasized by Purwanto & Sukardi, 2015, who assert that workshops or laboratories equipped with complete facilities and well-maintained conditions can provide optimal service to students, helping them achieve competence and expertise in their field. With good conditions, the benefits that students derive from the workshop and laboratory are maximized.

The management of facilities and infrastructure for teaching and learning activities in the Department of Civil Engineering and Planning Education, Faculty of Engineering, UNY, is crucial for practical learning, particularly in the Woodworking Workshop at PTSP FT UNY. Issues identified include: The Educational Institution for Teacher Training (LPTK) such as Universitas Negeri Yogyakarta being inadequately prepared to provide necessary educational support; the Woodworking Workshop at PTSP FT UNY lacking sufficient K3 facilities, leading to work accidents during practical sessions; failure to utilize technology, such as applications, resulting in frequent errors in recording the quantity and availability of materials; the lack of proper documentation for incoming and outgoing materials, leading to unusable or damaged practical materials; manual checks of practical materials, causing delays in the availability of information; suboptimal practical learning due to outdated and inadequate equipment; the absence of a media development application for easier material management in the woodworking workshop, which fails to leverage practical technological advancements that can be accessed anytime and anywhere; and the lack of an information system for material management in the woodworking workshop, which hinders the material requisition process.

This impacts both instructors and administrators, causing delays in information and reports related to facilities data. The use of traditional manual methods results in lengthy processing times and inaccurate calculations, requiring managers to check material availability first. This delays the teaching and learning process at the Department of PTSP FT UNY, reducing its effectiveness.

Currently, education is expected to foster innovation and creativity in technology usage, in line with rapid technological advancements (Titania & Widodo, 2020). One way to optimize the learning process is by designing an application that incorporates an information system development method to facilitate inventory management more efficiently and accurately. Audio-visual media is an alternative technology for learning (Marsudi et al., 2020). The development of a web-based inventory management system utilizes PHP programming language with the Codeigniter framework, Bootstrap for the display layout, HTML components from jQuery, and the XSS Filtering library for data security. This combination enhances the speed and responsiveness of inventory management (Anggara & Somya, 2021). The web-based system at CV

Telaga Berkat, developed using the Waterfall model, provides accurate information (Hakim et al., 2019). The information system for managing raw material data at PT Wijaya Karunia Megah, developed using the prototype method, enhances the effectiveness of inventory (Wijayanti et al., 2022).

Based on the various issues outlined, a solution in the form of a web-based application is needed to facilitate the inventory management of facilities and infrastructure more efficiently. The methodology applied in the development of this application involves internet-based software designed to control the facilities and infrastructure in teaching and learning activities. Therefore, the researcher decided to develop a web-based material management application for the woodworking workshop. The objectives of this research are: first, to ensure that material management activities run more smoothly through the use of the application; second, to make planning, procurement, and recording of materials entering and leaving more efficient and faster; and third, to meet the learning needs of students, thereby improving the teaching and learning process and enhancing the quality of education.

### Research Methods

This study employs the Research and Development (R&D) method. The research was conducted over a period of four months, located at the PTSP FT Department of Yogyakarta State University, from August to November 2023. The target users of the application are faculty members, woodworking workshop lab administrators, and students of PTSP FT Yogyakarta State University.

The study uses purposive sampling, focusing on selected informants with rich cases for in-depth study. The researcher employed data collection instruments to gather relevant data for the study, ensuring the process is systematic and organized. The instruments used in this study include materials, media, and user assessment. The validation process in this study involved one material expert and one media expert, both of whom are lecturers at PTSP FT Yogyakarta State University. These experts acted as validators, providing assessments of the feasibility of the research product. The material expert evaluated three aspects: the content of the website application, the feasibility of the website application, and the presentation of the website application. Meanwhile, the media expert assessed two aspects: the application aspect and the media aspect. The user assessment involved a lecturer from PTSP FT Yogyakarta State University., who serves as the coordinator of the woodworking workshop, as well as two woodworking workshop technicians. The users assessed two aspects: the application aspect and the media aspect.

Table 1. Material Expert Validation Instrument

Number	Aspect	Indicator
1	Website Application Material	Relevance of Material Presentation of Material Web Application Quality
2	Web Application Feasibility	Knowledge Material
3	Website Application Presentation	Application Presentation

Table 2. Media Expert Validation Instrument

Number	Aspect	Indicator
1	Application	Ease of application and navigation Website appearance

Number	Aspect	Indicator
		App benefits
2	Media	Website Presentation Media Benefits of Use

Table 3. User Assessment Instrument

Number	Aspect	Indicator
1	Application	Ease of use and navigation Website appearance App benefits
2	Media	Website Presentation Media Benefits of Use

The feasibility categories are presented in **Table 4**.

Table 4. Feasibility categories

Answer Score	Category
$X > Mi + 1.5 (SDi)$	Feasible
$Mi < X < Mi + 1.5 (SDi)$	Moderately Feasible
$Mi - 1.5 (SDi) < X < Mi$	Less Feasible
$X < Mi - 1,5 SDi$	Not feasible

Description:

X = obtained score

$Mi = \frac{1}{2} \times (\text{maximum score} + \text{minimum score})$

$SDi = \frac{1}{6} \times (\text{maximum score} - \text{minimum score})$

The analysis process was then converted into percentages. The calculation of the percentage results is as follows:

$$p = \frac{f}{n} \times 100\%$$

Description:

P : percentage value

f: frequency for which the percentage is calculated

n : number of cases (total frequency/number of individuals)

The software development research method adopts the waterfall development model. This method follows a systematic and sequential approach, starting from system requirements analysis and progressing through the stages of analysis, design, coding, testing/verification, and maintenance. The waterfall model is named as such because each stage must wait for the completion of the previous one, starting with the requirement stage. The waterfall system development model is illustrated in Figure 1.

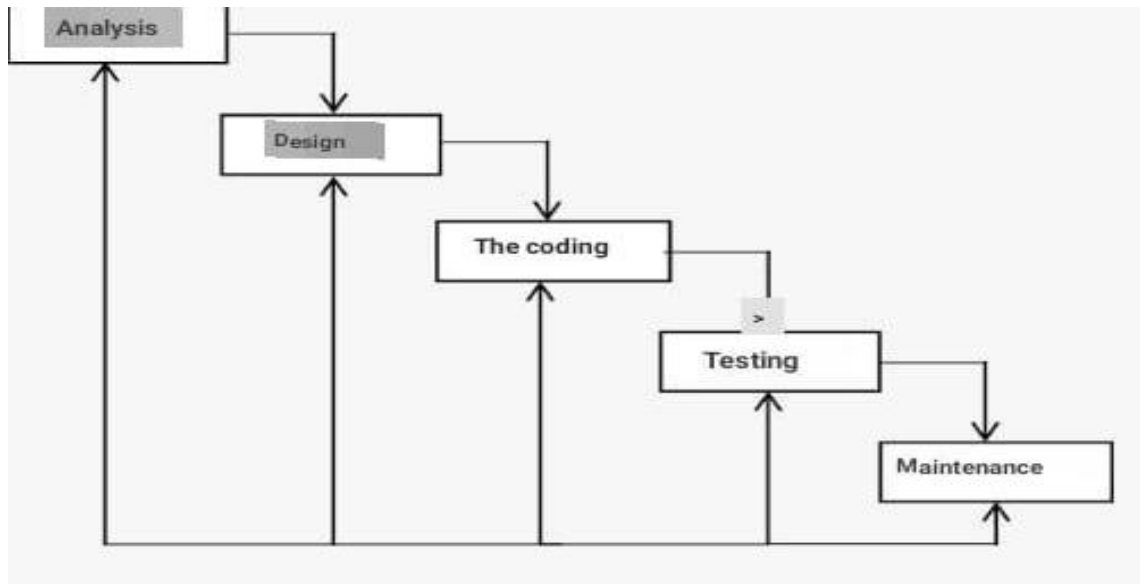


Figure 1. Waterfall System Development Method

**Results and Discussion**

The testing conducted on the application, based on the ISO 25010 reference, includes compatibility testing, performance testing, and validation by content and media experts. . Content expert validation assesses three main aspects: the website application's hardware with 12 sub-indicators, the website application's feasibility with 6 sub-indicators, and the website application's presentation with 3 sub-indicators. Overall, the assessment is carried out using professional documents, covering 21 sub-index elements. The website application aspect evaluates document relevance, document presentation, and web application quality. The feasibility of the web application assesses knowledge and documentation, while the presentation of the website considers the website's presentation. The content validation was performed by Dr. Ir. Sunar Rochmadi, M.E.S., a lecturer at the Department of Civil Engineering and Planning Education, Faculty of Engineering, Yogyakarta State University. The results of the content validation score distribution are presented in Table 5.

Table 5. Distribution of Content Validation Results

Number	Aspect	Indicator	Number of Items	Score Spread			
				1	2	3	4
1	Website Application Material	Relevance of Material	6	-	-	-	6
		Presentation of Material	3	-	-	2	1
		Web Application Quality	3				
2	Web Application Feasibility	Knowledge	3	-	-	-	3
		Material	3	-	-	-	3
3	Website Application Presentation	Application Presentation	3	-	-	-	3

Based on the validation from content experts, the validation scores for the web-based material management application for the woodworking workshop are presented in **Table 6**.

Table 6. Material Expert Validation Results

Number	Aspect	Indicator	Number of Items	Score obtained	Maximum score
1	Website	Material Relevance	6	24	24
	Application	Material Presentation	3	10	12
	Material	Web Application Quality	3	12	12
2	Web Application	Knowledge	3	12	12
	Feasibility	Material	3	12	12
3	Website	Application Presentation	3	12	12
	Application Presentation				
Amount			21	82	84
Average				3,90	4

The scores obtained from the content expert validation are then calculated to compare them with the maximum score for each sub-index element. The results of this comparison are as follows.

Table 7. Comparison Between Aspects of Content Validation

Number	Aspect	Indicator	Score obtained	Maximum score	Percentage
1	Website	Material Relevance	24	24	100%
	Application	Material Presentation	10	12	83,33%
	Material	Web Application Quality	12	12	100%
2	Web Application	Knowledge	12	12	100%
	Feasibility	Material	12	12	100%
3	Website	Application Presentation	12	12	100%
	Application Presentation				

The comparison chart of the assessment scores between aspects and sub-indicators can be seen in Figure 2.

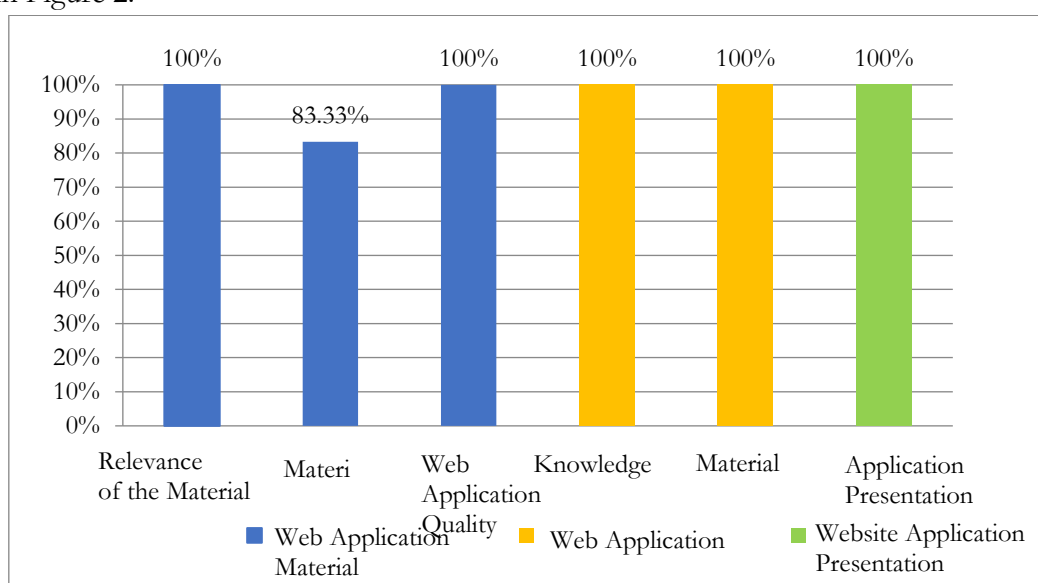


Figure 2. Comparison Between Aspects of Content Validation

The assessment results are then converted based on the score conversion category, as shown in Table 4 and then converted into percentages. Based on the analysis conducted, the conversion results are presented in Table 9.

Table 9. Results of Content Expert Validation Data Analysis

Number	Intervals	Score obtained	Percentage	Category
1	$X > 68.25$	82	97.61%	Feasible
2	$52.5 < X < 68.25$			Moderately Feasible
3	$36.75 < X < 52.5$			Less Feasible
4	$X < 36.75$			Not feasible

Based on the data analysis from the content expert validation conducted on the web-based material management application, the results show that the sub-indicators of Material Relevance, Web Application Quality, Knowledge, Material, and Application Presentation received a 100% score, while the sub-indicator of Material Presentation received 83.33%, with an average rating of 3.90. The content validation results for the web-based material management application, based on the score conversion table, fall under the "**Feasible**" category. The 100% scores for material relevance, web application quality, knowledge, material, and application presentation indicate that the application is considered highly relevant, of good quality, and capable of supporting knowledge needs. The woodworking workshop coordinator and technicians can adapt the application in the process of workshop management. However, improvements are needed in material organization to ensure better presentation. These findings are consistent with previous studies conducted by Meilano et al. (2020), Wau (2022), Sismadi (2020), and Mohammad Rizky et al. (2021), which similarly showed that material feasibility in application programs was categorized as good. This result demonstrates that the web-based material management application is feasible for use.

Media Expert Validation assesses two aspects: the Application aspect, which consists of 13 sub-indicators, and the Media aspect, which consists of 18 sub-indicators, totaling 31 sub-indicators. The application evaluates three metrics: ease of use and navigation, website appearance and feel, and the application's benefits. The evaluation of the application aspect includes website presentation, media, and usage benefits. This application was evaluated by Dr. Ir. Nuryadin Eko Raharjo, M.Pd., a lecturer at the Department of Civil Engineering and Planning Education, Faculty of Engineering, Yogyakarta State University. The results of the content expert validation score distribution can be seen in **Table 10**

Table 10. Distribution of Media Validation Results

Number	Aspect	Indicator	Number of Items	Score Spread			
				1	2	3	4
1	Application	Ease of application and navigation	5	-	-	2	3
		Website appearance	5	-	-	-	5
		App benefits	3	-	-	-	3
2	Media	Website Presentation	5	-	-	2	3
		Media	10	-	-	-	10
		Benefits of Use	3	-	-	-	3

Based on the validation by the media expert on the web-based material management application for the woodworking workshop, the validation scores are presented in Table 11.

Table 11. Media Expert Validation Results

Number	Aspect	Indicator	Number of Items	Score obtained	Maximum score
1	Application	Ease of application and navigation	5	18	20
			5	20	20
		Website appearance	3	12	12
		App benefits			
2	Media	Website Presentation	5	18	20
		Media	10	40	40
		Benefits of Use	3	12	12
Amount			31	120	124
Average				3.87	4

The scores obtained from the media expert validation are then calculated to compare the obtained scores with the maximum score for each sub-indicator item. The results of this comparison are as follows:

Table 12. Comparison Between Media Expert Validation Aspects

Number	Aspect	Indicator	Number of Items	Score obtained	Maximum score
1	Website Application Material	Ease of application and navigation	18	20	90%
			20	20	100%
		Website appearance	12	12	100%
		App benefits			
2	Web Application Eligibility	Website Presentation	18	20	90%
		Media	40	40	100%
		Benefits of Use	12	12	100%

The comparison of the sub-indicator scores and between aspects can be seen in Figure 3.

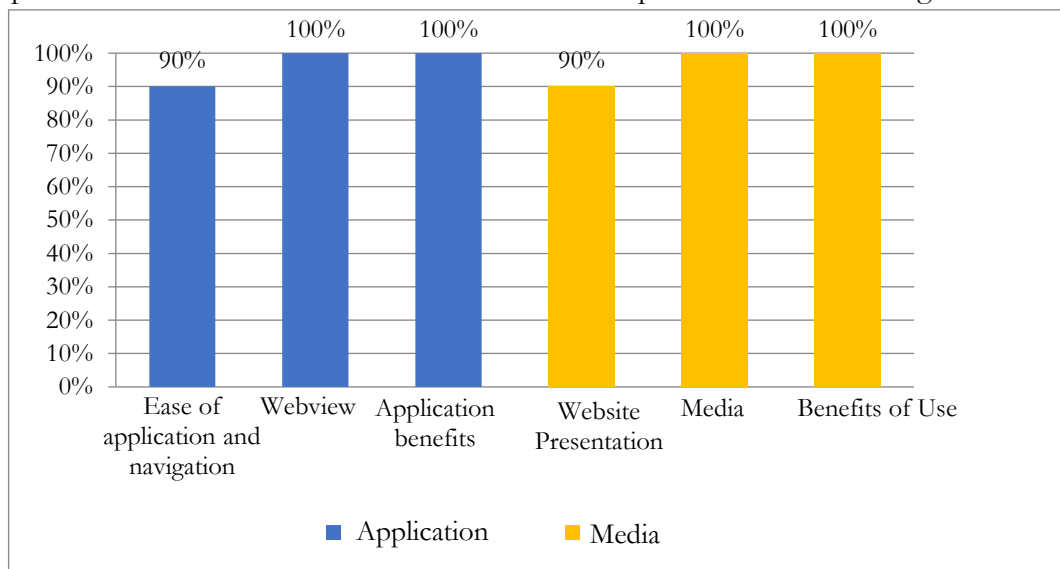


Figure 3. Comparison of Media Validation Between Aspects

The media expert assessment, based on the score conversion category, is shown in **Table 14**. The results of the conversion analysis conducted are presented as follows:

Table 14. Results of media expert validation data analysis

Number	Intervals	Score obtained	Percentage	Category
1	$X > 68.25$	120	96.77%	Feasible
2	$52.5 < X < 68.25$			Moderately Feasible
3	$36.75 < X < 52.5$			Less Feasible
4	$X < 36.75$			Not feasible

The data analysis from the media expert validation conducted on the web-based material management application for the woodworking workshop revealed that the sub-indicators for website appearance, application benefits, media, and usage benefits received a 100% score, while application ease and navigation, as well as website presentation, received 90%, with an average rating of 3.87. The media validation results for the web-based material management application, based on the score conversion table, were categorized as "**Feasible**." The percentage indicates that the application is relevant and of good quality, although several aspects still require improvement. Nevertheless, the application can be used for managing woodworking workshops. These findings are consistent with previous studies conducted by Meilano et al. (2020), Wau (2022), Sismadi (2020), and Mohammad Rizky et al. (2021), which similarly demonstrated that the feasibility of media in application programs was categorized as good. This result shows that the web-based material management application is feasible for use.

Users assessed two aspects: the application aspect, which includes 13 sub-indicator items, and the media aspect, which includes 18 sub-indicator items, totaling 31 sub-indicator items assessed by the users. The application evaluates three metrics: ease of use and navigation, website appearance and feel, and application benefits. The communication aspect evaluates three components: website presentation, media, and usage benefits. The users of the web-based material management application for the woodworking workshop were evaluated by Mrs. Indah Wahyuni, S.Pd.T., M.Pd., the woodworking workshop coordinator, Mr. Suparjo, and Mr. Tedjo Sulaksono, the woodworking technicians. The distribution of the scores can be seen in Table 15.

Table 15. Distribution of User Assessment Results

Number	Aspect	Indicator	Number of Items	Score Spread			
				1	2	3	4
1	Application	Ease of use and navigation	15	-	-	3	12
		Website appearance	15	-	-	7	8
		App benefits	9	-	2	-	7
2	Media	Website Presentation	15	-	-	3	
		Media	30	12			
		Benefits of Use	9	-	-	6	
				24			
				-	-	2	7

Based on the user assessment of the web-based material management application for the woodworking workshop, the user scores are presented in **Table 16**.

Table 16. User Assessment Score Results

Number	Aspect	Indicator	Number of Items	Score obtained	Maximum score
1	Application	Ease of application and navigation	15	57	60
		Website appearance	15	53	60
		App benefits	9	32	36
2	Media	Website Presentation	15	57	60
		Media	30	114	120
		Benefits of Use	9	34	36
Amount			93	347	372
Average				3.73	4

The scores obtained from the user assessment are then calculated to compare the obtained scores with the maximum score for each sub-indicator item. The results of this comparison are as follows:

Tabel 17. Comparison Between User Assessment Aspects

Number	Aspect	Indicator	Score obtained	Maximum score	Percentage
1	Application	Ease of application and navigation	57	60	95%
		Website appearance	53	60	88.33%
		App benefits	32	36	88.88%
2	Media	Website Presentation	57	60	95%
		Media	114	120	95%
		Benefits of Use	34	36	94.44%

The comparison chart of the assessment scores between aspects and sub-indicators is presented in Figure 4.

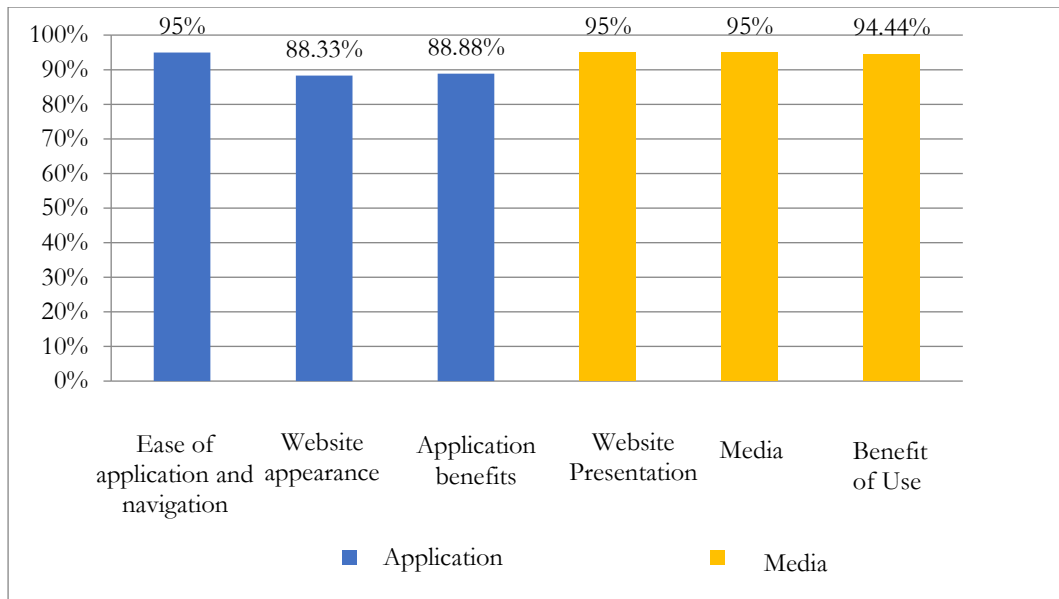


Figure 4. Comparison Between User Aspects

Based on the analysis conducted, the conversion results are presented in Table 18.

Table 18. Results of user assessment data analysis

Number	Intervals	Score obtained	Percentage	Category
1	$X > 68.25$	347	93.28%	Feasible
2	$52.5 < X < 68.25$			Moderately Feasible
3	$36.75 < X < 52.5$			Less Feasible
4	$X < 36.75$			Not feasible

Based on the data analysis from users conducted on the web-based material management application, the results revealed that the sub-indicators for ease of use and navigation, website presentation, and media received a 95% score, while website appearance received 88.33%, with an average rating of 3.73. The user assessment results for the web-based material management application, based on the score conversion table, fall under the "Feasible" category. The results indicate that the application is relevant and of good quality, although certain aspects, particularly the website display, still require improvement. With certain adjustments, the application can be utilized for woodworking workshop management. These findings are consistent with previous studies conducted by Meilano et al. (2020), Wau (2022), Sismadi (2020), and Mohammad Rizky et al. (2021), which similarly reported that user evaluations of application programs were categorized as good. These results demonstrate that the web-based material management application is feasible for use.

The purpose of testing on various devices is to determine whether the application functions normally and does not affect device performance, even when the device is accessing other applications. The test results are shown in Table 19.

Table 19. Co-existence Test Results

Number	Running Applications		Successful	Fail
1	Materials Management Application	Google Chrome	1	0
2	Materials Management Application	WhatsApp	1	0
3	Materials Management Application	WPS	1	0
4	Materials Management Application	GoogleDrive	1	0
5	Materials Management Application	Opera	1	0
	Total		5	0

Co-existence testing was conducted by running five different applications simultaneously on a device along with the web-based material management application for the woodworking workshop. Based on Table 19, the results showed a feasibility percentage of 100%, and the web-based material management application for the woodworking workshop was categorized as **“Feasible.”** These findings show that the application can function normally and does not affect device performance even when the device is accessing other applications. Coordinators and technicians can operate the material management application simultaneously with other software, facilitating flexible monitoring of material inventory and usage without disrupting other woodworking workshop activities.

Performance Efficiency testing was carried out to assess the response time and processing speed of the application when launched on different devices. The experimental results are presented in Table 20.

Table 20. Performance Efficiency Test Results

Number	Device	Specification	Failed
1	Laptops Fujitsu	Intel core Lseries 2GB	0 second
2	Laptops AXIOO	M1169C/11G, 4GB	0 second
3	Iphone 12	IOS 128GB	0 second
4	Redmi 12C	Android 128GB	0 second
5	PC AXIOO	Intel Core8 GB DDR4 Memory 128 GB	0 second
	Average		0 second

Based on the results obtained regarding time, the application response yielded an average of 0 seconds. As shown in Table 13, the web-based wood workshop management application was categorized as **“Very Satisfied.”** These findings show that the application has satisfactory response times and processing speeds even when run on different devices. Through this application, coordinators and technicians can improve the operational efficiency of woodworking workshops. Fast response times and smooth interaction allow the application to be used regularly and consistently.

## Conclusion

Based on the results of the research on the development of a web-based material management application using the waterfall method, the analysis of software requirements can be concluded as follows: The stages of product planning include problem analysis, design creation, coding, and testing. The feasibility of the web-based material management application, as evaluated by content experts, media experts, and users, showed that content expert validation yielded a percentage of 97.22% with an average score of 3.90, categorized as feasible; media expert validation yielded a percentage of 96.67% with an average score of 3.87, categorized as feasible; and user assessment resulted in a percentage of 92.78% with an average score of 3.73, categorized as feasible. Co-existence testing achieved an application feasibility percentage of 100%. Device compatibility testing also resulted in a 100% feasibility percentage, with all categories categorized as feasible. Performance efficiency testing yielded an average result of 0 seconds, and based on the table, the web-based material management application for the wood workshop met the "Very Satisfied" criteria.

The implications of these findings for vocational education are that it can facilitate management, planning, procurement, and recording of material inflows and outflows, making these activities easier and faster, and ensuring that students' learning needs are met. However, this study has limitations, namely that maintenance and upkeep are quite expensive in the long term, and researchers have limited ability to identify materials in the application. Recommendations for further research include the need to develop materials for the application, the need for more comprehensive application development, and the development of the effectiveness of web-based woodworking workshop material management application programs.

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