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A DSRM-Based Digital Library to Improve Reading Interest among Elementary School Students : MIN 7 Tulungagung Case Study

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ABSTRACT

The low level of reading interest among Indonesian children reported by UNESCO to be merely 0.01% highlights an urgent need for innovative approaches to promote literacy engagement. The digital library emerges as a relevant solution; however, most existing services have not been specifically designed to cater to elementary school students. This study aims to develop a Digital Library based on the Design Science Research Methodology (DSRM) as a medium to enhance reading motivation among students at MIN 7 Tulungagung. The research employed the DSRM framework, encompassing the stages of problem identification, system design, prototype development, implementation, and evaluation. The primary users of the system were elementary school students, while validation involved expert review (validators) and direct user testing by students. Data collection techniques included observation, questionnaires, and documentation. The findings indicate that the developed Digital Library system achieved overall ratings in the "good" to "very good" categories. The user interface (UI) aspect obtained the highest score of 93.75%, followed by user compatibility (87.50%) and system functionality (87.50%). Conversely, data reliability and security received the lowest rating, at 75.00%. Implementation testing with students also demonstrated highly positive responses, with the indicator "Willing to use the application again" achieving a score of 95%. The students appeared enthusiastic, demonstrated independent use of the application, and exhibited increased motivation to read after exploring its features. In conclusion, the Digital Library developed using the DSRM approach has proven to be both feasible and effective in enhancing reading interest among elementary school students. Future work is recommended to strengthen data security mechanisms and expand the diversity of reading materials to further optimize the system's contribution to children's literacy development.

Keywords: *digital library; design science research methodology; reading motivation; information literacy*

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1. INTRODUCTION

The significant spread of information today requires innovation in technology, especially in libraries (Asemi et al., 2020). Libraries are information providers that should be able to provide information and knowledge to their users (Anser et al., 2023). The increasingly complex technological advances require libraries to be accessible anytime and anywhere (Onunka et al., 2023). One innovation that has emerged as a solution to meet information needs is the digital library.

A digital library is a system that manages all collections in digital format that can be accessed by its users using the internet network (Anser et al., 2023). Digital libraries differ from conventional libraries because they do not require physical space to store collections (Puspitasari, 2016). This is because all collections owned by digital libraries are digital collections. Digital libraries are also often referred to as libraries without walls (Panda & Chakravarty, 2022). This term emerged because library users will not find a physical form of this library. However, they can still utilize the information owned by this library. Nevertheless, electronic devices are still required to access digital libraries (Hakim & Hadiapurwa, 2022).

Currently, there are quite a number of digital libraries available for users (Khan, 2021). However, there are still few digital libraries that are specifically designed for children. This is because the digital libraries that are currently available have diverse collections. Therefore, it is quite difficult to filter reading materials that are suitable for elementary school children.

In this day and age, technology is an integral part of everyday life, including for children (Nguyen, 2021). This has led to a situation where elementary school children are in a reading crisis because they are more interested in using gadgets to play online games or social media than reading (Lin et al., 2023). Data from UNESCO shows that the percentage of Indonesian children who enjoy reading is currently at 0.01 percent, meaning that only one in 10,000 children in Indonesia likes to read (Safitri et al., 2021). Therefore, a system such as a digital library with fun features is needed to attract children to read or at least increase their interest in reading (Tulodo et al., 2024). These features are expected to be an effective means of fostering a habit of reading that will enrich children's knowledge.

Reading interest in children is one of the most important factors in shaping a critical, creative, and broad-minded generation (Shakhanova, 2025). However, it cannot be denied that currently, children's reading interest is overshadowed by the appeal of entertainment content such as social media, online games, and videos, which are widely accessible to children for free. Therefore, parents need to play a role in supervising their children (Rahman et al., 2020). When parents prohibit their children from accessing such content, they must have something else to divert their children's attention. One of them is providing interesting reading materials. The current challenge is the lack of applications or systems that provide such materials.

The existence of a digital library with a special collection for children can be an alternative for parents in diverting their children's attention so that they maintain an interest in reading, which will be beneficial for them in the future (Riani, 2022). This digital library application will be designed using the DSRM (Design Science Research Methodology) method, which is the standard for research related to services in the form of systems (Haryanti et al., 2024). The DSRM method consists of the stages of problem formulation, literature study, system design and development, implementation, and evaluation (Gregor & Hevner, 2013).

The problem statement or focus of this research is the development of a digital library using the DSRM method as a means of increasing reading interest among elementary school children. One of the relevant previous studies is the research conducted by Sianturi, et al. (2021) in their study entitled

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Designing a Web-Based Library System Using the Waterfall Method, which states that the manual processing of book data in libraries results in ineffective services, thus requiring a web-based library system that will make it easier for students to use the library, especially in terms of circulation (Sianturi & Katarina, 2021). This also becomes a factor that influences the lack of interest of users, especially children, in utilizing the library.

Furthermore, research conducted by Ayu Puspa Arum (2021) in her study entitled Development of Digital Libraries to Facilitate Access to Information shows that the dynamics of digital library development should not only focus on the application of technology, but also on facilitating access to information contained in the library. The services provided can be available 24 hours a day, which can also be included in social change opportunities that are highly dependent on modern society. Modern society, which is currently in a reading emergency, can be influenced by their habits (Arum & Marfianti, 2021). Therefore, a system is needed that can change people's habits from an early age.

Thus, the emergence of this digital library is expected to be able to provide new habits for the community to enjoy reading from an early age. With the existence of a digital library that has a special collection for children, it is hoped that it can increase their interest in reading and show their interest in books. The digital library application that will be developed is an application that can be accessed through Android so that students can still access it in their respective homes. Parents also do not need to worry because the collection that will be included in this digital library is child-friendly and will not contain elements that could harm children's mindsets. This research uses the DSRM approach to develop a child-friendly and interactive digital library, which has not been widely applied in the context of basic libraries in Indonesia.

2. RESEARCH METHODS

This research will use the Design Science Research Methodology (DSRM), a method that aligns with standard guidelines for developing information systems (Gregor & Hevner, 2013). There are several stages in the DSRM method, starting with Problem Identification, Object Identification, Design and Development, Demonstration, Evaluation, and finally Communication.

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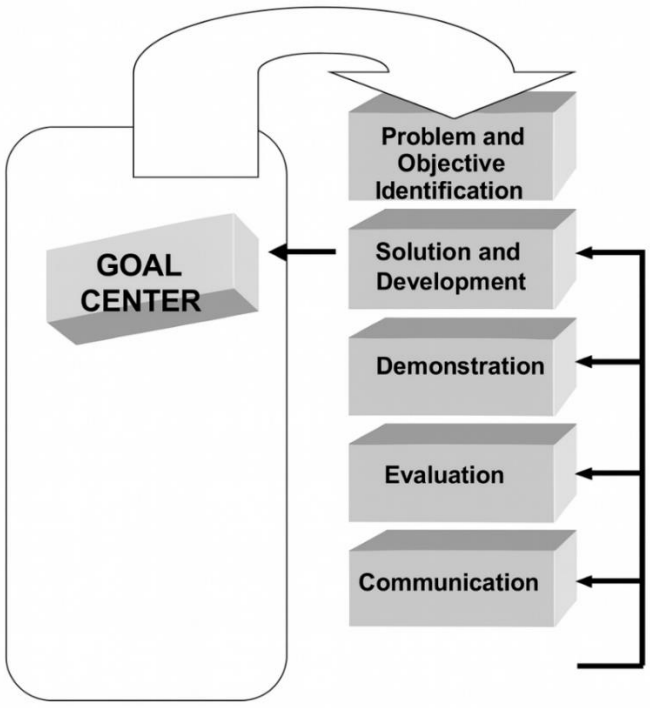

Figure 1. DSRM Method(Peffers et al., 2007).

Figure 1 explains the stages of the DSRM method used to develop a digital library as a means of increasing reading interest in elementary school children. The first stage begins with identifying problems found in elementary school-aged children, who are currently less interested in reading books or visiting the library. Elementary school-aged children are more interested in using gadgets to play online games and access social media, which can potentially have a negative impact on them. This is due to the lack of filtering on social media for elementary school-aged children. Furthermore, elementary school-aged children need an application that they can access even without an internet connection.

Based on the Self-Determination Theory put forward by Deci and Ryan (1985), a child's motivation to engage in an activity is greatly influenced by the fulfillment of three basic psychological needs: autonomy (the need for independence), competence (the need for a sense of ability), and relatedness (the need for social connectedness). In this context, children tend to choose to use gadgets for playing or socializing because these activities provide a sense of autonomy (freedom of choice), competence (feeling capable of mastering the game), and connection (interacting with friends online).

Therefore, to direct gadget use in a more positive direction, it is necessary to develop engaging and interactive educational applications that still meet these three basic psychological needs but can also be accessed offline, thus encouraging children to learn and explore independently. This problem identification process was conducted through several methods, including direct observation, literature review, and interviews with several parents and elementary school teachers.

The second stage in the DSRM method is identifying solutions to the identified problems, which is achieved by defining the objectives of the research. Furthermore, a literature review is conducted to identify relevant theories and algorithm concepts. The digital library application to be developed will be accessible not only via a computer network but also offline. This is expected to facilitate users who may not have a computer network at the time to still access the digital library.

After carrying out identification, the next stage is Design and Development. This stage uses an Entity Relationship Diagram (ERD), which is a diagram used to illustrate the relationships between tables

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in a database (Rukmana et al., 2023). The use of this ERD is expected to provide a common view regarding data relationships starting from the network model, relationship model to the set, so that it will be easy to analyze the relationships that exist in the system to be built.

The next stage is a demonstration or implementation to see the results of this system design. If at this stage the design that has been created is deemed inadequate, improvements will be made to achieve results that meet needs. At this stage, expert assessment is required to obtain the validity of the system design. After the expert validator's assessment is completed, the next process is improvement and will enter the testing phase. The testing phase will also use a questionnaire method that will be distributed to students of MIN 7 Tulungagung as research objects to determine how they assess the digital library system.

The final stage is communication by creating a research report. This report contains conclusions that will be published. This conclusion includes an assessment of the system created and the results of the analysis of the system tested.

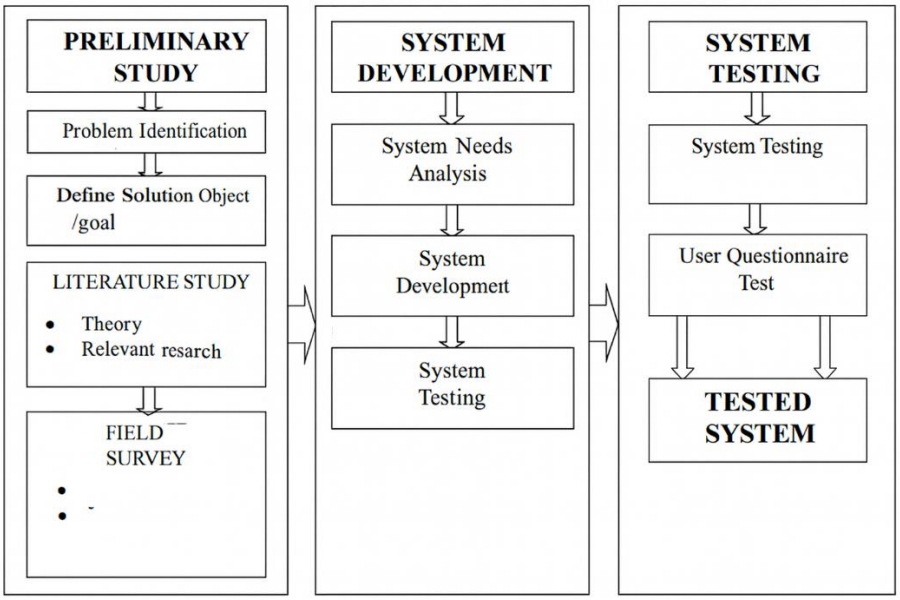

Figure 2. Details of Research Stages

Figure 2 shows the detailed stages of the Design Science Research Methodology (DSRM) method used in developing a digital library as a means of increasing reading interest in elementary school children.

3. RESULTS AND DISCUSSION

System Requirements Analysis

A system requirements analysis was conducted to ensure that the developed Digital Library aligns with the research problems and objectives. Based on observations at MIN 7 Tulungagung and interviews with teachers and students, the following requirements were identified.

1. Functional Requirements

   Functional requirements are requirements that are directly related to the features that must be present in the system:

   a. User Management: Different access rights for teachers and students
   b. Digital Book Collection:

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1) Upload, update books by admin (teacher)
2) Access to digital books by students

c. Book search and categories
1) Search feature by title/author
2) Categories based on reading type

d. Reading statistics
1) Note the number of books read by students
2) Reading interest data recap for teachers

e. Child-Friendly Interface: Simple interface, attractive icons and easy to understand for students.

2. Non-Functional Needs
a. Usability: Easy for kids to use, simple navigation
b. Availability: Can be accessed online via school computers/laptops or student cell phones connected to the school network.
c. Performance: The system is able to display book collections quickly, without long loading times.
d. Portability: Can run on various browsers

3. Device Requirements Analysis
a. Hardware:
1) Server/hosting
2) Computer/laptop
b. Software:
1) Windows operating system
2) Browser for system access

Prototype Development

1. System Home Page

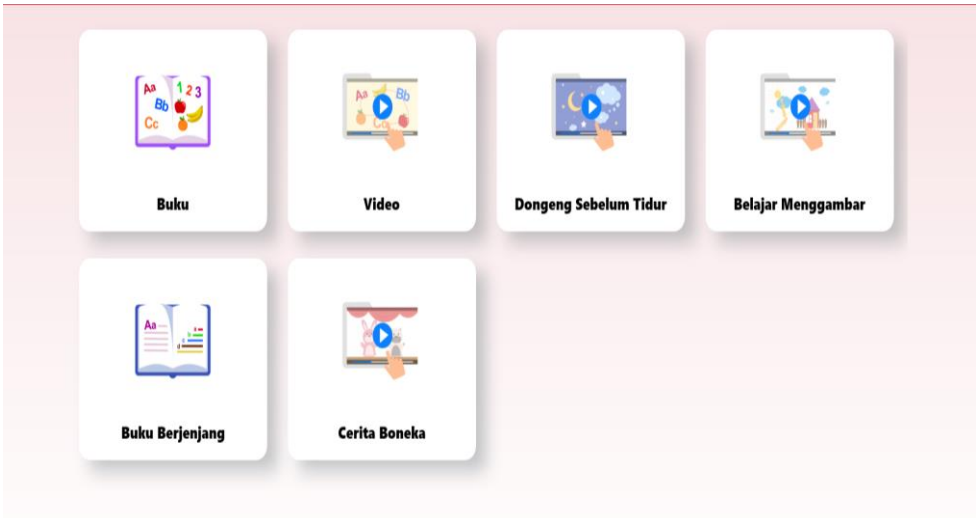

Figure 3. System Home Page

This page is the main menu of the digital library system aimed at elementary school-aged children. The display uses a simple design with bright colors and illustrated icons to make

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it easy to understand and engage children. This page will appear when children log in to the application. The menu options include:

a. Books: A collection of digital books that students can read.
b. Video: Video-based learning materials for children.
c. Bedtime Stories: A collection of digital fairy tales in video/audio format to foster interest in reading through stories.
d. Learn to Draw: An interactive feature that encourages student creativity through drawing guides.
e. Graded Books: A collection of books according to reading difficulty level based on grade level.
f. Puppet Stories: Puppet video/animation content tailored for children's entertainment and education.
i. The primary goal of this system is to increase reading interest among elementary school-aged children through a digital approach that is engaging, easy, and tailored to their needs. The homepage shown includes several features that align with this goal.

2. Sub-Menu of Book Category

Figure 4. Book Category Sub-Menu

This page is a submenu of the book category within the digital library system. Its primary purpose is to provide a selection of digital reading materials that children can easily access.

Page elements:

a. Digital Book Collection
Presented in grip format with a fairly attractive colored cover. Each book has a child-friendly title and illustrative cover, for example: Learning to Save, When the Rain Comes, and so on. The book themes vary quite widely, including Education, Daily Life Stories, Fairy Tales or Children's Fiction, Positive Habits and Characters.
b. Visual Design
The dominant colors are bright. The book covers are full of colorful, simple illustrations, tailored to children's tastes and understanding levels. The layout also makes it easy for children to choose books that interest them. This Digital Library system is expected to create a child-friendly literacy environment tailored to their

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needs, thus indirectly encouraging the development of reading habits from an early age.

3. Sub-Menu of Video Category

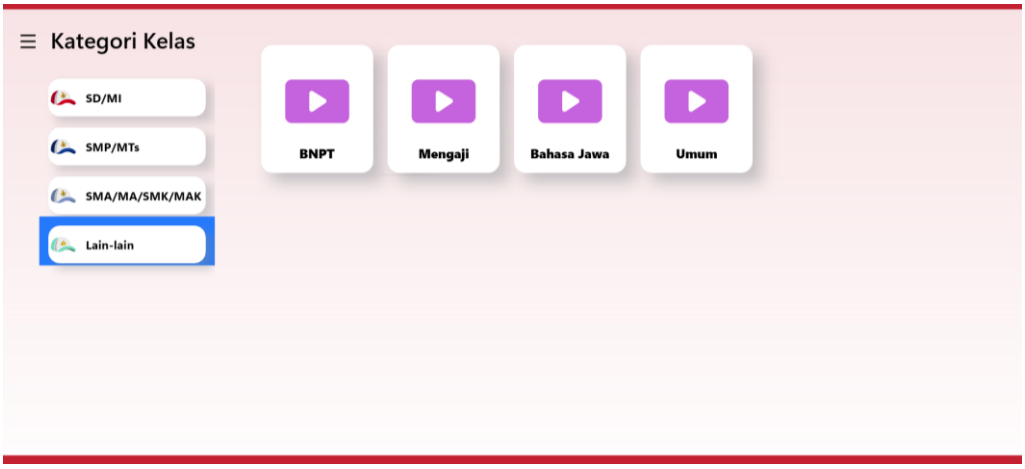

Figure 5. Video Category Sub-Menu

This page is a dedicated menu for video content within the digital library system. Its primary purpose is to provide audiovisual-based learning media that can help children understand the material more easily and enjoyably. This submenu provides categories based on educational level. These categories allow for more structured video content tailored to the child's educational level. This page demonstrates that the digital library provides not only reading materials but also organized audiovisual materials. Therefore, it can be a supporting tool for fostering reading interest through a multimedia approach.

4. Practice Questions Sub-Menu

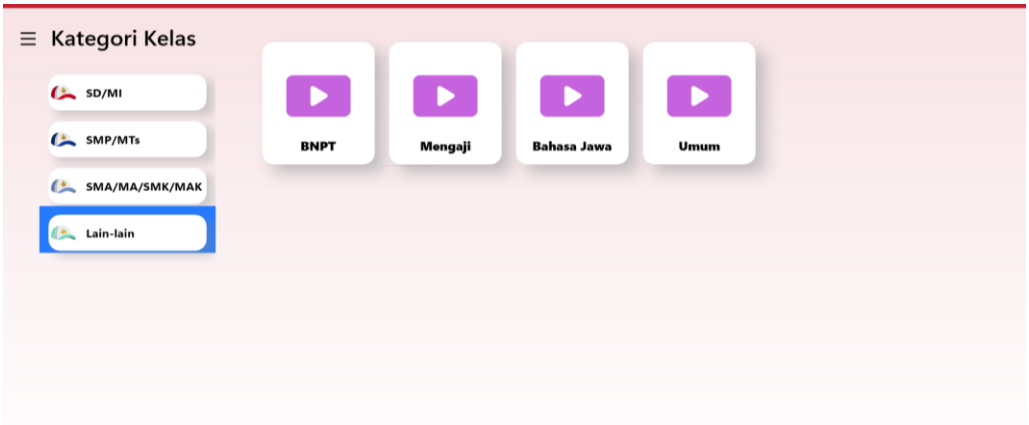

Figure 6. Practice Questions Sub-Menu

This practice question selection page is part of the Practice Questions feature in the digital library system. This page displays a variety of subjects available for children. At the top, there is a filter menu that allows users to select questions based on specific subjects, such as Indonesian, English, Javanese, Natural Sciences, Social Sciences, Mathematics, Islamic Religious Education and Character Education, Christian Religious Education, and Civics. There is also an "All" option to display all questions without any filters.

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The question list is displayed in a simple box with the subject name, class, semester, and number of questions, for example, "Elementary School Grade 1 - Indonesian Language Exam - Semester 2" with 10 questions or "Elementary School Grade 1 - Social Sciences Final Exam Semester 1" with 23 questions. The interface is designed to be simple and intuitive, making it easy for students to choose questions according to their needs. In addition, at the top right of the page there are search, download, and home icons that help users navigate the system more quickly and practically. This page serves as a central access point for practice questions, which supports students in independent study, strengthening their understanding of the material, and better preparing for exams.

Discussion of Research Results

System prototype testing*Digital Library*The trial, developed using the Design Science Research Methodology (DSRM), involved expert validators and primary users, namely elementary school students. The purpose of this trial was to assess the extent to which the designed system met user needs, in terms of functionality, interface appearance, efficiency, and suitability to the characteristics of elementary school-aged children.

The validation process is conducted through a series of indicator-based assessments covering six main aspects: feature suitability to user needs, system functionality quality, user interface quality, system efficiency and performance, suitability to user capabilities, and data reliability and security. Each aspect is assessed on a scale of 0–4 with specific assessment criteria, then the average score and percentage are calculated to determine the system quality category.

Furthermore, documentation of the trial activities shows that children were quite enthusiastic when introduced to this application. They showed curiosity and interest in trying out the various available features, thus concluding that*Digital Library*This application has the potential to increase reading interest in elementary school students. The results of the application test by the validator refer to the following elements:

Table 1. Application Test Elements by Validator

Aspect	Indicator	Score (0-4)	Validator Notes
Feature Compatibility with User Needs	Catalogs available according to age/grade	4	It is divided into classes (1–6), making selection easier.
	The book collection is varied and relevant	3	The collection is quite large, but there needs to be more local folklore books.
	Easy to use search feature	4	Fast, keyword-based search results.
	Interactive features (audio/image) are available	3	There is audio, but the sound quality needs to be improved.
	Reading activity report feature	2	There is already a reading history, but the reports for teachers are still simple.
	Menu/buttons work as intended	4	All buttons work fine, no broken links.

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System Functionality Quality	The login/access process is running well	3	Student login is easy, but admin login takes a bit longer.
	The book reading feature is running smoothly	4	Page navigation is smooth, audio runs without errors.
	Saved history and bookmarks	3	Bookmarks work, but sometimes they don't save if the connection is lost.
Interface Quality (UI)	Child-friendly visual display	4	Bright colors, large icons, suitable for elementary school children.
	Simple & clear language	4	The language is easy for children to understand, there are no complicated technical terms.
	Easy to understand navigation	3	Simple flow, but the menu icons need additional text labels.
	Button size according to children	4	Large buttons, easy to press, very kid friendly.
System Efficiency and Performance	Fast application loading time	3	Opening the app takes ±4 seconds, which is quite good but could be accelerated.
	The book opens quickly	4	Book opens in 1–2 seconds, responsive.
	Stable app on standard devices	3	Stable on school tablet, but a bit slow on old phone.
	Reasonable data consumption	3	Data is quite economical, but audio streaming requires a strong connection.
Suitability to User Abilities (Elementary School Children)	Children can use it without assistance	4	Children learn quickly, can open books by themselves.
	Visual clues help	4	Clear icons, effective hint animations.
	Cognitive age appropriate content	4	Age-appropriate illustrated stories, simple language.
	Motivational (reward) features are available	2	Simple rewards (stars), children like them but lack variety.
Data Reliability and Security	Secure login mechanism	3	Safe, but needs a simple PIN login option for young children.
	Children's data is protected	3	There is already basic privacy, it needs to be explained more clearly for parents.
	Backup & recovery available	2	Backups exist, but they are not automatic.
	Access rights according to role	4	Students cannot change admin data, it is safe.

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Based on the validation results, the percentage of achievement in six main aspects was obtained, as shown in the following table:

Table 2. Application Test Results by Validator

Aspect	Average Score (0–4)	Percentage (%)	Category
Feature Compatibility with User Needs	3.2	80.00%	Good
System Functionality Quality	3.5	87.50%	Very good
Interface Quality (UI)	3.75	93.75%	Very good
System Efficiency and Performance	3.25	81.25%	Good
Suitability to User Abilities (Elementary School Children)	3.5	87.50%	Very good
Data Reliability and Security	3	75.00%	Good

Overall, the Digital Library app received a good to excellent rating. The highest score was for the user interface (93.75%), while the lowest score was for data reliability and security (75.00%). This indicates that the app is suitable for supporting increased reading interest in elementary school children, with several recommendations for improvements in security and additional reading content.

System implementation*Digital Library*The system, developed using the Design Science Research Methodology (DSRM), was tested with students of MIN 7 Tulungagung as the primary users. The purpose of this test was to determine the extent to which the system could be directly used by the students and to assess its impact on their reading interest. The test was carried out in the form ofapplication introduction session**,**demonstration of the use of key features, Anddirect practice by studentsIn the initial phase, students are introduced to the app's basic functions, such as logging in, searching for reading material, opening digital collections, and using the book category feature. Afterward, students are given the opportunity to try it independently with guidance from teachers and researchers.

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Figure 7. User Testing

The results of application testing by system users refer to the following elements:

Table 3. Application Test Results by Users

Aspect	Indicator	Average Score	Percentage	Category
Ease of Use	Students can understand how to log in	3.7	92.50%	Very good
	Students are able to find the main menu easily	3.5	87.50%	Very good
	Students can access digital reading independently	3.6	90%	Very good
Appearance Attractiveness	Display design according to child's character	3.6	90%	Very good
	The display attracts students' interest in trying	3.4	85%	Good
	Icons and symbols are easy to recognize	3.5	87.50%	Very good
Reading Comfort	Readable text (size, spacing, contrast)	3.5	87.50%	Very good
	Children feel comfortable reading digitally	3.3	82.50%	Good
	Reading time lasts longer	3.4	85%	Good
Reading Motivation	Students are more interested in reading	3.6	90%	Very good

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	The app encourages searching for new reading material.	3.5	87.50%	Very good
	Children enjoy discovering digital stories	3.7	92.50%	Very good
User Satisfaction	Useful application for reading	3.7	92.50%	Very good
	Children are satisfied with the reading collection	3.6	90%	Very good
	Want to use the app again	3.8	95%	Very good

The table shows that nearly all indicators scored above 85%, indicating excellent acceptance. The highest indicator was "Want to use the app again" with a score of 3.8 (95%), indicating the app truly encourages children to continue reading. The lowest indicator was "Children feel comfortable reading digitally" with a score of 3.3 (82.5%), although still in the Good category, indicating the need for improvements in the comfort of the reading display.

The research results show that the Design Science Research Method (DSRM) approach has proven effective in developing a digital library that meets the needs of elementary school students. The problem identification phase revealed low reading interest among children due to limited access to printed books and a lack of engaging learning media. Through the design and prototype development process, the digital library was designed with child-friendly features, attractive visual displays, and simple navigation that students can use independently. This aligns with previous research findings that the application of digital-based educational technology can increase the accessibility of learning resources. Based on the results of limited trials, students showed increased interest in reading after using the digital library. Influencing factors include:

1. Interactive and illustrated content makes it easier for children to understand the story.
2. A varied collection of books that suits children's age levels and interests.
3. Flexible access through digital devices that are widely used at home and school.

This finding is consistent with the theory of children's digital literacy, which emphasizes that children in the digital age (digital natives) are more responsive to visual and interactive media-based learning Buckingham (2007) And Ng (2012)Digital literacy is not just the ability to read text on a screen, but also includes children's ability to understand, evaluate, and interact with multimedia content. Engaging visual features, animations, and audio support in digital libraries can improve focus, memory retention, and comprehension of reading content, because information is presented through more than one sensory channel (dual coding theory; Paivio, 1986). Furthermore, interactive features allow children to actively explore the content of the reading, thus supporting their intrinsic motivation to read.

This is in line with the Self-Determination Theory (Ryan & Deci, 2000), where fulfilling the needs for autonomy, competence, and relatedness encourages children to voluntarily engage in digital reading activities. Thus, the implementation of digital libraries not only expands access to reading materials but also plays a role in developing digital literacy skills and fostering a sustainable interest in reading in elementary school-aged children. This reinforces the theory that a fun and adaptive learning environment can increase children's intrinsic motivation to read. The use of digital libraries is not only beneficial for students, but also for teachers and parents. Teachers can use them as additional media in learning, while parents can supervise and accompany children's reading activities at home. Thus, the

development of digital libraries contributes to the creation of a broader and more sustainable literacy ecosystem.

4. CONCLUSION

This research successfully developed a Digital Library based on the Design Science Research Methodology (DSRM) as a means of increasing reading interest in elementary school children. The development process was carried out through the stages of problem identification, design, implementation, evaluation, and communication of research results. Validation test results showed that the developed system has a high level of feasibility with categories of "Good" to "Very Good" in six main aspects, including feature suitability, system functionality, user interface, efficiency, suitability to children's abilities, and data security.

The resulting Digital Library application features a child-friendly interface, age-appropriate reading content, and interactive features such as videos, stories, and practice questions that are able to attract students' attention. Based on implementation tests on students at MIN 7 Tulungagung, results showed that children demonstrated high enthusiasm and motivation for reading, with an average user satisfaction score of over 85%. The highest indicator was the aspect of the desire to use the application again (95%), indicating that this Digital Library is effective in stimulating children's interest in reading.

Overall, this research demonstrates that the application of the DSRM method in the development of a Digital Library can produce a digital learning system that is innovative, educational, and tailored to the characteristics of elementary school children. This application not only increases students' interest in reading but can also be used as a supporting medium for literacy activities at school and at home. Future development can be directed at adding local reading content, improving data security systems, and integrating reward features to further enhance children's reading motivation.

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