



## **Report WP4-A1:**

# Platform requirements analysis and system design



## Result

Report on platform requirements analysis and system design

## Related to

WP4-A1: Platform requirements analysis and system design

## Statement of originality

This report contains original unpublished work, except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation, or both.

## Disclaimer

This report contains material, which is the copyright of TET Consortium Parties. All TET Consortium Parties have agreed that the content of the report is licensed under a Creative Commons Attribution Non-Commercial Share Alike 4.0 International License. TET Consortium Parties does not warrant that the information contained in the Deliverable is capable of use, or that use of the information is free from risk and accept no liability for loss or damage suffered by any person or any entity using the information.

## Copyright notice

© 2022-2025 TET Consortium Parties

## Note

For anyone interested in having more information about the project, please see the website at: <https://tet-erasmus.eu/>



This publication is licensed under a [Creative Commons Attribution-NonCommercial 4.0 International Public License](https://creativecommons.org/licenses/by-nc/4.0/) (CC BY-NC 4.0).

## Table of contents

1.	Introduction .....	3
2.	Work package 4.....	4
2.1	Brief description and objectives .....	4
2.2	Activity WP4-A1: Description and objectives .....	5
2.2.1	Objectives and scope .....	5
2.2.2	Elements of system design and specific tasks.....	5
2.2.3	Factors affecting the design process.....	6
2.2.4	Expected outcomes of WP4-A1 .....	7
3.	Review of previous work packages .....	8
3.1	Work package 2 – Platform tools analysis .....	8
3.2	Work package 3 – Core textbook content preparation .....	10
4.	The Evolving Textbook platform .....	12
4.1	System design .....	12
4.1.1	Architectural design .....	12
4.1.2	Core modules and components.....	13
4.1.3	Interfaces and user experience.....	15
4.1.4	Continuous adaptation and improvement .....	15
4.2	Analysis of potential online platforms .....	16
4.3	Selection of BookStack.....	21
4.3.1	BookStack overview .....	22
4.3.2	Alignment with TET platform requirements .....	24
4.3.3	Alignment with TET platform system design .....	26
4.3.4	Conclusion.....	29

## 1. Introduction

The Evolving Textbook (TET) aims to develop an innovative online platform for higher education textbooks that evolves through time with active participation from students. This project leverages advanced information and communication technologies (ICT) to create a dynamic and interactive educational resource. The TET platform will support content creators, teachers, and learners by providing tools for content creation, structuring, connectivity with other resources, and storage. It will facilitate easy browsing, presentation, and sharing of relevant educational materials in both classrooms and online or blended learning environments. Furthermore, the platform will include a recommender system to suggest pertinent content, enhancing the learning experience.

Work Package 4 (WP4) is central to the development and deployment of the TET platform. This work package is crucial as it encapsulates the primary objective of the entire project: to build a robust, evolving educational platform that meets the needs of modern learners and educators. WP4 focuses on defining the platform's requirements, designing its system architecture, developing its core modules, integrating various components, and preparing the user manual for the platform.

This report, WP4-A1, details the activities related to platform requirements analysis and system design. It summarizes the findings from previous work packages (WP2 and WP3) and outlines the comprehensive design for the TET platform. By addressing these elements, the report aims to provide a clear framework for the development process, ensuring the platform's effectiveness, scalability, and adaptability to different educational contexts.

The University of Ljubljana (UNILJ) is the leading organization and coordinator for this work package.

## 2. Work package 4

### 2.1 Brief description and objectives

Work Package (WP4) is the cornerstone of the TET project, focusing on the development and deployment of the innovative educational platform. The primary objective of this work package is to transform the insights and foundational elements from previous work packages into a functional, dynamic educational platform that evolves over time with active participation from students and educators.

The specific objectives of WP4 are as follows:

- **TET platform requirements and system design**
  - Analyse the requirements and limitations identified in WP2 and WP3.
  - Develop a comprehensive system design that includes architecture, modules, components, interfaces, and data management.
- **TET platform basic modules**
  - Develop and integrate the core modules of the platform, ensuring they meet the identified requirements and support the platform's objectives.
  - These modules will handle various functionalities, including content creation, structuring, connectivity with other resources, storage, browsing, presentation, and sharing of relevant educational materials.
- **TET platform integration and deployment**
  - Integrate the developed modules into a cohesive platform.
  - Deploy the platform, ensuring it is accessible and functional for users in both classroom and online or blended learning environments.
- **TET platform user manual**
  - Develop a comprehensive user manual to guide educators, content creators, and learners in effectively utilizing the platform.

- The manual will cover all aspects of the platform's functionalities and provide detailed instructions for its use.

## 2.2 Activity WP4-A1: Description and objectives

### 2.2.1 Objectives and scope

Activity WP4-A1 is focusing on the analysis of platform requirements and the comprehensive design of its system. This phase sets the foundation for subsequent development activities by establishing a clear and structured framework that ensures the platform meets the project's objectives.

#### Analysis of requirements and limitations

The initial step in WP4-A1 involves an analysis of the requirements and limitations identified in both Work Package 2 (WP2) and Work Package 3 (WP3). These analyses are essential to understand the scope and constraints that will influence the platform's design. WP2 provided valuable insights into the needs of educators and learners, the functionalities required for effective content creation and management, and the technological considerations for a robust platform. Meanwhile, WP3 focused on the preparation and optimization of core textbook content, offering a structured framework for organizing educational materials through the development of the CONALI 3.0 ontology schema.

Key aspects of the analysis include identifying the specific tools and technologies necessary for the platform, understanding user engagement mechanisms, and assessing the administrative and evaluation functionalities. Additionally, the analysis considers the pedagogical framework, including elements such as Bloom's taxonomy, learning outcomes, and educational goals, which are integral to the content structuring process provided by WP3.

### 2.2.2 Elements of system design and specific tasks

The system design process for the TET platform encompassed the following elements:

- **Architecture:** A conceptual model defining the structure, behaviour, and views of the system.
- **Modules:** Components handling specific tasks within the system.

- **Components:** Functional units providing particular functions or related groups of functions.
- **Interfaces:** Shared boundaries across which system components exchange information.
- **Data:** Management of information and data flow within the system.

The system design process involved several specific tasks, including:

- **Design definition:** Planning and identifying technologies to compose and implement system elements and their interfaces. This includes documenting the design definition strategy and the requirements of enabling systems, products, or services.
- **Establish design characteristics:** Defining characteristics relating to the architectural features and ensuring they are implementable. This task also involves refining interfaces.
- **Assess the alternatives:** Evaluating design options and selecting the most appropriate alternatives.
- **Manage the design:** Capturing and maintaining the rationale for all design selections and controlling the evolution of design characteristics.

### 2.2.3 Factors affecting the design process

Several factors influence the system design process, including:

- **Scale of the platform:** Ensuring the platform can handle a large number of users and a wide variety of content,
- **Efficiency:** Ensuring the platform performs well under various conditions,
- **User experience:** Creating an intuitive and engaging interface for all users,
- **Maintainability:** Designing the platform for easy updates and maintenance,
- **Reliability:** Ensuring the platform is dependable and free from critical errors,
- **Scalability:** Designing the platform to grow and adapt to increasing demand,
- **Cost:** Managing the budget effectively to avoid overspending,

- **Time:** Meeting project timelines and milestones.

### 2.2.4 Expected outcomes of WP4-A1

The primary outcome of WP4-A1 is a system design that provides a clear blueprint for the development of the TET platform. This design includes documentation of the system architecture, modules, components, interfaces, and data management strategies. By establishing a robust and scalable design framework, WP4-A1 ensures that the platform can effectively support dynamic, interactive, and evolving educational content.

In summary, WP4-A1 lays the groundwork for the TET platform by conducting a detailed analysis of requirements and limitations from both WP2 and WP3, and developing a comprehensive system design. This phase ensures that the platform is well-structured, scalable, and capable of meeting the diverse needs of modern learners and educators, setting the stage for successful development and deployment in subsequent phases of the project.



## 3. Review of previous work packages

### 3.1 Work package 2 – Platform tools analysis

Work Package 2 (WP2) provided a foundational analysis essential for the development of the TET platform. This phase of the project involved an in-depth examination of online educational platform parameters, the evaluation of existing tools, and the identification of platform requirements and limitations. The insights garnered from WP2 are crucial as they directly inform the design and development activities in WP4.

#### **WP2-A1: Definition of online educational platform parameters**

One of the key activities within WP2 was defining the parameters for materials to be used in online educational platforms. This analysis resulted in a detailed report that highlighted the importance of tools like Wooclap and Google Forms. We identified these tools for their ability to engage students actively, encouraging them to both create and find relevant educational materials. Additionally, the analysis underscored the value of leveraging previous projects and exams as exemplar materials, providing a rich repository of content for the evolving textbook.

#### **WP2-A3: Analysis of available tools and applications for online education**

Another significant output of WP2 was a comprehensive report recommending tools and functionalities for the TET platform. This analysis covered a range of tools, from essential communication aids such as email and chat, to more advanced functionalities like virtual classrooms and video conferencing. The study also emphasized the necessity of content creation tools that support reuse of materials, drag-and-drop interfaces, and robust backup systems. Furthermore, the report highlighted the importance of co-creation tools to facilitate teamwork, feedback, and discussions among students and educators. We also identified administrative functions, such as user management and grading systems, as critical components, along with gamification features designed to increase student engagement through points, rewards, and levels.

#### **WP2-A4: Deliverable on available tools and applications**

The deliverable on available tools and applications for online education provided further insights, particularly regarding the technological infrastructure required for the TET platform. The analysis advocated for the use of teleconferencing solutions, cloud technologies, and modern web development tools like JavaScript and HTML5. The report also recommended a

human-centered design approach to ensure the platform is user-friendly and accessible. We placed emphasis on integrating ready-made software solutions to facilitate remote collaboration, which is particularly pertinent given the increasing trend towards online and hybrid learning environments.

## **WP2-A2: Definition of platform requirements and limitations**

In defining the platform requirements and limitations, WP2 produced a comprehensive list of recommended tools, technologies, and methodological approaches. Key recommendations included the need for collaborative document editing capabilities, robust change tracking, and systems for review enforcement and commenting. We also deemed the ability to insert links and integrate various media types essential for creating a rich, interactive learning experience.

## **Conclusions from WP2 and input for WP4**

The insights and recommendations derived from WP2 are important for the ongoing work in WP4. The detailed analysis of user engagement tools, communication platforms, content creation and co-creation functionalities, and administrative and evaluation systems provides a clear blueprint for the requirements of the TET platform.

For WP4, these conclusions translate into actionable inputs that will shape the design and development of the TET platform. The platform must incorporate tools to foster student engagement and participation. Effective communication tools are essential to support seamless interaction between students and educators. In terms of content creation, the platform needs to support a variety of inputs, from reusable materials to interactive presentations and peer reviews. The co-creation tools identified in WP2 will facilitate teamwork and collaborative learning, enhancing the overall educational experience. Administrative functions must be robust, supporting comprehensive user management and diverse evaluation methods. Technologically, the platform should leverage cloud solutions, and be built using modern web technologies like JavaScript and HTML5. A human-centred design approach will ensure the platform is intuitive and accessible.

By incorporating these recommendations, WP4 will ensure that the TET platform is not only innovative but also responsive to the needs and expectations of modern learners and educators. The system design derived from these inputs will form the backbone of a dynamic, evolving educational tool that stands at the forefront of digital learning solutions.

## 3.2 Work package 3 – Core textbook content preparation

Work Package 3 (WP3) concentrated on the preparation and optimization of the core textbook content for the TET platform. This phase was essential in establishing a solid foundation of educational materials that would serve as the backbone for the platform. WP3 involved several key activities, including the definition of an ontology schema, selection of tools for its implementation, preparation of core content, and subsequent review and optimization of this content.

### **WP3-A1: Definition of the ontology schema for textbook content preparation**

A significant achievement in WP3 was the development of an ontological scheme named CONALI 3.0. We designed this scheme to structure textbook content in a way that enhances its educational value and usability. The ontology schema includes critical elements such as subject matter, detailed descriptions, keywords, placements within Bloom's taxonomy, defined learning outcomes, educational goals, relevant activities, and various assessment types. This comprehensive schema ensures that the content is well-organized and aligned with pedagogical standards, facilitating a more effective learning process.

### **WP3-A2: Tools for the ontology schema implementation**

To implement the ontology schema, the project team selected Protegé and Microsoft Word as the primary tools. We chose Protegé, a popular ontology editor, for its robust capabilities in managing complex ontological structures. We also utilized Microsoft Word for its widespread accessibility and user-friendly interface, allowing for easier content editing and collaboration among educators and content creators.

### **WP3-A3: Preparation of core textbook content**

The next critical task in WP3 was the preparation of the core textbook content. This involved compiling an extensive database of initial learning materials that would populate the TET platform. We curated the content to align with the ontology schema, ensuring consistency and coherence across all educational materials. This database serves as the initial repository of knowledge that users of the TET platform can access and build upon.

### **WP3-A4: Review of core textbook content and optimizations**

Following the preparation of the core content, a thorough review and optimization process was undertaken. This involved scrutinizing the initial learning materials to ensure they met

the highest standards of quality and relevance. The review process led to updates and enhancements, resulting in an optimized database of core textbook content that is ready for integration into the TET platform. Among other things, the project consortium added information on accessibility rights to all the collected learning materials.

### **Conclusions from WP3 and input for WP4**

The outcomes and insights from WP3 are important for the subsequent activities in WP4. The development of the CONALI 3.0 ontology schema provides a structured framework for organizing and presenting educational content on the TET platform. This schema's emphasis on elements such as Bloom's taxonomy placement and learning outcomes ensures that the content is pedagogically sound and geared towards effective learning.

For WP4, the inputs from WP3 translate into specific requirements for content structuring and management. The TET platform should incorporate the CONALI 3.0 schema to maintain the structured approach established in WP3. The database of initial learning materials will serve as the starting point for the platform's content repository. WP4 will focus on integrating this content into the platform, ensuring it is accessible and interactive for users. The optimized content database will also need to be dynamic, allowing for continuous updates and additions as the platform evolves with user contributions and new educational materials.

Overall, WP3 has laid a critical foundation for the TET platform by providing a well-structured, high-quality database of core textbook content. The detailed ontology schema and the selection of appropriate tools for content implementation are key inputs that will guide the design and development activities in WP4. By building on these insights, WP4 will ensure that the TET platform is equipped with robust, well-organized educational content that meets the diverse needs of modern learners and educators.

## 4. The Evolving Textbook platform

### 4.1 System design

The system design of the TET platform encompasses several key elements that work together to create a dynamic, interactive, and evolving educational platform. This design integrates the requirements from WP2 and WP3 and adheres to the goals and functionalities outlined in WP4. The following sections detail the main components and their interactions within the TET platform.

#### 4.1.1 Architectural design

##### Platform Architecture

The TET platform will be built using a modular architecture to ensure flexibility and scalability. This architecture includes key components divided into the front-end, back-end, collaboration tools, and evaluation systems.

##### Front-End: User interface for content creation, browsing, and interaction

The front-end of the TET platform is designed to be user-friendly and accessible, providing a seamless experience for content creation, browsing, and interaction. To build it we will use modern web technologies and it should feature:

- Responsive design to ensure usability across various devices, including desktops, tablets, and smartphones.
- Interactive elements to engage users and enhance learning experiences.

##### Back-End: Server-side processing and data management

The back-end supports server-side processing and robust data management, ensuring the platform's reliability and efficiency. Using scalable server-side technologies, it should feature:

- An API for content management, allowing seamless integration and data exchange between different modules.
- User authentication to ensure secure access and protect user data.
- Data storage capabilities to manage educational content and user information securely.

## Collaboration tools: integrated tools for communication and co-creation

To facilitate communication and collaborative learning, the TET platform should include various tools that support teamwork and interaction.

- Chat to enable real-time and asynchronous communication.
- Collaborative editing tools that allow multiple users to work on documents simultaneously.

## Evaluation: systems for engagement and assessment

Engagement and assessment are critical for the learning process, and the TET platform should incorporate data tracking and engagement algorithms that feature:

- Points, rewards, and levels to motivate learners and track their progress.
- Gradebook and attendance tracking for comprehensive evaluation.
- Multiple grading scales and grade comments to provide detailed feedback.

### 4.1.2 Core modules and components

#### Content creation and structuring

This module includes tools for creating, editing, formatting, and organizing educational materials. It should support a variety of content types, including text, multimedia, and interactive elements.

- **Text editor:** Allows users to create and format text-based content with features similar to standard word processors.
- **Multimedia integration:** Enables embedding of videos, images, and audio files to enrich the educational materials.
- **Interactive content tools:** Provides functionalities for creating interactive diagrams, and other engaging content formats.

#### Connectivity with other resources:

This module should facilitate integration with external content sources, enhancing the platform's versatility.

- **API integration:** Allows connection with external databases, resources, and platforms.
- **Content import/export:** Enables users to import content from various formats and export materials for offline use or sharing.

## Storage and data management

This component ensures the secure and efficient storage of educational materials and user data.

- **Database management system:** Utilizes a robust system to store and manage content, user profiles, and interaction logs.
- **Cloud storage integration:** Provides scalable storage solutions leveraging cloud technologies to ensure data availability and security.

## Browsing and presentation

Tools for easy browsing, presentation, and sharing of content are included, supporting various educational settings.

- **Search engine:** Advanced search functionalities to help users quickly find relevant materials.
- **Content catalog:** Organized presentation of available resources, categorized by subjects, topics, and educational goals.
- **Presentation mode:** Allows educators to present content in a structured and visually appealing manner during classes.

## Feedback and recommender system

This system enhances user interaction and personalization of content.

- **Rating and commenting:** Enables learners to provide feedback on content through ratings and written comments.
- **Content recommendation engine:** Uses algorithms to analyse user interactions and recommend relevant content based on user preferences and activities. This includes comparing learners' activities to identify similar user groups and suggesting materials liked by these groups.

## Content management and editorial oversight

A content editor role is established to ensure the quality and relevance of submitted content.

- **Content review workflow:** Processes for content submission, review, and approval by domain experts.
- **Quality assurance tools:** Tools to help editors evaluate the educational value and relevance of new content.

### 4.1.3 Interfaces and user experience

#### User interface

The UI should be designed to be intuitive and accessible, providing a seamless experience for users.

- **Responsive design:** Ensures the platform is usable on various devices, including desktops, tablets, and smartphones.
- **User dashboard:** Personalized dashboards for content creators, teachers, and learners, providing easy access to their respective tools and resources.

#### Data security and privacy

Ensures compliance with data protection regulations and secures user information.

- **Encryption:** Uses encryption protocols to protect data in transit and at rest.
- **Access control:** Implements role-based access control to restrict access to sensitive data and functionalities.

### 4.1.4 Continuous adaptation and improvement

The design should include mechanisms for continuous assessment and improvement.

- **User feedback loop:** Collects user feedback to inform ongoing improvements and updates to the platform.
- **Scalable infrastructure:** Designed to handle increasing numbers of users and content without compromising performance.



## 4.2 Analysis of potential online platforms

As part of the platform requirements analysis, we evaluated several potential platforms to determine the best fit for the TET platform. Building a platform from scratch was not feasible due to the existence of many similar tools and the time and cost limitations of the Erasmus+ project. Therefore, we aimed to find a platform that closely matched our requirements and needs. Our analysis focused on each platform's ability to meet the specific needs outlined in WP2, WP3, and WP4, ensuring that we selected the most complete and suitable option available. Below are the platforms we tested and the reasons they were ultimately not selected.

### Moodle

Moodle is an open-source learning management system (LMS) widely used in education. It is highly customizable and supports a variety of plugins and integrations.

#### Key features:

- **Content creation and management:** Includes built-in tools for course creation, content editing, and organization.
- **Collaboration tools:** Supports forums, chats, and real-time collaboration plugins.
- **User management:** Comprehensive user management with roles and permissions.
- **Integration:** Extensive support for API integrations and third-party tools.
- **Scalability:** Can be hosted on cloud platforms like AWS, Google Cloud, or Azure for scalability.

#### Drawbacks:

It is too complex for our purpose, especially in terms of system maintenance. The extensive features would require significant resources to manage and maintain, which is beyond our scope. While Moodle is highly customizable, the process can be complex and time-consuming, often requiring deep technical knowledge and programming skills.

### Canvas LMS

Canvas is a modern, cloud-native LMS used by many educational institutions. It provides a clean, user-friendly interface and robust feature set.

### Key features:

- **Content creation and management:** Rich content editor, multimedia integration, and course organization tools.
- **Collaboration tools:** Built-in chat, video conferencing, and collaborative document editing.
- **User management:** Advanced user and role management capabilities.
- **Integration:** Supports LTI (Learning Tools Interoperability) for integrating various third-party applications.
- **Scalability:** Fully scalable cloud solution with high reliability.

### Drawbacks:

Canvas LMS is a commercial product that incurs licensing fees and ongoing expenses for implementation, maintenance, and support. While it is user-friendly and designed to meet diverse educational needs, its extensive features make it a complex system. Like Moodle, Canvas is overly complex and resource-intensive for our requirements, leading to high maintenance and administrative overhead.

## Open edX

Open edX is an open-source platform developed by MIT and Harvard, used by many institutions for online education. It offers a comprehensive suite of tools for creating and delivering online courses.

### Key features:

- **Content creation and management:** powerful authoring tools for creating interactive and multimedia-rich courses.
- **Collaboration tools:** forums, peer reviews, and integrated collaboration tools.
- **User management:** detailed user management with analytics and reporting.
- **Integration:** strong API support for integrating additional tools and services.
- **Scalability:** can be deployed on cloud platforms for scalable and reliable performance.

### Drawbacks:

The platform's complexity and the associated maintenance requirements were deemed excessive for our project. Managing Open edX would demand more technical resources than we have available.

## Blackboard Learn

Blackboard Learn is a popular LMS known for its comprehensive feature set and robust support. It is used by many educational institutions globally.

### Key features:

- **Content creation and management:** Extensive tools for course creation, multimedia integration, and content management.
- **Collaboration tools:** Built-in collaboration tools, including chat, discussion boards, and virtual classrooms.
- **User management:** Advanced features for managing users, roles, and permissions.
- **Integration:** Integrates with a wide range of third-party tools and services.
- **Scalability:** Cloud-based deployment options for scalability and reliability.

### Drawbacks:

Blackboard Learn is a commercial product that incurs licensing fees along with costs for implementation, maintenance, and support. It is a highly complex system, offering a wide range of features and capabilities that exceed the specific requirements of the TET platform. This complexity can result in a steep learning curve for both users and administrators. Despite being feature-rich, Blackboard Learn has been criticized for its user interface, which some users find less intuitive and user-friendly compared to newer, more streamlined platforms.

## Sakai

Sakai is an open-source LMS used by various educational institutions and organizations. It focuses on providing a flexible and customizable learning environment.

### Key features:

- **Content creation and management:** tools for creating, organizing, and managing course content.
- **Collaboration tools:** Includes forums, chat, and collaborative tools.
- **User management:** Comprehensive user management and role assignment features.
- **Integration:** Supports integrations with external tools and services via APIs.
- **Scalability:** Can be deployed on cloud platforms to ensure scalability.

#### Drawbacks:

Sakai, like other comprehensive LMSs, has a complex feature set designed to cater to a wide range of educational needs. This complexity can lead to a steep learning curve for both administrators and users. Sakai requires significant technical expertise for installation, configuration, and maintenance.

## LearnHouse

LearnHouse is an emerging platform designed for educational purposes, with a focus on content creation and learner interaction.

#### Key features:

- **Content creation and management:** course authoring tools, multimedia integration, drag-and-drop interface
- **Collaboration tools:** discussion forums, live chat, group projects
- **User management:** role-based access control, user registration and profiles,
- **Integration:** API access, third-party integrations
- **Scalability:** usage analytics, custom reports, secure authentication

#### Drawbacks:

LearnHouse is still in development and does not currently support all the functionalities we require, making it unsuitable for immediate deployment. As a newer platform, it lacks an established track record for stability and reliability. Additionally, LearnHouse has a smaller user base and community support compared to more established platforms. Its feature set is still evolving, and it does not yet offer the full range of customization options needed for the TET platform.

## Strapi

Strapi is a headless CMS with flexibility in content management and strong API support.

### Key features:

- **Content creation and management:** headless CMS for flexible content management, intuitive admin panel, support for various content types
- **Collaboration tools:** role-based permissions for collaborative content creation, content versioning
- **User management:** granular user roles and permissions, user authentication and management
- **Integration:** RESTful and GraphQL APIs for seamless integration, plugins for additional functionalities, web hooks for real-time updates
- **Scalability:** modular architecture for easy scalability, can be deployed on various cloud platforms, performance optimization features

### Drawbacks:

Strapi lacks many of the educational functionalities needed for the TET platform. Although it excels in content management, it does not offer essential tools for collaboration, gamification, and detailed user management. While Strapi supports role-based permissions, it falls short in advanced collaboration tools such as discussion forums, live chat, and group project management. Despite having granular user roles and permissions, Strapi is not specifically designed for educational user management needs. Furthermore, although Strapi provides robust API capabilities, integrating various third-party educational tools and services can be complex.

The following table emphasizes the main drawbacks of the analysed platforms:

Platform	Drawbacks
Moodle	<ul style="list-style-type: none"><li>• Can be overly complex and difficult to navigate for some users</li><li>• Requires significant customization and configuration</li><li>• High maintenance effort</li><li>• Performance issues with large-scale deployments</li></ul>

<b>Canvas LMS</b>	<ul style="list-style-type: none"> <li>• High licensing fees and ongoing costs for implementation, maintenance, and support</li> <li>• Complex and resource-intensive</li> <li>• High maintenance and administrative overhead</li> </ul>
<b>Open edX</b>	<ul style="list-style-type: none"> <li>• High setup and maintenance complexity</li> <li>• Requires substantial technical expertise to deploy and manage</li> <li>• Limited out-of-the-box functionality; relies heavily on plugins</li> <li>• Can be resource-intensive to scale</li> </ul>
<b>Blackboard Learn</b>	<ul style="list-style-type: none"> <li>• High licensing fees and associated costs</li> <li>• Complex system with a steep learning curve</li> <li>• Criticized user interface compared to newer platforms</li> </ul>
<b>Sakai</b>	<ul style="list-style-type: none"> <li>• Limited documentation and community support</li> <li>• May lack advanced features found in more established platforms</li> <li>• Smaller user base, potentially leading to fewer updates and slower development</li> <li>• Customization options are be limited compared to other platforms</li> </ul>
<b>LearnHouse</b>	<ul style="list-style-type: none"> <li>• Still in development, lacking necessary functionalities</li> <li>• No established track record for stability and reliability</li> <li>• Smaller user base and community support</li> <li>• Evolving feature set does not offer full customization options needed</li> </ul>
<b>Strapi</b>	<ul style="list-style-type: none"> <li>• Lacks educational functionalities such as collaboration, gamification, and detailed user management</li> <li>• Missing advanced collaboration tools (discussion forums, live chat, group project management)</li> <li>• Not specifically designed for educational user management</li> <li>• Complex integration of third-party educational tools and services despite robust API capabilities</li> </ul>

### 4.3 Selection of BookStack

After a thorough evaluation, we opted for BookStack as the foundation for the TET platform. BookStack is a simple, self-hosted, and easy-to-use platform for organizing and storing information. Below is a detailed explanation of why BookStack was chosen and how it aligns with our project requirements.

### 4.3.1 BookStack overview

BookStack is an open-source, self-hosted, documentation and knowledge management platform. It was created to provide a simple and user-friendly interface for creating, managing, and sharing documentation within an organization. The platform is designed to be easy to use, customizable, and efficient in organizing large amounts of information in a structured and hierarchical manner.

In the following paragraphs, we define core features, technical specification and some use cases of BookStack platform.

#### Core features

Aspect	Details
<b>Books, chapters, and pages hierarchy</b>	Organization of content into Books (broad topics), Chapters (subdivisions), and Pages (detailed information).
<b>Bookshelves</b>	Grouping of multiple books for additional organization, a book can belong to multiple bookshelves.
<b>Powerful WYSIWYG editor</b>	Provides easy content creation with text formatting, tables, lists, links, and media embedding.
<b>Markdown editor</b>	Writing content in Markdown with live preview capabilities, following CommonMark standards with extensions.
<b>Attachments and media management</b>	Attachment of files and links to pages, controlled by permissions for authorized access.
<b>Tagging System</b>	Flexible categorization and search via tags with names and values for detailed metadata.
<b>Advanced search functionality</b>	Robust search engine with advanced syntax and filters for precise queries.
<b>User roles and permissions</b>	Multiple user roles with customizable permissions at system and content levels.
<b>Customizable interface</b>	Branding, colours, default language, fonts, and code block themes are customizable.
<b>Integrations and extensibility</b>	Support for various authentication providers, web hooks, and REST API for integrations.

<b>Drawings and diagrams</b>	Integration with diagrams.net for creating and embedding complex diagrams.
<b>Revisions and history</b>	Maintains a revision history for each page, allowing change tracking and reversion.
<b>PDF export and custom commands</b>	Export pages as PDFs using dompdf or custom commands with A4 and US Letter sizes.

### Technical functionalities

Aspect	Details
<b>Backend</b>	Built with PHP (Laravel framework).
<b>Frontend</b>	Uses HTML, CSS, and JavaScript with various libraries.
<b>Database</b>	Supports MySQL/MariaDB and SQLite.
<b>Deployment</b>	Deployable on any server supporting PHP and compatible databases; Docker images available.

### Use cases

Use case	Details
<b>Internal Documentation</b>	To maintain internal policies, procedures, and technical guides.
<b>Knowledge Base</b>	To serve as a knowledge base for customer support and IT departments.
<b>Project Documentation</b>	To document project plans, progress, and technical details.
<b>Educational Resources</b>	To organize course materials, lesson plans, and instructional guides.
<b>Collaboration</b>	To facilitate collaborative documentation with secure multi-user contribution and editing.



BookStack is a versatile and powerful documentation platform that combines ease of use with advanced features to support various documentation needs. Its hierarchical organization, robust search capabilities, and extensive customization options make it a good choice for organizations looking to efficiently manage and share their knowledge and documentation.

### 4.3.2 Alignment with TET platform requirements

In evaluating potential platforms for the TET project, BookStack emerged as a strong candidate due to its good alignment with the specific requirements outlined in WP2, WP3, and WP4. This section provides a comparison of BookStack's features and characteristics against these requirements, highlighting its suitability and advantages for the TET platform. The analysis focuses on key areas such as user engagement, content creation, administrative functions, and integration capabilities, demonstrating how BookStack meets the project's needs and supports its goals.

Requirements	BookStack features and characteristics
<b>WP2 Requirements</b>	
<b>User engagement and participation</b>	Simple and intuitive interface WYSIWYG editor and Markdown support for easy content creation and editing
<b>Communication tools</b>	Open-source nature allows for integration of additional communication functionalities
<b>Content creation and co-creation</b>	Structure of Books, Chapters, and Pages for organized content creation Features like page revisions for collaborative content development
<b>Administrative and evaluation functions</b>	User management with role and permission settings
<b>WP3 Requirements</b>	

<b>Ontology schema implementation</b>	Flexible content organization can be adapted to include metadata such as subject, description, keywords, learning outcomes, and educational goals
<b>Core textbook content</b>	Effective structuring and presentation of core textbook materials  Easy navigation through Books, Chapters, and Pages
<b>WP4 Requirements</b>	
<b>Content creation and structuring</b>	Tools for creating, editing, and formatting content  Supports multimedia integration and interactive elements
<b>Connectivity with other resources</b>	Open-source nature allows customization to connect with external content sources and learning management systems
<b>Storage and data management</b>	Built on robust technologies  Ensures secure and efficient data storage  Optimized for affordable hosting solutions
<b>Feedback and recommender system</b>	Can be extended to include features for user feedback, such as ratings and comments  Functionality for a recommender system can be developed
<b>Awards and motivation systems</b>	Gamification features like points and rewards can be added through custom development
<b>Additional advantages of BookStack</b>	
<b>Multi-lingual support</b>	Supports multiple languages, making it accessible to a diverse user base
<b>Integrated authentication</b>	Supports various authentication methods, including social providers and enterprise options like LDAP and SAML2

<b>Powerful features</b>	Includes search and linking capabilities, cross-book sorting, image management, and multi-factor authentication
--------------------------	---

### 4.3.3 Alignment with TET platform system design

In selecting a platform for the TET project, BookStack was chosen for its ability to align sufficiently with the system design requirements of the TET platform. This subsection details how BookStack's features and characteristics meet the architectural design, core modules, and user experience components essential for the TET platform. By examining key elements such as front-end and back-end functionalities, collaboration tools, content management, and data security, this analysis illustrates how BookStack provides a robust foundation to support the dynamic and interactive educational environment envisioned for the TET platform.

System design requirements	BookStack features and characteristics	Limitations
<b>Architectural design</b>		
<b>Front-end</b>	<ul style="list-style-type: none"> <li>User-friendly interface for content creation, browsing, and interaction</li> <li>Responsive design for various devices</li> <li>WYSIWYG editor and Markdown support</li> </ul>	<ul style="list-style-type: none"> <li>Lacks drag-and-drop functionality for content creation and editing</li> <li>Limited interactive elements</li> </ul>
<b>Back-end</b>	<ul style="list-style-type: none"> <li>API for content management</li> <li>User authentication</li> <li>Data storage capabilities</li> <li>Built on robust technologies optimized for affordable hosting</li> </ul>	<ul style="list-style-type: none"> <li>Basic API functionality</li> <li>Limited scalability for more complex educational environments</li> </ul>
<b>Collaboration tools</b>	<ul style="list-style-type: none"> <li>Simple commenting system</li> <li>Open-source nature allows for integration of additional</li> </ul>	<ul style="list-style-type: none"> <li>No chat, forums, or video conferencing capabilities</li> </ul>

	communication functionalities	
<b>Evaluation</b>	<ul style="list-style-type: none"> <li>• Basic page revision tracking</li> </ul>	<ul style="list-style-type: none"> <li>• No points, rewards, or levels for gamification</li> <li>• No gradebook or attendance tracking</li> </ul>
<b>Core modules and components</b>		
<b>Content creation and structuring</b>	<ul style="list-style-type: none"> <li>• Rich text editor for creating and formatting content</li> <li>• Supports images and file attachments</li> <li>• Features like page revisions for collaborative content development</li> </ul>	<ul style="list-style-type: none"> <li>• Limited multimedia integration (no direct video or audio embedding)</li> <li>• No tools for creating interactive content</li> </ul>
<b>Connectivity with other resources</b>	<ul style="list-style-type: none"> <li>• Supports integrations via API</li> <li>• Import/export capabilities</li> <li>• Open-source nature allows customization to connect with external content sources and learning management systems</li> </ul>	<ul style="list-style-type: none"> <li>• Basic import/export functionalities</li> </ul>
<b>Storage and data management</b>	<ul style="list-style-type: none"> <li>• Database management</li> <li>• Cloud storage integration</li> <li>• Ensures secure and efficient data storage</li> <li>• Local and S3 storage options available</li> </ul>	<ul style="list-style-type: none"> <li>• Cloud storage integration may require additional configuration</li> </ul>
<b>Browsing and presentation</b>	<ul style="list-style-type: none"> <li>• Advanced search functionality</li> <li>• Organized book structure for content categorization</li> <li>• Presentation mode for viewing pages</li> <li>• User-friendly navigation</li> </ul>	<ul style="list-style-type: none"> <li>• Limited presentation features for classroom use</li> </ul>

<b>Feedback and recommender system</b>	<ul style="list-style-type: none"> <li>• Basic commenting on pages</li> <li>• Can be extended to include features for user feedback, such as ratings and comments</li> <li>• Functionality for a recommender system can be developed</li> </ul>	<ul style="list-style-type: none"> <li>• No rating or advanced feedback system</li> <li>• No content recommendation engine</li> </ul>
<b>Content management and editorial oversight</b>	<ul style="list-style-type: none"> <li>• Page revision history</li> <li>• Simple content approval process</li> <li>• User management with role and permission settings</li> </ul>	<ul style="list-style-type: none"> <li>• Limited content review workflow</li> <li>• Limited quality assurance tools</li> </ul>
<b>Interfaces and user experience</b>		
<b>User interface</b>	<ul style="list-style-type: none"> <li>• Intuitive and accessible UI</li> <li>• Responsive design</li> <li>• User dashboard for easy access to content</li> <li>• Supports multiple languages</li> </ul>	<ul style="list-style-type: none"> <li>• Lacks advanced user personalization features</li> </ul>
<b>Data security and privacy</b>	<ul style="list-style-type: none"> <li>• User authentication</li> <li>• Basic encryption</li> <li>• Supports various authentication methods, including social providers and enterprise options like LDAP and SAML2</li> </ul>	<ul style="list-style-type: none"> <li>• May require additional measures for compliance with data protection regulations</li> </ul>
<b>Continuous Adaptation and Improvement</b>		
<b>User feedback loop</b>	<ul style="list-style-type: none"> <li>• Basic commenting system</li> </ul>	<ul style="list-style-type: none"> <li>• Limited mechanisms for continuous user feedback and improvement</li> </ul>
<b>Scalable infrastructure</b>	<ul style="list-style-type: none"> <li>• Can be hosted on scalable infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>

#### 4.3.4 Conclusion

Despite its limitations, BookStack was selected for the TET platform due to its significant advantages. BookStack offers a user-friendly and intuitive interface, making it accessible for users with varying levels of technical expertise. Its responsive design ensures usability across different devices, which is crucial for modern educational environments. Additionally, BookStack's robust API capabilities and basic data management functions provide a solid foundation for content organization and accessibility.

While it lacks some advanced features such as sophisticated collaboration tools, evaluation systems, and comprehensive multimedia integration, BookStack's strengths in content creation, organization, and ease of use make it a practical choice. The platform's simple yet effective structure allows for scalability and customization to meet future needs, making it a viable starting point for developing the TET platform. With additional development and integration of necessary functionalities, BookStack can evolve to support the dynamic, interactive, and evolving educational goals of the TET platform.

Moreover, BookStack's open-source nature allows for the integration of additional communication functionalities and customization options to enhance connectivity with external content sources and learning management systems. Its support for various authentication methods, including social providers and enterprise options like LDAP and SAML2, ensures secure user access and data privacy. Despite potential performance issues with large-scale deployments, BookStack's adaptable infrastructure provides a scalable solution for the TET platform, ensuring it can grow and evolve with the educational needs of its users.



Lead Partner



UNIVERZA  
V LJUBLJANI

Partners



**POLITECHNIKA  
RZESZOWSKA**  
im. IGNACEGO ŁUKASIEWICZA



UNIVERSITÀ DI PISA

