Rapid Learning Tool for Students

BY

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ABSTRACT

Due to information overload, language difficulties, and fragmented technologies, students frequently struggle to navigate large volumes of academic content. The creation of a web-based Rapid Learning Tool (RLT) that combines document analysis, AI-powered summarization, translation, definition lookup and research support into a single platform is the project's suggested solution to these problems. A variety of document formats (PDF, DOC, DOCX, PPT, PPTX, and TXT) can be uploaded to the system, which also automatically extracts and summarizes important information, translates or explains words in real time, and collects relevant research papers from reliable databases, for example Semantic Scholar. Additionally, the word cloud visualization and keyword extraction features enable students to rapidly understand the primary ideas of texts. Rapid Learning Tool (RLT) combines AI services like Cohere AI, Ollama, DeepL, and Google Translate and is based in Node.js and Express.js for the backend. To guarantee a customized and safe educational environment, it also makes use of secure JWT authentication, session monitoring, and user conversation history abilities. Rapid Learning Tool successfully lowers students' cognitive load while improving their understanding and learning effectiveness by using these features. It overcomes the gap between disjointed learning processes and effective, intelligent learning support by giving students a reliable, adaptable and useful instructional tool.

Area of Study (Minimum 1 and Maximum 2): Artificial Intelligence, Educational Technology

Keywords (Minimum 5 and Maximum 10): AI Summarization, Document Analysis, Highlight-to-Translate and definition, Research Support, Web-Based Learning Tool

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LIST OF ABBREVIATIONS

RLT	Rapid Learning Tool
AI	Artificial Intelligence
NLP	Natural Language Processing
API	Application Programming Interface
ORC	Optical Character Recognition
JWT	JSON Web Token
PDF	Portable Document Format
DOCX	Microsoft Word Document Format
PPTX	Microsoft PowerPoint File Format
TXT	Plain Text File Format
LMS	Learning Management System
Q&A	Question and Answer
JSON	JavaScript Object Notation
CORS	Cross-Origin Resource Sharing
LLM	Large Language Model
NPM	Node Package Manager

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Chapter 1

Project Background

A learning tool is any resource that improves student capacity to learn, retain, and apply information [1]. Textbooks, online courses, and research databases are examples of traditional resources. Building upon this framework, new developments in generative Artificial Intelligence (AI), like ChatGPT, greatly speed up learning by offering pertinent summaries, explanations, and translations of student's inquiries.

This chapter provides an overview of the project's motivation, problem statement, research background, and contributions. The foundation for the creation of the suggested Rapid Learning Tool (RLT) is established by the comprehensive clarification of each section.

1.1   Introduction

Students are overwhelmed with academic material both online and offline in today's digital learning environment. Even while the internet has a wealth of resources, including e-books, research databases, and scholarly articles, using them successfully can still be difficult, particularly for students who lack sufficient time, language skills, or subject-matter expertise [2]. Despite their usefulness, traditional learning tools frequently lack functionality and require students to switch between programs for summarizing, translating, and searching the articles which make learning disjointed and ineffective [3].

Several essential learning features are combined into a single platform by the Rapid Learning Tool (RLT), an integrated web-based learning tool. Rapid Learning Tool (RLT) offers customers a smooth and practical learning experience by combining document analysis, summarization, real-time translation, word definition and academic resource recommendations, in place of single-function tools. Students can communicate with the system

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via an AI-powered chat interface and upload documents in a variety of formats, such as PDF, DOC, DOCX, PPT, PPTX, and TXT. In order to support in-depth study, the application intelligently extracts important concepts, produces succinct summaries, offers real-time translations, and suggests relevant research articles.

Rapid Learning Tool (RLT) provides a chat history tool to improve continuity and customization, enabling students to examine previous exchanges and monitor their learning development. Additionally, Rapid Learning Tool (RLT) facilities global translation (with DeepL and Google Translate as choices), guaranteeing precise translation of both broad and specialized terms, enhancing inclusivity and dependability. When used with word cloud visualization, advanced keyword extraction aids students in rapidly understanding important points and comprehending complex information.

Technically, Rapid Learning Tool uses a dynamic frontend design and a Node.js backend, using password hashing, refresh tokens, and JWT authentication to protect student access and data. System stability and dependability in practical situations are guaranteed by strong logging, error-handling, and backup features.

The Rapid Learning Tool frees students from the stress of hard technical tasks by combining many learning functions, allowing them to concentrate on critical thinking and meaningful learning. It seeks to increase learning effectiveness, lessen cognitive load, and offer a safe, intuitive, and expandable platform for students to successfully study, comprehend, and apply academic material.

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1.2   Problem Statement

Students in modern education must collect and analyze data from a variety of sources, frequently in a short period of time [4]. But when it comes to understanding and integrating information, the conventional techniques and resources that students utilize are frequently ineffective and inefficient [5]. Effective learning and research are still limited by three main issues: fragmented workflows, language obstacles, and information overload.

1.2.1   Lack of Integration and a Fragmented Toolkit

To finish various learning objectives, students frequently need to use several distinct applications. For example, students may utilize one platform for document organization, another for translation, a dictionary app for definitions, and academic database for research papers. Students are forced to switch tools frequently due to this fragmented learning strategy, which loses critical learning time in addition to distracting them and increasing cognitive load [6]. Additionally, frequent copying and pasting raises the possibility of miscommunication and loss of information.

1.2.2   Challenges with Terminology and Limits to Language

Numerous technical terminologies, domain-specific vocabulary, and challenging writing styles are frequently found in academic materials, which can be quite difficult for many students to understand [7]. It is considerably more challenging for non-native English speakers to come across such terms in professions like engineering, medicine, computer science, and law. Traditional translation technologies frequently only offer literal translations, missing details of academic context and resulting in confusion [8]. Additionally, the learning process is interrupted and understanding efficiency is decreased when content must be copied and pasted into another platform for translation.

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In order to fully understand the meaning of technical terminology, students frequently require both translations and explanations. Although currently available translation systems are capable of translating sentences and phrases, they usually do not provide dictionary-level explanations inside the same interface. Students then must use different dictionary tools, which add to their challenges.

1.2.3 <u>Overwhelming information and trouble finding appropriate resources</u>

The abundance of academic information on the internet presents another significant obstacle for students. Thousands of search results are frequently returned by academic databases, many of which have nothing to do which have not much to do with the student's research topic [9]. Students who lack experience struggle to identify reputable and academically significant articles. In addition to wasting time, this results in a brief or insufficient comprehension of the subject issue. Additionally, students frequently find it difficult to read and comprehend lengthy research papers and technical documents fast [10]. Students struggle to effectively extract important information in the absence of efficient filtering or reading tools.

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1.3   Motivation

The quick growth of digital learning tools has provided students with unparalleled access to material. However, access has also generated additional challenges that prevent effective teaching [11]. The desire to assist students in resolving the three main problems mentioned in the problem statement – fragmented workflows, language difficulties, and information overload is what motivates this project.

First at all, relying on numerous unconnected tools frequently distracts students' attention from the main learning objective. In addition to taking up important study time, constantly switching between platforms for research support, translation, summarization, and dictionary lookups also raises cognitive stress. The goal of creating an integrated platform is to give students the opportunity to work in a smooth learning environment so they may concentrate more on understanding and analyzing information than on tool operation.

Second, technical terminologies and language difficulties represent serious challenges, particularly for students learning a second language or coming across specialized terms in the workplace. Significant subjects may not be fully or accurately understood if terms used in academics are misunderstood. In order to ensure that students can comprehend difficult information without interrupting their learning flow, real-time support technologies that offer both translations and dictionary-level explanations immediately within the same platform have been developed.

Lastly, the goal of addressing information overload is to make it easier for students to locate relevant and excellent academic resources. Students frequently spend a lot of time sorting through pointless articles because traditional search engines and academic databases frequently return a high volume of useless search results. Students require a more accurate and accessible method of connecting trustworthy academic resources with their present reading material. The system may make recommendations for relevant scholarly publications fast by

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creating a feature that lets students highlight sentences in a text and use them as search keywords. In addition to saving time and lowering student irritation, this gives them access to carefully chosen materials that are specifically relevant to their present work.

The goal of this project is to provide an all-inclusive, dependable, and efficient learning tool that specifically solves these issues. By minimizing inefficiencies, removing language barriers, and assisting students in navigating large volumes of material, the Rapid Learning Tool seeks to equip students with the tools and trust necessary to make deeper, quicker, and more significant academic progress.

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1.4 Project Background

The background of the Rapid Learning Tool (RLT) is presented in this part, along with the different kinds of tools that shaped and inspired their design, such as AI-based conversational tools, research tools, and translation tools. While these technologies have all contributed to the growth of digital learning, they do have limitations, which prompted us to combine their features into a more comprehensive and focused on student's platform.

1.4.1 Introduction to Translation Tools

Particularly in the increasingly globalized educational setting where students regularly come across academic materials in non-native languages, translation tools have become essential to academic learning [12]. Quick translation of words, sentences, and even full documents is possible with tools like Google Translate and DeepL, which increase the accessibility of knowledge for non-native speakers [13]. They enable students to access foreign academic resources that would otherwise be challenging to understand and get over language challenges.

However, the majority of translation tools are stand-alone programs that require students to copy and paste content from their reading materials into another platform to translate it, which slows learning and decreases productivity. These drawbacks show how important it is to have a translation function built right into the classroom so that students may translate words or sentences as they are being spoken without having to stop what they are doing.

1.4.2 Introduction to Research Tools

For students to conduct literature reviews, obtain scholarly material, and establish a strong research foundation, research tools are important [14]. Large databases of journal

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articles, conferences papers, and other scholarly resources are available on platforms like Google Scholar, Semantic Scholar, and PubMed. These resources are very helpful for locating previous research, looking into relevant studies, and locating trustworthy scholarly references [15].

Research instruments are useful, but they often have drawbacks. The vast number of results from a single search, many of which might not be specifically related to their research topic, could confuse students [16]. Furthermore, many students lack the experience necessary to formulate effective keywords, particularly in the early stages of their education. These challenges may result in ineffectiveness, time loss, and poor comprehension of the course materials. Students can therefore identify relevant literature more quickly and accurately with a more directed approach, such as letting them underline important sentences in their own research papers and having the system automatically retrieve relevant articles.

1.4.3   Introduction to AI Conversational Tools

The way students engage with digital resources has been completely transformed by AI-powered conversational solutions like Microsoft Copilot and ChatGPT that are built on Large Language Models (LLMs) [17]. These algorithms can produce summaries, explain things, respond to inquiries, and even translate material in real time. Interactive learning is made possible by their conversational interface, which also facilities specific learning and makes difficult information easier to understand.

Despite their strength, these technologies are typically closer to general-purpose assistants than platforms made especially for academic study. When using them for research, students could run into problems like unrelated responses, limited access to scholarly databases, or trouble keeping track of their interactions. Furthermore, these technologies do not always maintain individual student records in way that encourages ongoing academic success,

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and they usually demand an ongoing internet connection. Thus, it is essential to create a specialized AI conversational system. With functions like dictionary lookup, translation, text summarization, and interaction with academic resources, such as system could build on the advantages of current tools and customize its features to meet the demands of academic learning.

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1.5   Contributions

By creating a Rapid Learning Tool (RLT) that specifically solves the three primary challenges of modern learning which is fragmented workflows, language barriers, and information overload. This project advances the area of educational technology. Through the integration of Natural Language Processing (NLP), Artificial Intelligence (AI), and several external APIs into a single platform, the system provides students with an efficient, safe, and efficient academic support tool.

1.5.1   <u>Integrating Multiple Academic Functions into a Single Platform (#Addressing Problem #1)</u>

Simplifying processes by combining essential academic assistance features into a single platform in one of the project's main goals. Nowadays, students frequently need to require a variety of resources, including dictionaries, translation, document analysis tools, and research databases. Students' cognitive loads are increased, time is wasted, and the learning flow is disrupted by this disjointed approach. Students may complete tasks including document analyzing, translation, dictionary lookup, and academic research in a single environment due to the Rapid Learning Tool (RLT) platform's integration of these services into a single system. Students may concentrate on understanding and analysis rather than tool operation due to this integration, which also decreases the chance of information loss during copy-paste operations and platform switching.

1.5.2   <u>Offering Real-time Translation and Vocabulary Definition to Support Languages. (#Addressing Problem #2)</u>

Examining how language challenges affect students' learning is one of the project's other goals. Numerous technical terminologies, domain-specific vocabulary, and confusing

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sentence structures are frequently found in academic materials, making them challenging for many students, especially non-native speakers to understand. Traditional tools might be helpful, but they usually only translate text literally, which makes it difficult to effectively convey academic content. Additionally, utilizing different dictionary tools can be distracting. Thus, the goal of this real-time language support tool is to incorporate terminology explanation and real-time translation right into the reading experience. Simply highlighting a word will provide students with a translation and thorough explanation, along with instances of usage and part of speech. Additionally, they could highlight words or phrases for instant translation. This technique guarantees that students can more readily comprehend technical terms and difficult content by combining translation and vocabulary definitions, which improves learning efficiency and elevates the educational process.

1.5.3   <u>Sentence-to-Article Search for Research Assistance (Addressing Problem #3)</u>

This project's creation of a "Sentence-Based article Search" function is one of its main contributions. It aids students in efficiently managing vast volumes of data and enhancing their study productivity. The method rapidly finds relevant scholarly databases like Semantic Scholar when students just highlight a sentence in AI response. Students no longer must manually enter keywords or sort through pointless search results due to this method. Students may easily locate literature that improves their comprehension because of this feature, which directly connects their learning materials with related outside resources. As a result, students can focus more on their studies and carry out better academic research in addition to saving crucial study time and lowering cognitive stress.

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1.6   Project Scope

To solve issues with academic learning, including disjointed processes, language obstacles, and information overload, this project intends to design and create a web-based Rapid Learning Tool (RLT). Students can upload documents in a variety of formats such as PDF, DOC, DOCX, PPT, PPTX, and TXT. It utilizes a range of learning assistance tools on this integrated platform. Students may quickly get summaries of lengthy documents using AI, extract keywords, and display important ideas using word clouds. They can also look for relevant scholarly publications from reputable sources like Semantic Scholar, highlight words to obtain dictionary definitions and translations, or define sentences for immediate translation. This project simplifies the learning process by combining these capabilities into a single platform, removing the need for students to switch between tools and offering a more effective and easy learning environment.

Features to guarantee stability, security, and customization are also included in the project. User identification is ensured by a JWT-based login process and secure password handling; students can review and reuse previous learning resources due to a conversation history management function. Additionally, automatic database backups, rate limitations, and error handling improve system stability and guarantee dependable operation in a learning environment.

The project scope is well-defined to keep attention on its primary goals. Rapid Learning Tool (RLT) is not meant to take the place of teachers or serve as a full tutoring system. It combines and makes use of pre-existing AI services and APIs, like Cohere AI, DeepL, Google Translate, and Semantic Scholar, rather than creating new machine learning models. Although document-based learning is supported by the system, advanced adaptive learning techniques, individualized learning routes, and course design are not included.

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The project, which has a well-defined scope, intends to provide a dependable, inclusive, and student-cantered learning tool that improves learning effectiveness, lowers comprehension difficulties, and encourages deeper engagement with academic materials.

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1.7 Project Objectives

By lowering inefficiencies in the learning process, removing language barriers, and assisting students in efficiently managing vast volumes of learning material, this project seeks to design and create a Rapid Learning Tool (RLT) that will improve the learning experience. Three main goals form the foundation of the system, each of which directly addresses a significant issue listed in the problem description.

1.7.1 To Integrate Multiple Academic Functions into Single Platform

In order to prevent fragmentation, the project's primary goal is to combine essential learning support services by combining several workflows into a single web-based platform. Students currently spend critical learning time and become distracted by the various tools they utilize for academic research, dictionary lookup, translation, and text summarizing. Students can upload papers in many formats and easily access research, dictionary lookup, summarization, and translation tools without navigating between apps due to the Rapid Learning Tool (RLT) integration of these capabilities into a single system. Instead of juggling several different tools, this reduces cognitive stress to concentrate on comprehension and analysis.

1.7.2 To Provide Language Support through Real-Time Translation and Dictionary Features

The project's second goal is to solve the difficulties students encounter when reading research papers due to language difficulties and specific terminology. Non-native speakers may find it challenging to comprehend the technical terms and specialist vocabulary found in many learning materials. While dictionary lookups need different programs, traditional translation tools frequently only offer basic translations, failing to properly represent the academic

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meaning. The Rapid Learning Tool (RLT) incorporates dictionary and real-time translation capabilities right into the learning environment to solve this. Students can highlight entire sentences or phases for immediate translation, or they can highlight individual words for translation and a comprehensive dictionary. This feature ensures that students can understand difficult terminology and maintain an easy time learning by making academic content readable and clear.

1.7.3 To Address Information Overload Using AI for Relevant Research and Information Summarization

In order to reduce the harmful effects of information overload, the third goal of this project is to assist students in more efficiently sorting and processing vast volume of learning resources. Academic papers are frequently long and challenging to read, and students frequently see thousands of search results while using academic databases and research tools. An AI-powered text summary tool that can extract important information keywords and reduce long scholarly publications into succinct, structured summaries is integrated into the Rapid Learning Tool (RLT) system to address this problem. After then, these keywords are shown as a word cloud, which aids students in rapidly understanding the article's primary ideas. Additionally, the system has phrase-based literature search functions, which allow students to instantly get relevant academic publications from reputable databases such as Semantic Scholar by simply highlighting a sentence in the AI response. The Rapid Learning Tool (RLT) system helps students save time, reduces their workload, and make better and more use of academic resources by combining text summarizing, keyword extraction, and relevant literature search.

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Chapter 2

Literature Review

An overview of current translation, research support, and AI-based conversational systems tools and technologies is given in this chapter. Although these technologies have a lot of useful features that can help with digital learning, they also have some drawbacks that allow opportunities for development and creativity. This chapter establishes the framework for the creation of a Rapid Learning Tool (RLT), which attempts to combine the best aspects of different technologies into a single platform by evaluating their advantages and disadvantages.

2.1   Review of Google Translate

Overview

One of the most popular machine translation services is Google Translate, which supports more than 130 languages [18]. Text, speech, photos, and complete documents may all be translated fast and effortlessly by users. Compared to conventional word-by-word translation techniques, it makes use of Neural Machine Translation (NMT) technology, which produces translations that are quicker and contextually correct. Additionally, its API, which offers real-time translation services for web and mobile platforms, is regularly included into third-party applications.

Advantages:

Google Translates' primary benefit is its convenience and ease of usage. It is quickly included in browsers and applications, supports a wide range of devices worldwide, and supports many input formats [19]. It is extremely reliable for daily usage because its machine learning model is always becoming better, especially for common language combinations.

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Disadvantages:

Although its many benefits, Google Translate has many drawbacks, especially when it comes to processing complicated sentence structures and translating less widely spoken languages accurately [20]. Misunderstandings may result from the frequent direct translations that overlook scholarly and cultural differences. These restrictions limit their relevance for professional or academic settings. Additionally, it lacks contextual information and dictionary-style explanations, which is inadequate for academics looking for a deeper understanding.

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2.2   Review of Google Scholar

Journal articles, books, research thesis, and conference papers are only a few of the scholarly materials that are indexed by Google Scholar, a free academic search engine [21]. It is frequently used to assist academics and students in locating scholarly materials in a variety of fields. New users may easily navigate their straightforward search interface, which also accommodates more complex academic inquiries.

Advantages:

Google Scholar gives users free access to an abundance of scholarly resources [22]. It has helpful features including author profiles, citation tracking, library system integration, and citation format generators (APA, MLA, and Chicago). It is a useful tool for organizing citations and carrying out effective literature searches because of these features.

Disadvantages:

However, Google Scholar's accuracy and search filtering are severely limited [23]. The platform may include out-of-date, duplicate, or unreliable content, and search results cannot be categorized by publication type, year, or quality. The utility of some papers for students without institutional access is limited by the high number of metadata mistakes and the requirement for paid access.

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2.3   Review of ChatGPT

OpenAI created ChatGPT, an interactive AI model that can produce human-like answers for a variety of activities, such as content generation, question answering, translation, test summarization, and coding support [24]. Its popularity is rising quickly because of its strong natural language processing capabilities, which make it the perfect learning aid for both teachers and students.

Advantages:

ChatGPT may clarify difficult ideas and offer interactive, real-time learning support by providing succinct, context-based explanations [25]. It can be used by students to create instructional materials, brainstorm ideas, clarify technical vocabulary, and summarize large literature. Its conversational interaction, in contrast to conventional static learning tools, makes the learning experience more dynamic, individualized, and engaging.

Disadvantages:

Even with all its benefits, ChatGPT still has certain issues with accuracy and dependability. The word "Hallucination" is the term for the occurrence that it occasionally produces responses that appear accurate but are in fact incorrect or out of date. It is also less appropriate for thorough academic study because it does not integrate with external databases or citation management system [26]. Its inability to immediately integrate functions like research support, translation, and text summary as a stand-alone application forces users to rely on various platforms, which adds to the learning load.

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2.4   Comparison of Different Tools

A comparison of ChatGPT, Google Scholar, and Google Translate shows both their advantages and disadvantages. The characteristics of each tool are compiled in Table 2.1 with respect to the suggested Rapid Learning Tool (RLT).

Features	Google Scholar	Google Translate	ChatGPT	Rapid Learning Tool (RLT)
Integrated Tools	Research only	Translation only	Summarization or answer	Combines summarization, translation, definition, research, keyword extraction, and word cloud
Translation Features	None	Full text translation	Can translate via prompts	Integrated real-time translation (word + sentence)
Document Summary	None	None	Basic contextual summary	AI-powered summarization, keyword

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				extraction, and word cloud
Source Relevance	Search relevance ranking	None	None	Filters related articles via Semantic Scholar
AI-Driven Insights	None	None	Advanced AI explanations	AI-powered analysis integrated with learning tools

Table 2.1 Comparison of Different Tools

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Chapter 3
System Methodology/Approach

The Rapid Learning Tool (RLT) development process and methodology are presented in this chapter. This technique, which is a development-based system project, concentrates on the design, implementation, and integration of several services into a single web-based platform. The system has a modular architecture, meaning that each functional module, such as research support, vocabulary definitions, translation, and content summarization interacts with the frontend and backend to give students a smooth learning experience.

The concepts of flexibility, reliability, safety, and focus on students are all incorporated into system design. This guarantees that the system will support future improvements in addition to meeting the needs analysis' requirements. A description of the Rapid Learning Tool (RLT) system's general architecture, functionalities, and operational procedures will be provided in the following sections, along with overall architecture, functional requirements, and activity flow.

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3.1 System Design Diagram/Equation

3.1.1 System Architecture Diagram

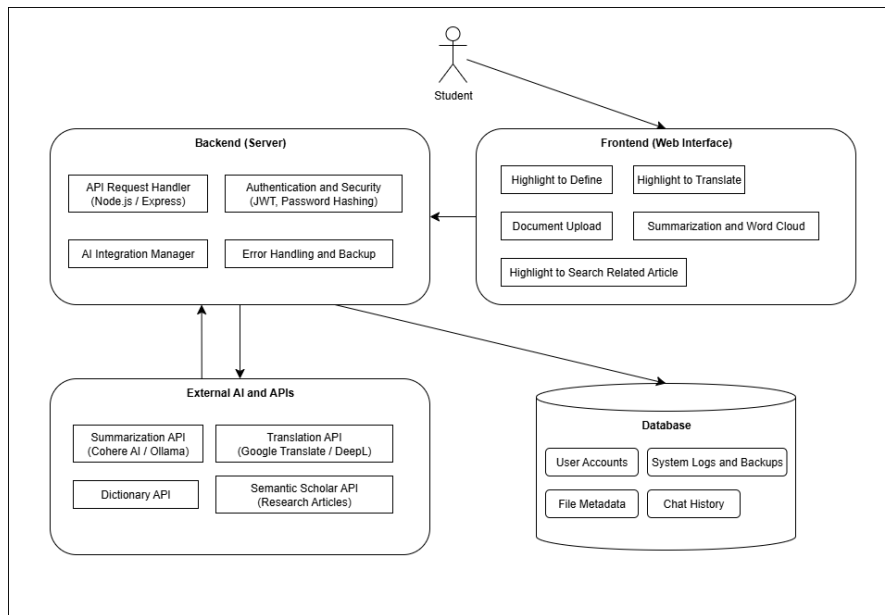**Figure 3.1 System Architecture Diagram**
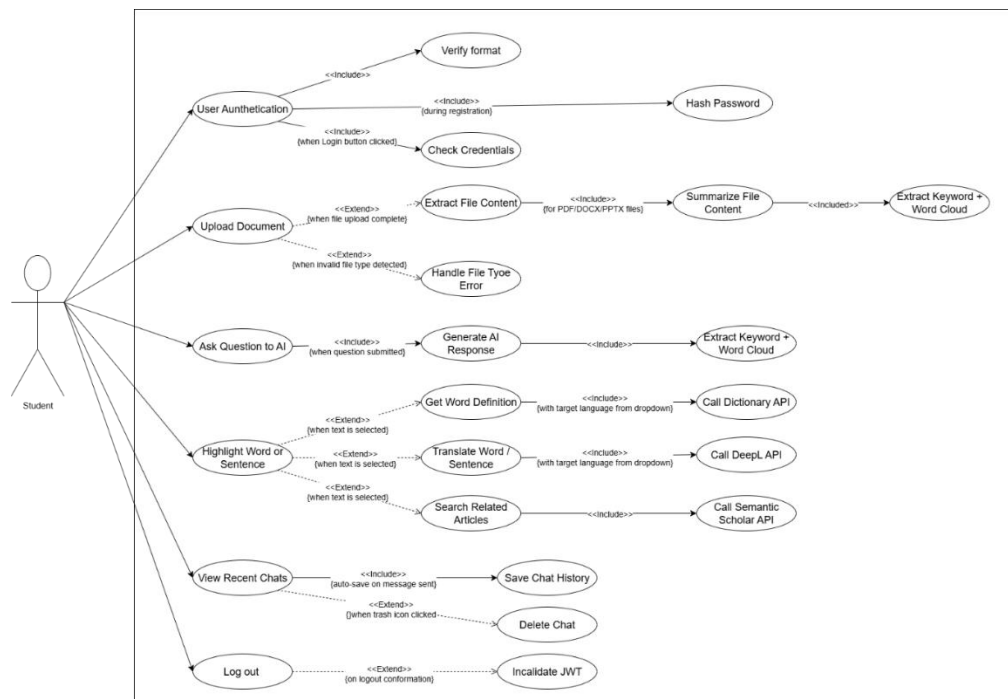
3.1.2 Use Case Diagram and Description

Figure 3.2 Use Case Diagram

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1. **User Authentication**

   - The user logs in or registers

   - Includes:

     - Verify format → Check valid input (email, name format).

     - Hash Password → Secure passwords.

     - Check Credentials → Verifies login information.

2. **Upload Document**

   - The user uploads a document (PDF, PPT, PPTX, DOC, DOCX, TXT)

   - Extends:

     - Extract File Content, when uploads complete.

     - Handle File Type Error, when invalid file detected.

   - Includes:

     - Summarize File Content, system creates a summary.

     - Extract Keyword + Word Cloud, generates keyword and word cloud.

3. **Ask Question to AI**

   - User submits questions.

   - Includes:

     - Generate AI Response

     - Extract Keyword + Word Cloud, generates keyword and word cloud.

4. **Highlight Word or Sentence**

   - User highlights word or sentence to get translation, research, or definition

   - Extends:

     - Get Word Definition (Definition lookup).

     - Translation Word or Sentence (Translation selected text).

     - Search Related Articles (Find relevant research).

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- Includes:

    - Call Dictionary API (for definitions).

    - Call DeepL API (for translations).

    - Call Semantic Scholar API (for related research).

5. View Recent Chats

- Users can review previous chat history

- Includes:

    - Save Chat History (auto-save messages).

- Extends:

    - Delete Chat (if trash icon clicked).

6. Log out

- User exits the system

- Extends:

    - Invalidate JWT, destroys authentication token.

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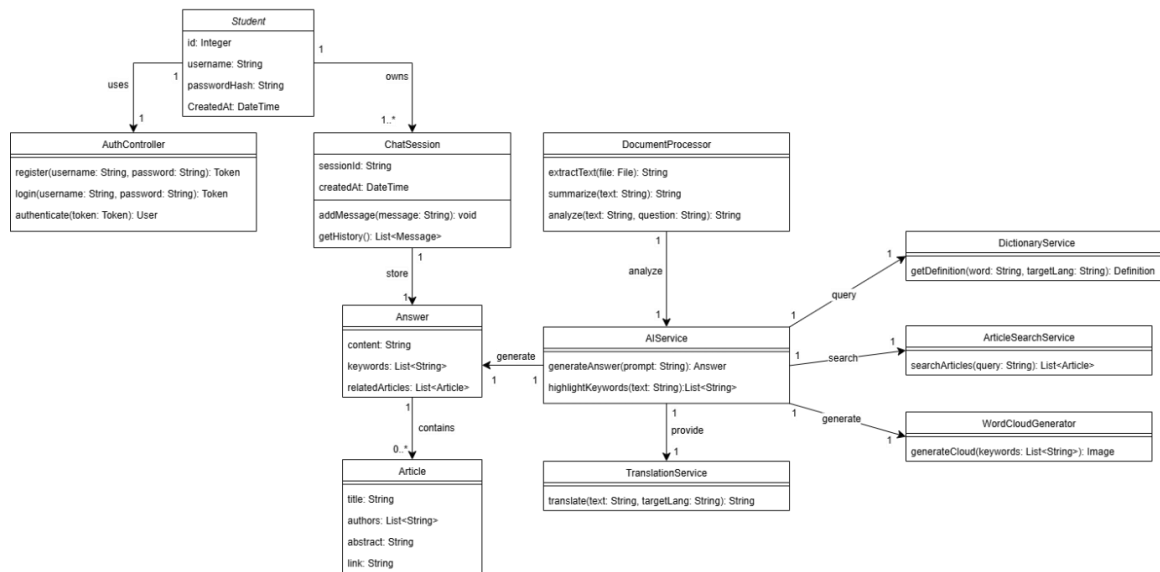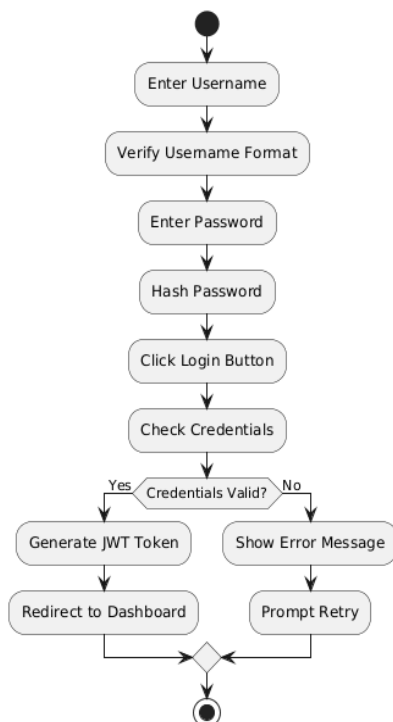
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3.1.3 Class Diagram

Figure 3.3 Class Diagram
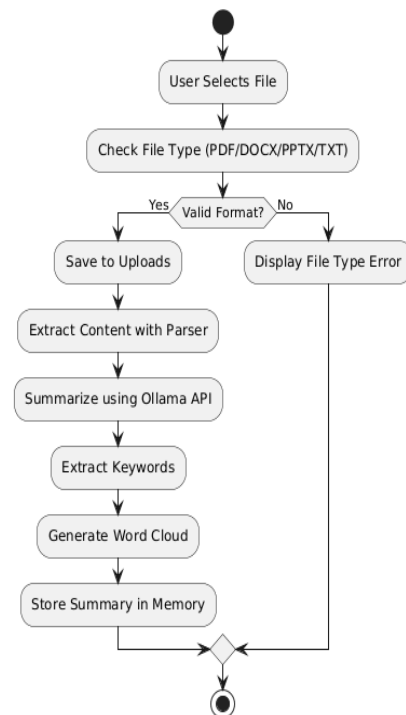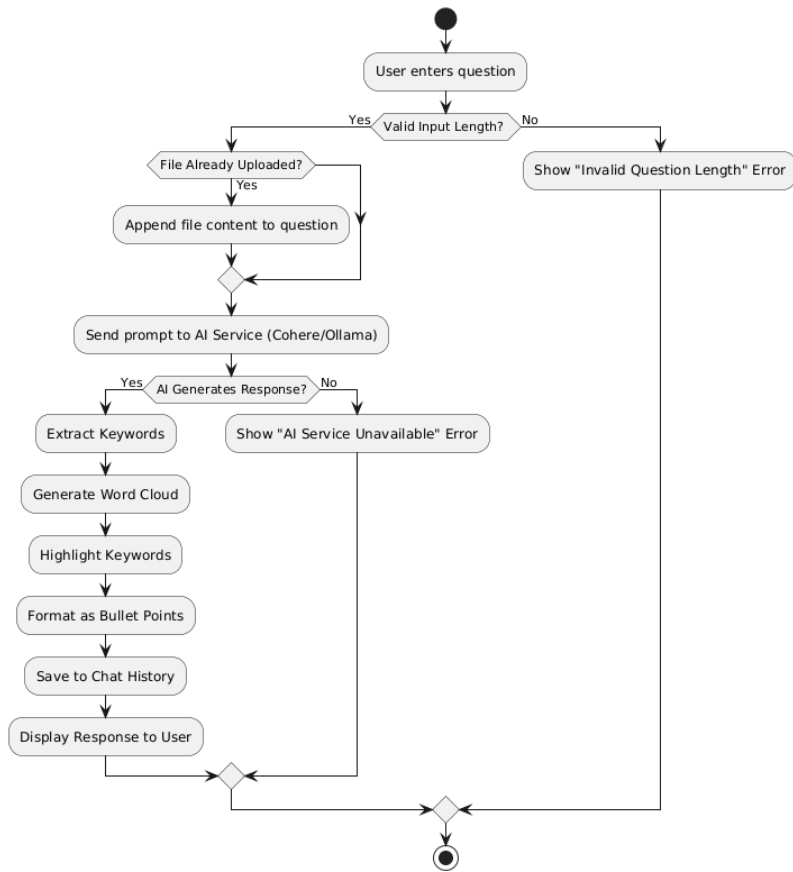
3.1.4 Activity Diagram

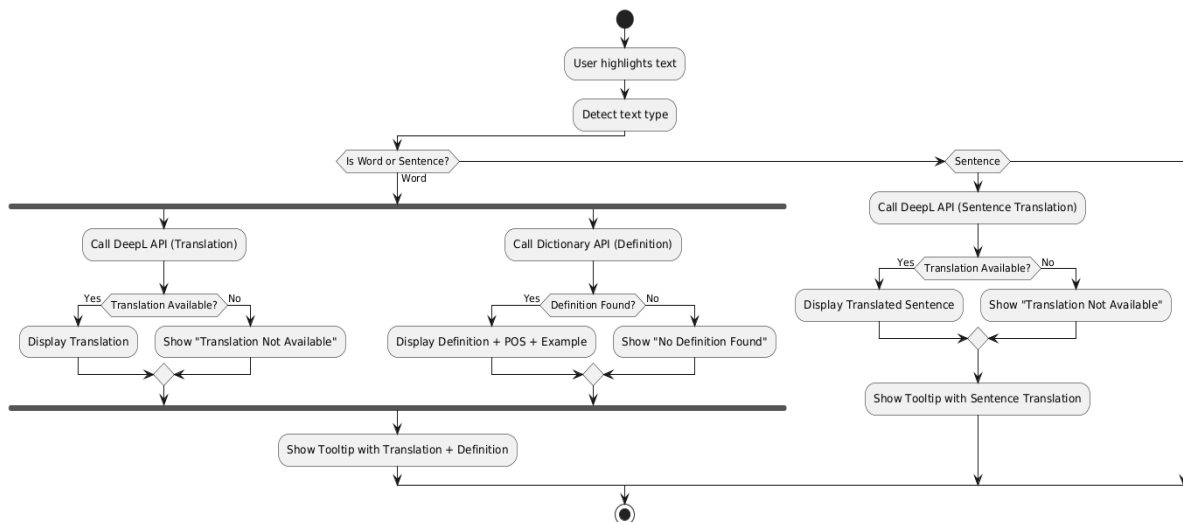**Figure 3.4: User Authentication**   **Figure 3.5: Upload Document**

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Figure 3.6: Ask Question to AI

Figure 3.7: Highlight Word or Sentence for Translation

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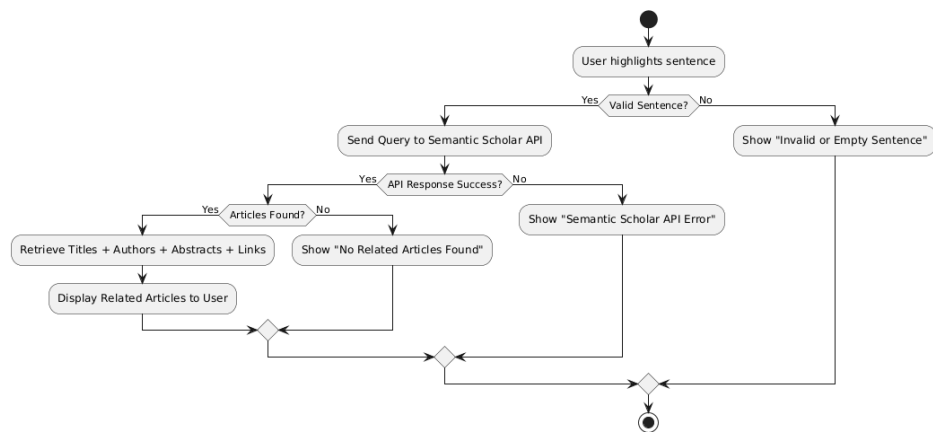
Figure 3.8: Highlight Sentence for Research Related Article
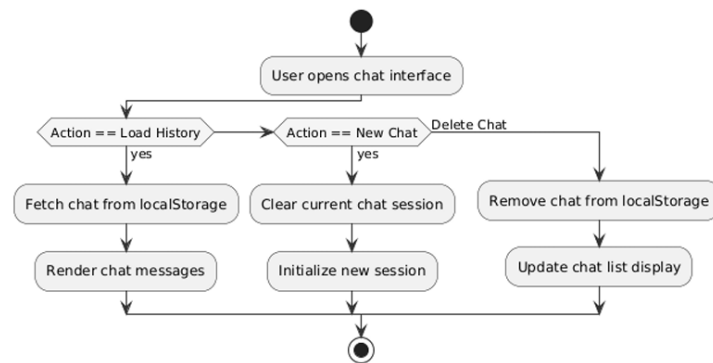
Figure 3.9: View Recent Chats

Figure 3.10: Log Out

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Chapter 4

System Design

4.1 System Block Diagram
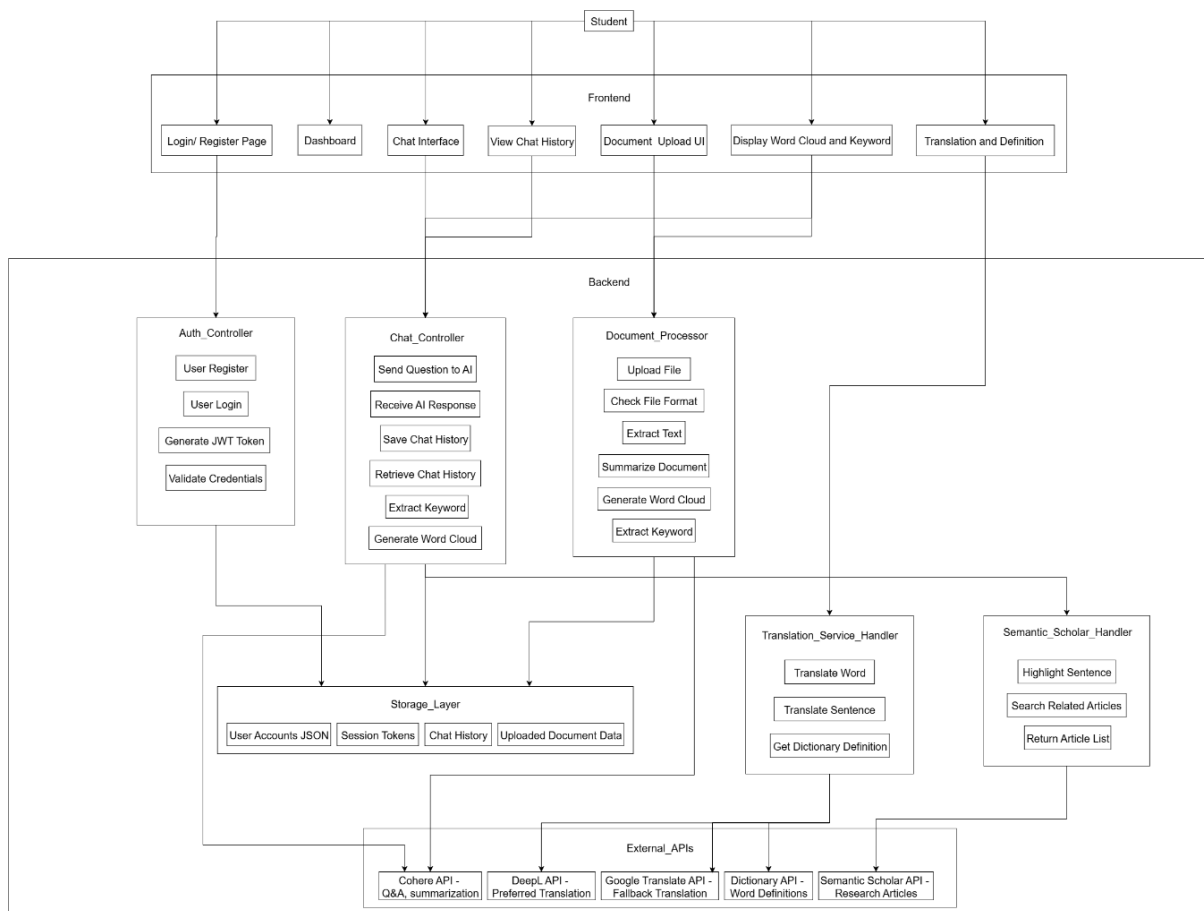
Figure 4.1 System Block Diagram

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4.2 System Component Specification

4.2.1 Frontend (Browser)

Inputs:	- User Credentials (Username, Password). - Uploaded Document (PDF, DOC, DOCX, PPT, PPTX, TXT). - Keywords or Sentences highlighted by the user. - User's question or query to the AI.
Processes:	- Collect user input via web forms, buttons, and text highlighting. - Send requests to the backend server via REST API - Display results, such as AI response, summary, keywords, word cloud, translation, word definition, and article link.
Outputs:	- Interactive dashboard with document summary. - Real-time translation and word definition. - AI response with keywords highlighted and word cloud. - List of related article links

Table 4.1 Frontend

4.2.2 Auth Controller (Backend)

Inputs:	- Registration information (Username, Password). - Login credentials. - Authentication token (JWT).
Processes:	- Hash the password using an encryption algorithm. - Verify that the user credentials match the data stored in the database. - Generate and validate the JWT token to ensure session security.
Outputs:	- Success message for successful login or registration.

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	- Error message for failed login or registration. - JWT token for secure communication.

Table 4.2 Auth Controller

4.2.3   <u>Chat Controller</u>

Inputs:	- The user's question or instruction. - The existing chat history requested by the user.
Processes:	- Send the user query to the AI service processor. - Store chat messages and responses in session memory or a JSON database. - Retrieve chat history records upon user request.
Outputs:	- AI response including a summary and extracted keywords. - Previous chat history for the user's reference.

Table 4.3 Chat Controller

4.2.4   <u>Document Processor</u>

Inputs:	- Uploaded files (PDF, DOC, DOCX, PPT, PPTX, TXT).
Processes:	- Check and validate the file type. - Extract text using relevant libraries (Exp. Textract, mammoth, pdf-parse). - Send the extracted text to an AI service for content summarization and keyword extraction. - Generate a word cloud based on the extracted keywords.
Outputs:	- Structured document text. - A concise summary of the document content.

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	- Extracted keywords and display word cloud.

Table 4.4 Document Processor

4.2.5 AI Service Handler

Inputs:	- Prompt information from the chat controller. - Extracted text from the document processor.
Processes:	- Send the prompt information or extracted text to the Cohere API or to Ollama when offline. - Receive the generated answer, summary, and list of keywords. - Enhance the AI output with keyword highlighting.
Outputs:	- AI responses to the user query. - A concise summary and extracted keywords. - Word Cloud data for visualization.

Table 4.5 AI Service Handler

4.2.6 Translation Service Handler

Inputs:	- The keyword or sentences to be translated. - Target language.
Processes:	- Use the DeepL API or Google translate API for text translation. - Retrieve dictionary definitions, part of speech, and example usage.
Outputs:	- Translated words with detailed dictionary information. - Translated sentences, maintaining academic context.

Table 4.6 Translation Service Handler

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4.2.7 Semantic Scholar Handler

Inputs:	- Use the highlighted text as the search keyword.
Processes:	- Call the Semantic Scholar API using the highlighted text. - Retrieve relevant metadata (title, abstract, authors, kinks and so on).
Outputs:	- A list of relevant academic articles. - Direct links to the external academic papers.

Table 4.7 Semantic Scholar Handler

4.2.8 Storage Layer

Inputs:	- User credentials and session data. - Uploaded files and extracted text. - Chat history and AI responses.
Processes:	- Store data using JSON files instead of a traditional database. - Organize each student's chat history by session. - Maintain a cache of uploaded files for quick access.
Outputs:	- Persistent user information (for authentication). - Historical chat logs and saved summaries. - Cached file content for easy reuse.

Table 4.8 Storage Layer

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4.3   System Components Interaction Operations

The Rapid Learning Tool (RLT) is made up of modular parts that communicate with one another via a clear data flow. Every key feature's interaction flow is explained in this section.

4.3.1   <u>User Authentication</u>

1. On the frontend login screen, the student inputs their username and password.

2. The request is sent to the backend Auth Controller.

3. The saved JSON user record and the user's credentials are compared by the system.

4. The system creates a JWT token and sends it back to the frontend for session management if authentication is successful.

5. An error message appears if authentication is unsuccessful, and the student is then taken to the dashboard.

Interaction Flow: Student → Frontend UI → Auth Controller → Storage Layer

4.3.2   <u>Uploading Documents and Generating Summaries</u>

1. Using the frontend, the student chooses and uploads a document.

2. The Document Processor receives the file and verifies its type.

3. The text content is extracted by libraries like pdf-parse, mammoth, or textract based on the file type.

4. The AI Service Handler receives the extracted text and uses the Cohere API to generate summaries and extract keywords.

5. The word cloud data, keyword list, and summary are generated by the backend.

6. The frontend dashboard shows the outcomes.

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Interaction Flow: Student → Frontend → Document Processor → AI Service Handler →

Cohere API → Frontend Display

4.3.3   Definition and Translation of Words

1. A word highlighted by the user.

2. The Translation Service Handler receives the word from the frontend.

3. For translation, the processor makes a call to the DeepL API or Google Translate API.

4. The system simultaneously looks up the definition, part of speech, and sample sentences using a dictionary API or built-in dictionary.

5. The frontend receives the definition and translation back.

Interaction Flow: Student → Frontend → Translation Service Handler → DeepL API + Dictionary → Frontend

4.3.4   Translation of Sentences

1. A whole sentence in AI responsse is highlighted by the student.

2. The Translation Service Handler receives the sentence from the frontend.

3. The translated text is returned by the processor after a call to the DeepL API or Google Translate API.

4. The translated sentence appears next to or under the original content in the frontend.

Interaction Flow: Student → Frontend → Translation Service Handler → DeepL API → Frontend

4.3.5   Highlighting Sentences to Search for Related Articles

1. The student chooses "Search" after highlighting a sentence in the AI answer.

2. The highlighted sentences are delivered to the Semantic Scholar Handler via the frontend.

3. The handler calls the Semantic Scholar API using the sentence as a query input.

4. Relevant scholarly articles including the title, abstract, author, and link are returned by the API.

5. The data is formatted and sent back to the frontend by the backend.

6. A list of articles with clickable links is shown on the frontend.

Interaction Flow: Student → Frontend → Semantic Scholar Handler → Semantic Scholar API → Frontend

4.3.6   Chat with the AI Assistant

1. The student uses the chat interface to ask questions.

2. The Chat Controller receives the query from the frontend.

3. The AI Service handler receives the inquiry from the Chat Controller and makes a call to the Cohere AI or Ollama.

4. After creating a response, the AI sends it back to the backend.

5. The backend creates a word cloud by extracting keywords from the answer.

6. The word cloud and AI response are shown on the frontend.

7. The history of the chat is saved for future viewing.

Interaction Flow: Student → Frontend → Chat Controller → AI Service Handler → Cohere API → Backend → Storage → Fronted

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Chapter 5

System Implementation

5.1   Hardware Setup

No specialized hardware is needed for the web-based Rapid Learning Tool (RLT). However, the server requires enough hardware resources to guarantee uninterrupted and effective performance during AI analysis and document processing.

Server Requirements (Development Machine):

- Processor: Intel(R) Core (TM) i5 or equivalent

- RAM: 16GB minimum

- Storage: 512GB SSD

- Network: Consistent 10 Mbps or faster broadband internet connection.

End-User Devices:

- A laptop, tablet, smartphone or other internet-enabled device running a modern web browser (Chrome, Edge, Firefox or Safari).

- For optimum performance, we advise that the user device have at least 4GB of RAM.

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5.2 Software Setup

This system is built using Node.js, Express.js, HTML, CSS, and JavaScript, and integrates various libraries and APIs.

Frontend Technologies:

- HTML, CSS, JavaScript – Implementation of Core UI

- Bootstrap 5.3 – Responsive design and layout.

- Font Awesome – Icon library for navigation and features.

- Animate.css – provide smooth UI animation effects.

- Wordcloud2.js – Tool for visualizing keyword and word cloud.

- Local Storage – Chat history caching

Backend Technologies:

- Node.js – Runtime environment.

- Express.js – Backend web framework.

- CORS – Cross-Origin Resource Sharing

- JWT (jsonwebtoken) – Secure login procedures and authentication.

- Multer: Uploading and processing files.

- Unzipper + xml2js + LibreOffice CLI – Text extraction from DOC, DOCX, PPT, and PPTX files.

- pdf-parse – Text extraction from PDFs.

- Stopword filtering (custom) – Cleans up keywords before generating word clouds.

- Cohere API / Ollama – For summarization, AI Chat, Keyword Extraction.

- Winston – Debugging and logging.

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External APIs Integrated

- Cohere API - For summarization, AI Chat, Keyword Extraction.

- DeepL API – For translation.

- Google Translate API – Fallback translation, multi-language support.

- DictionaryAPI.kev – For word definitions.

- Semantic Scholar API – Retrieval of academic research articles.

Development Environment

- IDE: Visual Studio Code.

- Version Control: Git + GitHub.

- Package Manager: npm (Node Package Manager).

- Environment Configuration: .env file for API keys and JWT secrets.

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5.3   Settings and Configuration

To guarantee dependable functioning, following setups were implemented:

Authentication

- Session management and login based on JWT.

- Data about user accounts was stored in lightweight JSON format that could be extended to a database.

- Access tokens expire in 2 hours, whereas refresh tokens expire in 7days.

File Handling

- Multer configures for file uploads.

- Supported file types: PDF, DOC, DOCX, PPT, PPTX, and TXT.

- Conversion: .doc → .docx and .ppt → .pptx using LibreOffice CLI.

- Text extraction using pdf-parse, xml2js, and fs reading.

API Configuration

- **API Keys stored in .env file:**

    - COHERE_API_KEY

    - DEEPL_API_KEY

    - SEMANTIC_SCHOLAR_API_KEY

- **Backend Routes**

    - /api/upload → Keyword creation, file upload, extraction, and summary.

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- /api/translate → Translation of words or sentences.

- /api/define → Definition in Word + Definition in translation.

- /api/search-articles → Retrieval of articles from Semantic Scholar.

- /api/chat → AI keyword extraction and chat.

Deployment

- Currently: localhost:3000

- Future: Deployable to Heroku, Vercel, or AWS.

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5.4 System Operation (with Screenshot)

The Rapid Learning Tool (RLT) performs six main functions:

1. User Registration/ Login – Students create accounts and log in securely.
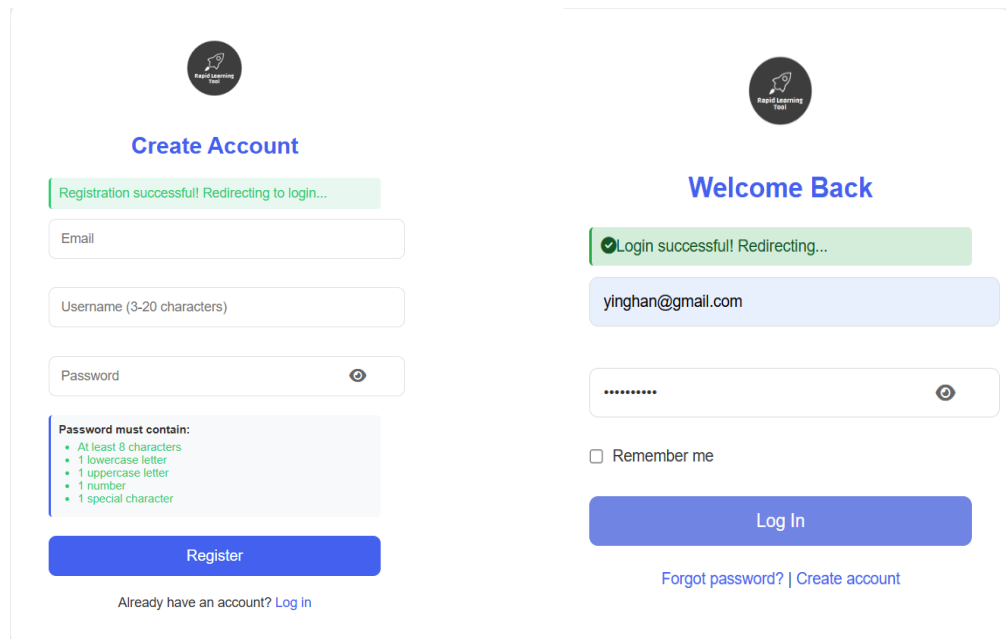
Figure 5.1 User Registration   **Figure 5.2 User Login**

2. Uploading Documents and Summarizing, analysis documents, extracts text, summarizes it using Cohere AI and displays the keywords as a word cloud.

Figure 5.3 Document Analysis

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3. Highlight Word → Translation + Definition. The dictionary definition and translated meaning of a single highlighted word are displayed.

Figure 5.4 Highlight Word for Definition

Figure 5.5 Highlight Word for Translation

4. Highlight the sentence and then translate it. DeepL/ Google Translate receives a highlighted sentence.

Figure 5.6 Highlight Sentence for Translation

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5. Highlight the sentence and search for related articles. The Semantic Scholar API retrieves the top five related publications when a sentence is highlighted.
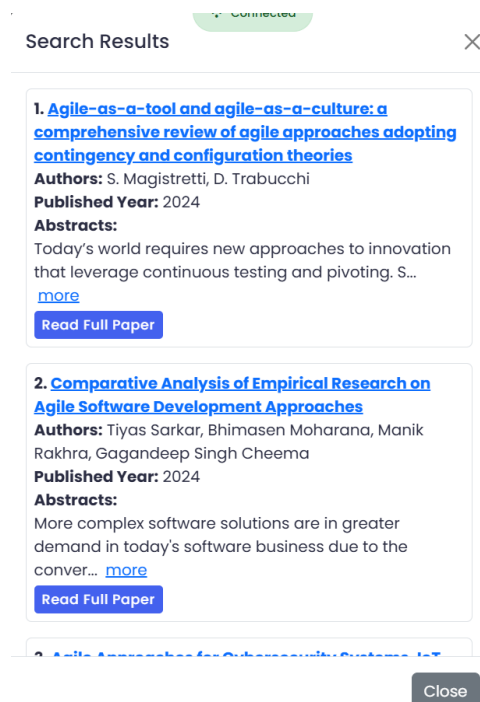
Figure 5.7 Highlight Sentence to Get Article

6. Communicate with the AI Assistant. Students engage in Q&A and keyword cloud generating conversations with Cohere AI.

Figure 5.8 AI Response

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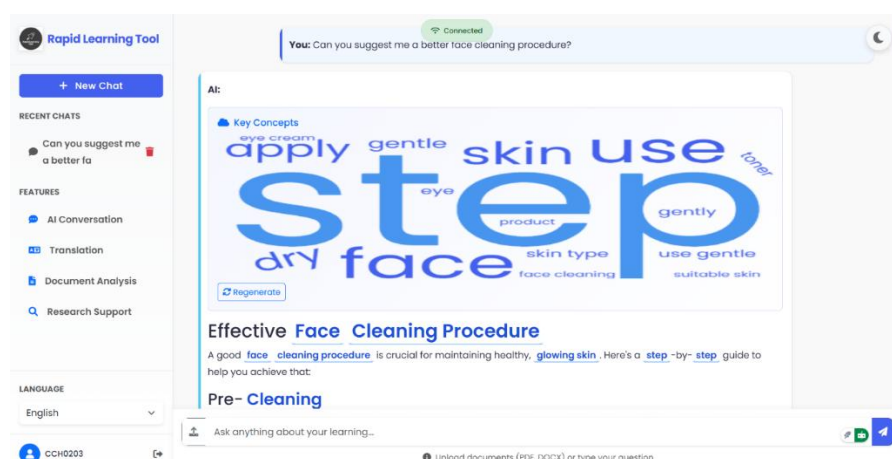
5.5 Implementation Issues and Challenges

1. API Limitations:

- Cohere AI and DeepL's free versions have daily query limitations.

- Solution: Use Google Translate as a backup and cache the most recent query results.

2. Document Parsing Errors

- It is not possible to correctly parse certain non-standard PDF documents.

- Solution: Make use of several document parsing tools (LibreOffice, xml2js, and pdf-parse).

3. Bottlenecks in performance

- When processing huge documents, keyword extraction and summary generation are slow.

- Solution: Use split processing and restrict the list of keywords to the top 30.

4. Quality of AI Response

- Cohere AI occasionally produces summaries that are unreliable or unnecessary.

- Solution: Use keyword validation + semantic filtering.

5.6 Concluding Remark

The Rapid Learning Tool's implementation showed that it is possible to combine definition, translation, summarization, and research support features into a single web-based platform. By simplifying academic procedures, minimizing tool disconnection, and offering students real-time support, the system effectively accomplished its objectives despite challenges including API limits and filter complexity.

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Chapter 6
System Evaluation and Discussion

6.1   System Testing and Performance Metrics

The Rapid Learning Tool (RLT) was put through a intense evaluation to evaluate its overall performance, stability, and efficacy in addressing academic problems. To guarantee correct operation, functional testing was used to confirm all key functions, such as user identification, document submission and summary, translation, dictionary definition lookup, research support through article search, and interaction with the AI assistant. Every functionality was tested under various input conditions and kinds to guarantee reliability.

Black-box testing was utilized to systematically confirm that the outputs displayed the expected behavior. Instead of looking at the internal code structure, this method assesses the system based on inputs and outputs. Login, document processing, translation, definitions, research support, and AI conversation were among the basic modules that were tested. Below are detailed test cases.

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Black Box Testing Results

1.   **User Authentication**

Test Case	Input	Expected Output	Actual Output	Result
Login with valid credentials	Email: test1@gmail.com Password: Test123~	User is logged in and redirected to dashboard	Successfully logged in	Pass
Login with invalid credentials	Email: test1@gmail.com Password:test123	Error message: "Invalid username or password"	Error message displayed	Pass
Register a new account	Email, Username, Password	Account created successfully	Account created	Pass
Register with existing username	Existing username	Error message: "Username already exists"	Error displayed	Pass
Login with empty fields	Email: " " Password: " "	Error message: "Fields cannot be empty"	System allowed empty login attempt	Fail → Fixed by adding input validation
Login with wrong email format	Email: test123.com	Error: "Invalid email format"	Error not triggered	Fail → Fix by using regular expression email validation

Table 6.1 User Authentication

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2. Document Upload and Summarization

Test Case	Input	Expected Output	Actual Output	Result
Uploaded PDF file	Sample academic PDF	Test extracted and summarized	Summary generated	Pass
Upload DOCX file	Word file with content	Test extracted and summarized	Summary generated	Pass
Uploaded PPTX file	PowerPoint slides	Test extracted and summarized	Summary generated	Pass
Upload unsupported file type	Image file (.jpg)	Error. "File type not supported"	Error displayed	Pass
Uploaded empty document	Blank PDF	Error: "No content found"	Error displayed	Pass
Uploaded a large PDF (50MB)	Long paper file	The system should summarize the file after processing.	Timeout	Fail → Increase the maximum file size and add a progress indicator.
Uploaded a corrupted DOCX file	Broken file	Error: "File is corrupted or unreadable."	System crash	Fail → Added error handling for corrupted files.

Table 6.2 Document Upload and Summarization

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3. **Translation Feature**

Test Case	Input	Expected Output	Actual Output	Result
Highlight word	"loss"	Translation: "kehilangan"	Translation displayed	Pass
Highlight sentence	"loss of control"	Translation: "kehilangan kawalan"	Translation displayed	Pass
Highlight unsupported characters	Random symbols "!"	Did not show the translate button	Did not show anything	Pass
Highlight long academic sentences	50-word paragraph	Full sentence translation	Only partial translation	Fail → Fix by splitting input into multiple parts
Translate from an unsupported language	Latin text	Error: "Language not supported."	Showing incorrect translation	Fail → Add correct handling for unsupported languages

Table 6.3 Translation Feature

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4. Dictionary Definition

Test Case	Input	Expected Output	Actual Output	Result
Highlight word	"prototype"	Definition + Part of Speech + Example	Correct definition shown	Pass
Highlight sentence	"Machine Learning is powerful"	Not supported; only word definition	No definition displayed	Pass
Highlight unsupported characters	Random symbols "!"	Not supported	Show Definition failed	Pass
Highlight ambiguous words	"lead"	Definitions of the noun (metal) and the verb (lead)	Showing only noun definitions	Partial → Improve API queries to return multiple meanings

Table 6.4 Dictionary Definition

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5. Research Assistance (Sentence-to-Article Search)

Test Case	Input	Expected Output	Actual Output	Result
Highlight sentence	"Machines learning is a subfiled of Artificial Intelligence"	Retrieve 5 – 10 related papers from Semantic Scholar	Relevant papers displayed	Pass
Highlight non-academic sentence	"I like pizza"	No related link found	No results found	Pass
No internet connection	Highlight sentence	Error: "Unable to fetch articles"	Error displayed	Pass
Highlight the ambiguous sentence	"Technology is important"	Retrieving general results	Retrieving irrelevant papers	Partial → Improving keyword extraction using stopword filtering
Highlighting long paragraphs	Over 100 words	Returning limited relevant results	API timeout	Fail → Implementing maximum input length and truncation

Table 6.5 Research Assistance

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6. AI Chat Functionality

Test Case	Input	Expected Output	Actual Output	Result
Ask question	"What is AI"	AI provide answer with highlighted keyword and word cloud	Slight delay but response generated	Pass
Ask unrelated question	"Tell me a joke"	AI generates appropriate casual response	Joke generated	Pass
Asking long, academic questions	200+ words	Concise, summarized answer	Timeout occurred	Fail → Added max token limit
Asking highly technical questions	"Explain backpropagation in deep neural networks"	Provide a technical explanation with steps	Response is too general	Partial → Improve prompt engineering to provide technical details.
Asking rapid queries in succession	Ask 5 questions within 10 seconds	The system should process requests sequentially	Overload and freeze	Fail → Increase request queues and rate limits.

Table 6.6 AI Chat Functionality

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6.2　Survey/ User Feedback Results

To support the functional testing, one can perform a survey to obtain direct input from end users. Undergraduates made up the five participants in this study, who ranged in age from 21 to 24. They can assess Rapid Learning Tool against current alternatives since this group reflects their regular use of digital learning resources.

The survey's quantitative findings show that participants strongly approved of the system. Participants gave the system a rating of 4.25 for ease of logging in, 4.75 for overall satisfaction, 4.25 for chance of recommending the system, and 4.75 for increased research efficiency on a five-point scale. The system's effectiveness rating was 4.0 when compared to other methods like Google Scholar or conventional AI chatbots. This suggests that although consumers find Rapid Learning Tool to be more integrated and user-friendly, the depth of feedback it offers might be enhanced. Crucially, with an average frequency rating of 4.5, participants indicated that they frequently used online learning resources. Given that it comes from experienced users who have had a great deal of experience with other systems, this supports the good comments even more.

Deeper understanding of the user experience was made possible by qualitative feedback. The research support, translation, and dictionary definition functions were especially appreciated by the participants, who said they were very helpful for both rapid comprehension and in-depth study. It was simple for users to highlight a word or sentence and get a translation or relevant article right away without switching platforms. However, one common issue was the poor reaction time of AI-generated output, particularly when collecting huge materials or answering complex queries. Improvement suggestions included improving the clarity of technical terminology, offering more detailed AI-generated replies, and optimizing speed to

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enable faster responses. Participants did not report any significant functional errors despite

these worries, suggesting that the system is dependable and stable.

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6.3   Testing Setup and Results

Testing was done on the Rapid Learning Tool. Although the summarization and document uploading features were dependable, processing times changed based on the quantity and format of the files. While documents with erratic formatting or embedded graphics occasionally produced inconsistent extraction results, PDFs with clean text processed without any issues. By using several parsing libraries like textract and pdf-parse, these problems were reduced, and it was still possible to process most files quickly.

In tests, the "Highlight Translation" and "Highlight Definition" features scored highly. Users can interact with documents directly without copying and pasting text into an external tool due to these user-friendly and effective capabilities. Similar to this, students can learn more than just submitted papers due to the "Sentence to Article" search function, which reliably delivers relevant research articles via the Semantic Scholar API. Because it makes it easier to locate relevant literature, this feature is especially helpful for students who are not familiar with academic databases.

Rapid Learning Tool is a helpful, accessible, and functioning tool, according to testing overall. However, performance tuning is still required to increase the speed and scalability of several AI-driven features.

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6.4   Project Challenges

Several issues appeared during the development and testing phases. Response time was the biggest problem, especially when using Cohere AI or Ollama to get AI-generated answers. Although the system produced data that was correct and pertinent to the context, response delays negatively impacted the user experience and were especially noticeable in user reviews. This difficulty is partly caused by the way AI models are processed, which makes longer inputs more complex.

Document analysis, especially for complicated PDF files, was another significant obstacle. Processing files with formatting, pictures, or scanned text is more difficult and can occasionally lead to an extraction that is insufficient or incorrect. Although they decreased their incidence, backup parses did not totally remove these problems.

Challenges also resulted from different user expectations. While some students liked more elaborate and in-depth explanations, others valued speed and chose shorter output. The necessity for customization options, including user-defined response levels or configurable summary length, was brought to light by balancing these preferences. These difficulties highlight the fact that even though Rapid Learning Tool interacts well with many tools, more work is required to reach peak performance and satisfy a range of user requirements.

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6.5 Objectives Evaluation

According to an assessment of the project's goals, Rapid Learning Tool mainly succeeded in achieving its objectives. Integrating several academic functions into a single platform was the first goal, and it was accomplished in full. Students no longer need to switch between applications because of the system's successful integration of summarization, translation, dictionary definitions, and research support functions. One of the most advantages feature of the system, according to users, is this integration.

Real-time language support, the second objective, was also accomplished. The dictionary and translation highlighting capabilities were regularly acknowledged as helpful and efficient, particularly for non-native speakers dealing with specialized or field-specific terms. Language difficulties are directly addressed by these features, which guarantees that students may quickly access definitions and translations within the same interface without interfering with their academic progress.

Some of the third objectives, which was to use AI-powered filtering to reduce information overload, were accomplished. Word cloud visualization, keyword extraction, and summarization assist students in focusing on relevant material and identifying important subjects. This objective is further enhanced by the sentence-to-article search feature, which makes it possible for students to quickly find relevant research. The smoothness of this produce was, however, limited by the AI's response time. Users highlighted the need for quicker processing rates to optimize the system's usefulness, even though some admitted that it reduced information overload.

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6.6   Discussion

The evaluation's finding clearly shows that Rapid Learning Tool is a creative and successful way to address typical academic problems. The system increases productivity by eliminating the inefficiency of tool switching by combining various tools into a single platform. Students say the approach saves time, makes academic study easier to handle, and increases their research efficiency and comprehension.

Compared to current solutions like Google Scholar, Google Translate, and stand-alone AI chatbots, Rapid Learning Tool has clear advantages. Although Google Translate offers good language support, it lacks contextual explanations and integrated definitions. In a comparable way, Google Scholar offers academic materials but no abstracts or assistance with translation. Though they are stand-alone applications that cannot be directly integrated with research databases or document processing workflows, chatbots such as ChatGPT are effective at producing responses. Because it combines these features, Rapid Learning Tool is special in that it gives students a smooth, contextually aware environment.

But the assessment also pointed out several areas that needed work. Performance speed is the most important constraint, especially for producing AI responses. Enhancing this component would greatly improve user experience and bring the system closer to what students expect. Additionally, the tool would be flexible to accommodate various learning methods if it included customization choices and increased the level of detail in AI-generated responses.

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6.7   Concluding Remark

All things considered, the assessment verified that the Rapid Learning Tool met its main goals and gave students real advantages. Workflow fragmentation, language difficulties, and information overload have all been successfully addressed by Rapid Learning Tool, which combines summarization, translation, dictionary help, and research support capabilities. The system's translation, definition, and research assistance features were especially appreciated by users, who gave it excellent ratings for effectiveness and satisfaction.

Even if there are still issues, especially with response time and the amount of detail in AI output, the system has shown great promise as a learning assistant that is focused on the needs of the learner. Expanding interaction with additional scholarly resources, improving AI processing for quicker reaction times, and adding collaborative tools to facilitate group learning are some potential future enhancements. Rapid Learning Tool might develop into a full academic platform that greatly enhances how students' study, conduct research, and engage with digital resources with these improvements.

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Chapter 7

Conclusion and Recommendation

7.1   Conclusion

The Rapid Learning Tool (RLT) was created to help students in higher education deal with three major issues, which are information overload, language difficulties, and fragmented workflows. The main objective of the project was to provide a single academic support platform that combines research support, definitions, translation, and document summarizing. Rapid Learning Tool reduces the need for students to transition between several external tools by combining these crucial aspects, which boosts comprehension, increase efficiency, and reduces cognitive stress.

The evaluation's findings show that Rapid Learning tool accomplished most of its goals. Students liked the system's use, ease, and practicality and expressed great satisfaction with its integrated functions. Because it directly addresses the difficulties of comprehending technical language and complex academic content, the translation highlighting and definition highlighting capabilities were especially valued. Likewise, the sentence-to-article search feature makes it simple for students to link their course materials with relevant articles, enhancing the depth and quality of their study.

The reliability of fundamental functionality across a variety of file formats, including PDF, DOCX, PPTX, and TXT, was further verified by system testing. Academic texts' primary themes are faithfully summarized by the system, and students can concentrate on these subjects with the use of word cloud visualizations and keyword extraction. Students can respond to queries and provide explanations in real time with AI-powered conversational help, transforming the system from a document analysis tool into an interactive learning partner.

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But the assessment also identified drawbacks. Response time was the most noticeable problem, especially when it came to AI-generated replies and summaries. The user experience suffered when summaries and conversational features occasionally lag, even if translation and keyword extraction were almost quick. Additionally, some participants recommended that the AI's responses be more detailed, as they felt that the output was occasionally too general for complex academic assignments. Minor issues with document parsing also developed, especially when handling complex PDFs with embedded pictures or irregular formatting.

With these difficulties, Rapid Learning Tool is generally regarded as a useful and cutting-edge academic support system. It effectively tackles the three main problems listed in the problem statement and shows promise for expansion and improvement. Rapid Learning Tool has the potential to develop into a full academic platform that greatly enhances how students' study, conduct research, and engage with academic content with its increased speed, depth, and usefulness.

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7.2   Recommendation

Even though the Rapid Learning Tool's current iteration has been successful and well-received, there are still several areas that require refinement and future development:

1. **Enhancement of Performance**

    The lengthy response time of AI-generated output is one of the main issues brought up by users. Prioritizing the use of more effective AI models and streamlining backend processing will help address issues. Response speed could be increased by investigating more lightweight Natural Language Processing (NLP) models or by putting in place a caching system for frequently asked questions.

2. **Improving the Processing of Documents**

    Complex PDF files, particularly ones with embedded graphics or scanned text, can occasionally cause problems for document parsing. Future iterations should have an enhanced parsing library that can better handle irregular formatting and optical character recognition (OCR) technology to process scanned documents. This will increase dependability and expand the selection of scholarly resources that are supported.

3. **Adaptable Output Choices**

    The level of detail in AI-generated responses changes throughout students. While some people appreciate in-depth explanations, others prefer succinct outlines. The application would be more flexible to accommodate different learning methods and academic requirements if it included user-configurable options for summary length, level of detail, or output format.

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4. Improving the Processing of Documents

Complex PDF files, particularly ones with embedded graphics or scanned text, can occasionally cause problems for document parsing. Future iterations should have an enhanced parsing library that can better handle irregular formatting and optical character recognition (ORC) technology to process scanned documents. This will increase dependability and expand the selection of scholarly resources that are supported.

5. Adaptable Output Choices

The level of detail in AI-generated responses changes throughout students. While some people appreciate in-depth explanations, others prefer succinct outlines. The application would be more flexible to accommodate different learning methods and academic requirements if it included user- configurable options for summary length, level of detail, or output format.

6. Features of Collaborative Learning

Collaborative technologies like group discussions, shared annotations, and Learning Management System (LMS) integration could be incorporated into Rapid Learning Tool in the future. In line with modern methods of instruction, this would change the system from personal learning assistance to a collaborative academic setting.

7. Constant Model Updates

Since Artificial Intelligence technology is developing quickly, Rapid Learning Tool needs to be updated frequently to remain accurate and relevant. The system will continue to be dependable and competitive for academic applications with regular inclusion of updated translation engines, better AI models, and improved summarization techniques.

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In conclusion, the Rapid Learning Tool effectively illustrates how to combine several academic assistances features into a single platform to handle important student issues. Its significance as a useful learning aid is highlighted by it unique features, great user happiness, and excellent assessment outcomes. Even if there is always room for improvement, especially in the functionality and richness of AI-generated material, Rapid Learning Tool has established a strong basis for further advancement. Rapid Learning Tool has the potential to develop into a strong, scalable, and extensively used teaching tool by overcoming its present drawbacks and implementing the suggested improvements. It could significantly impact the future of AI-assisted education by redefining how students engage with digital academic resources in addition to increasing individual learning efficiency.

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APPENDIX

Age :

5 responses

- Below 18 years old
- 18 - 20 years old
- 21 - 24 years old
- 25 years old and above

100%
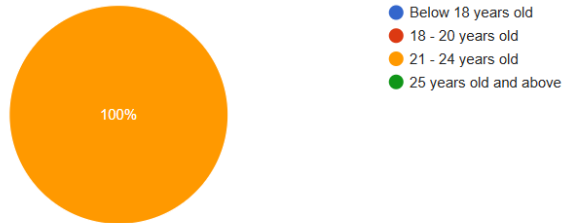
Gender :

5 responses

- Male
- Female
- Prefer not to say

40%

60%
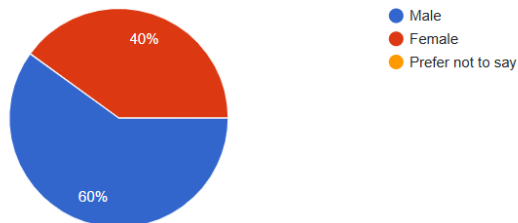
What is your current level of study?

5 responses

- Foundation
- Undergraduate
- Postgraduate

20%

80%
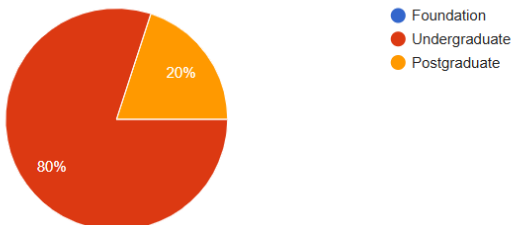
What is your main field of study?

5 responses

- Computer Science / IT
- Engineering
- Business / Management
- Education

20%

20%

60%

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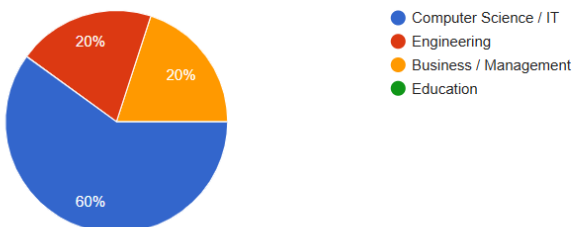
Section B: General Usage

Have you used similar tools before? (Exp. Google Translate, Grammarly, QuillBot)

5 responses

Copy chart

- Yes
- No

100%
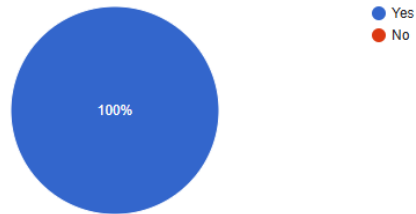
How often do you use online learning tools? (Translation Apps, Summarizers, Dictionaries...)

5 responses

Copy chart

0 (0%)	0 (0%)	1 (20%)	1 (20%)	3 (60%)
1	2	3	4	5
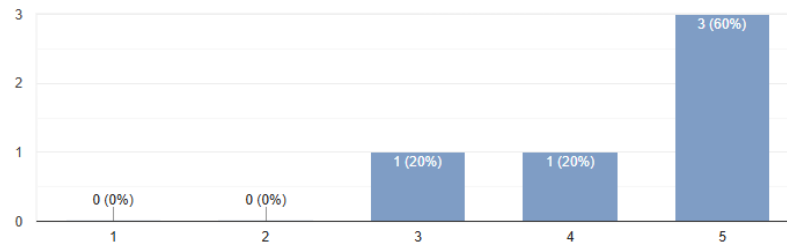
What is your primary purpose for using Rapid Learning Tool?

5 responses

Copy chart

- Translating Text — 3 (60%)
- Understanding Word Definitions — 2 (40%)
- Summarizing Documents — 3 (60%)
- Accessing Related Research Articles — 3 (60%)
- Chatting with AI for Study Support — 4 (80%)
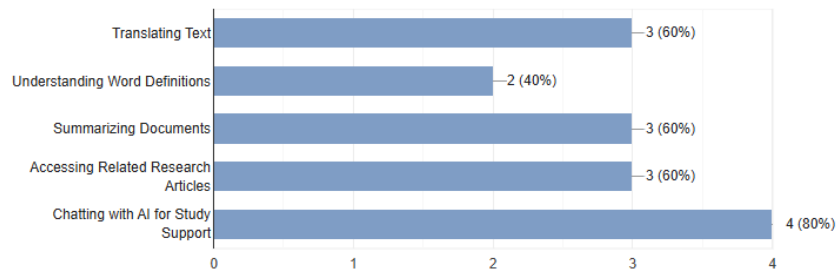
What types of files do you usually study with?

5 responses

Copy chart

- PDF — 4 (80%)
- Word (DOC/DOCX) — 4 (80%)
- PowerPoint (PPT/PPTX) — 3 (60%)
- Text (TXT) — 2 (40%)

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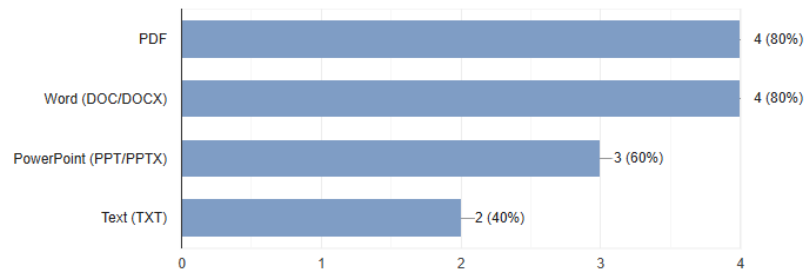
How much time do you **typically spend on learning tools** per study session?   Copy chart

5 responses

- Less than 15 minutes
- 15 - 30 minutes
- 30 - 60 minutes
- More than 1 hours

60%

40%

Section C: Usability and User Interface (UI/UX)

Do you find the **main chat interface intuitive and easy to navigate**?   Copy chart

5 responses
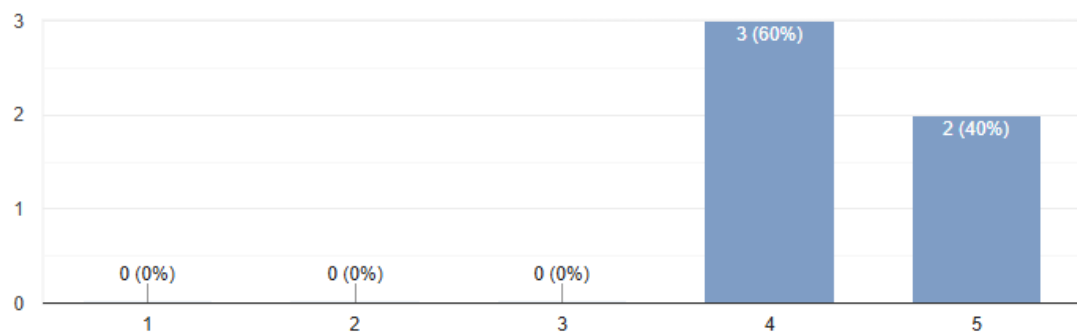
How satisfied are you with the **process of starting a new conversation** or **switching between different chats**?   Copy chart

5 responses

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71
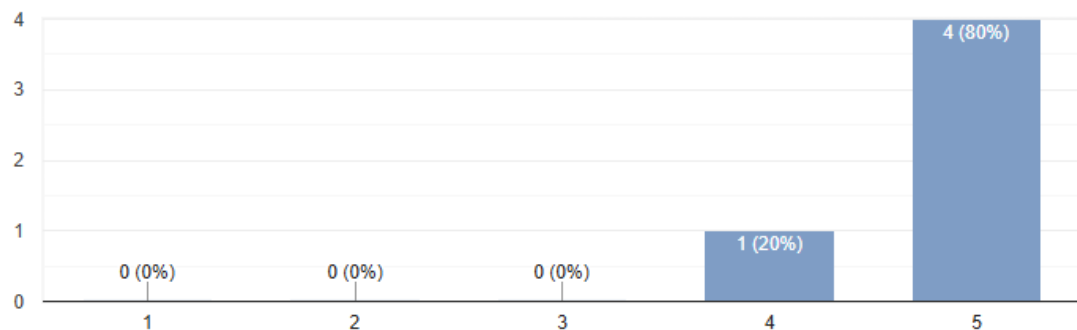
How clear and useful are the **notifications and error messages** presented by the system?
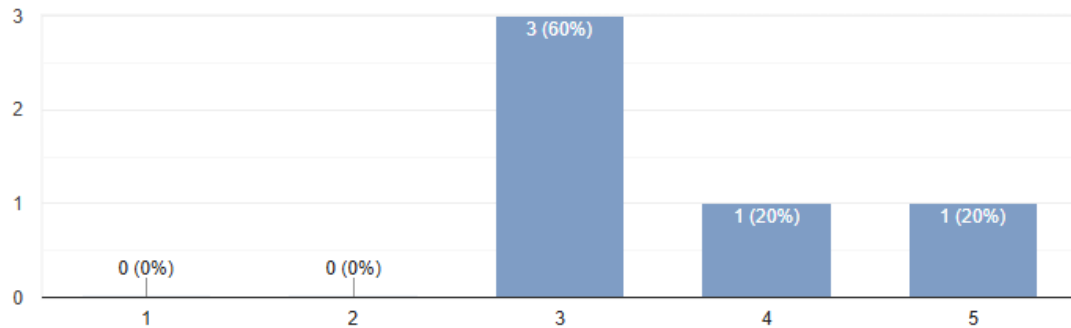
5 responses

How effective is the **dark/light theme toggle** for your comfort during use?
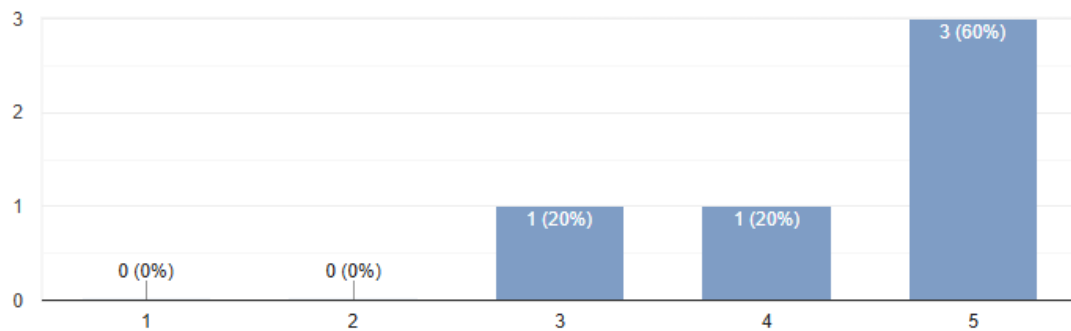
5 responses

The sidebar provides access to **chat history and features**. How would you rate its usefulness and organization?

5 responses

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72
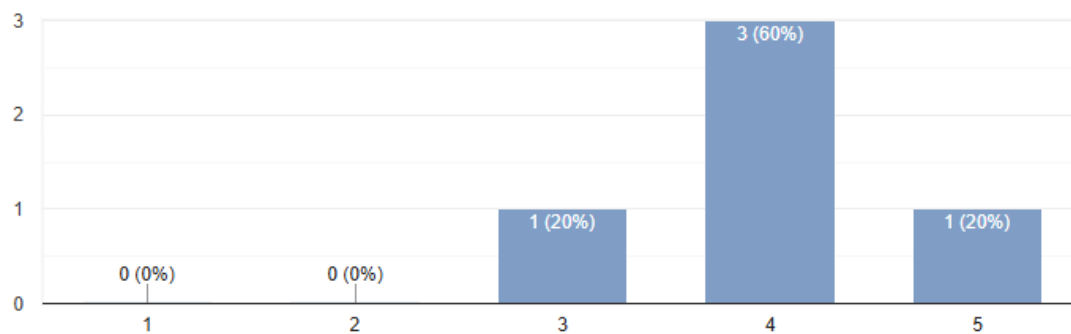
Section D: Core Feature Evaluation

How would you rate the **quality and relevance of the AI's responses** to your questions?

Copy chart

5 responses
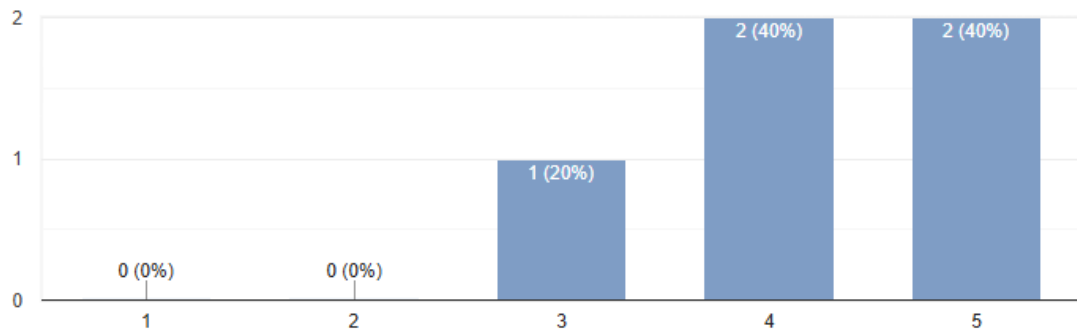
How accurate and helpful do you find the **automatic translation feature** for selected text?

Copy chart

5 responses

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73
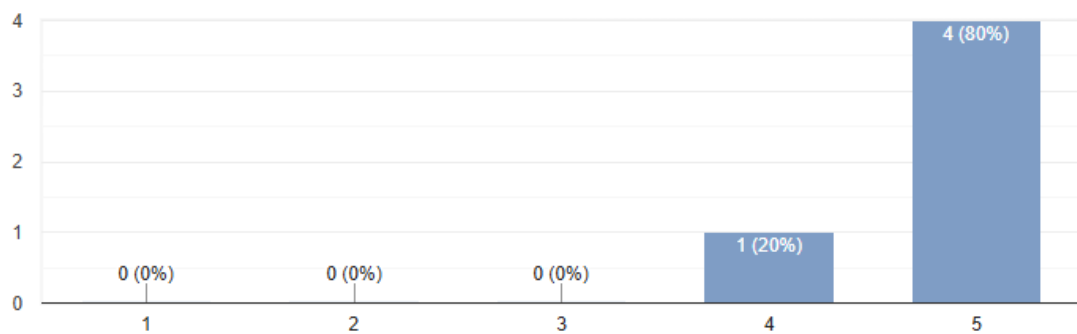
How useful is the **word cloud visualization** of key concepts generated from the AI's responses?

☐ Copy chart

5 responses
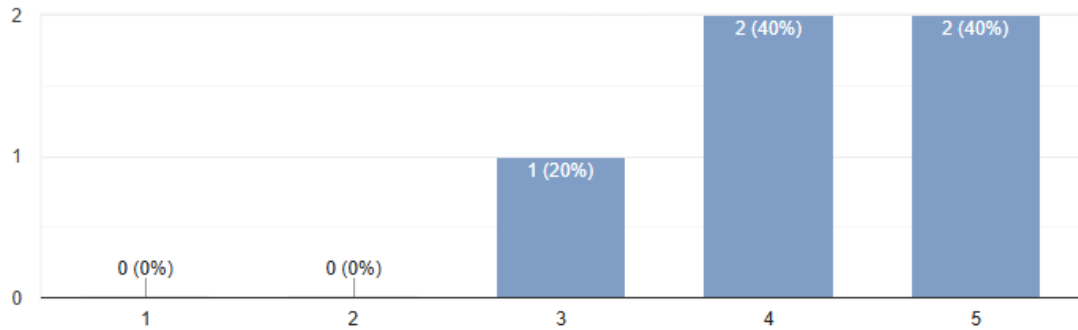
How valuable are the **related academic articles and links** (from Semantic Scholar) provided alongside answers?

☐ Copy chart

5 responses
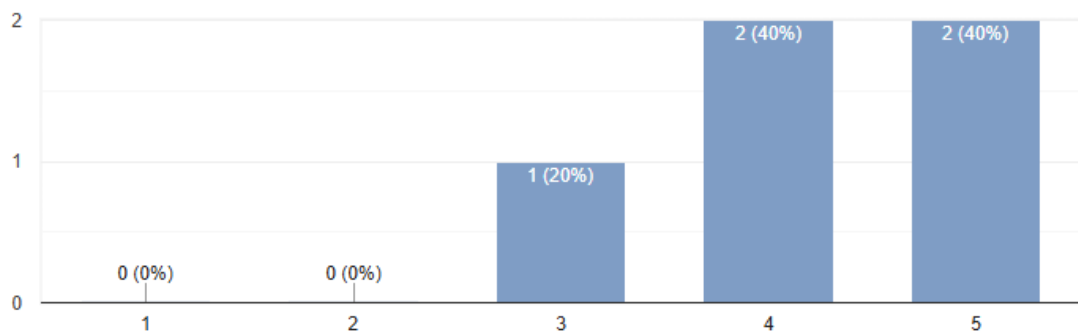
How accurate and comprehensive are the **definitions** provided for single words you select?

☐ Copy chart

5 responses

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74
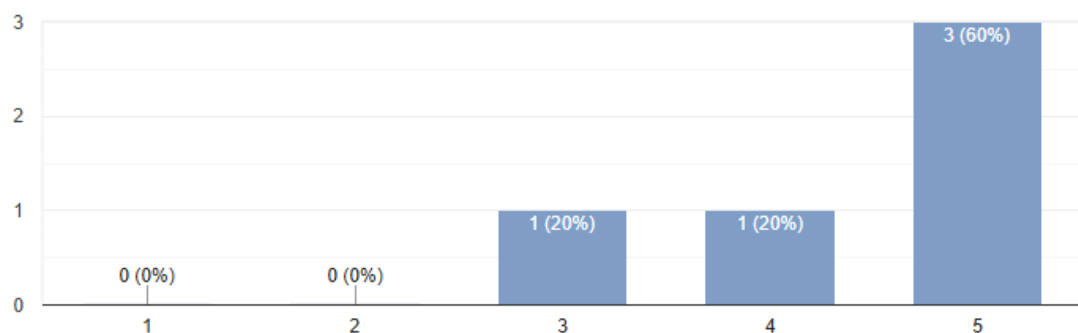
Section E: Document Analysis Feature

How straightforward is the process of **uploading a document** (PDF, DOCX, etc.) for analysis?

Copy chart

5 responses
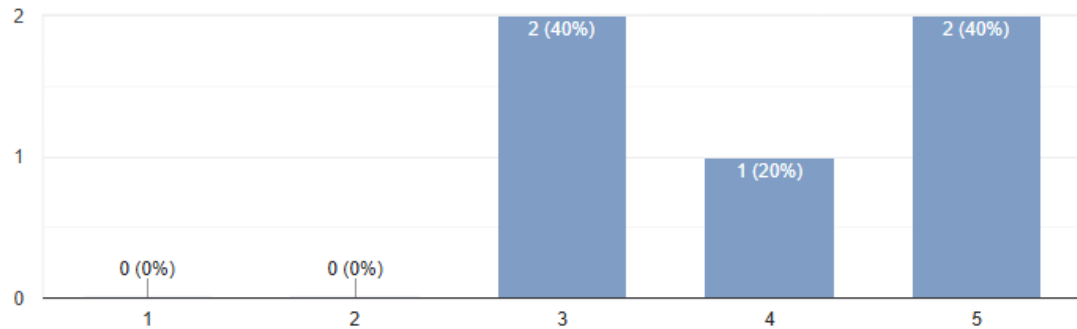
How satisfied are you with the **summary and key insights** generated from your uploaded documents?

Copy chart

5 responses

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75
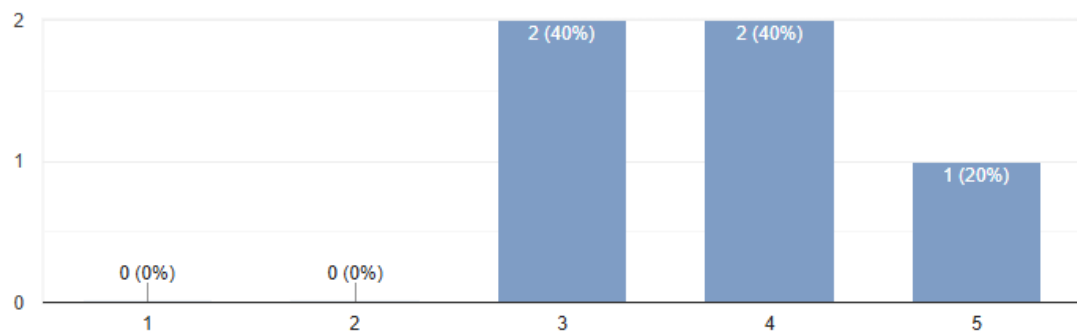
How relevant are the **keywords extracted** from your uploaded documents?

Copy chart
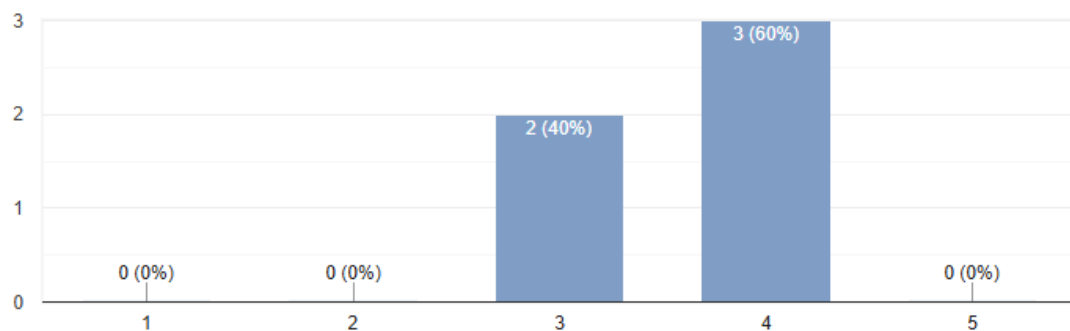
5 responses

Section F: Performance, Reliability and Security

How would you **rate the speed of the AI's response generation**?

Copy chart

5 responses
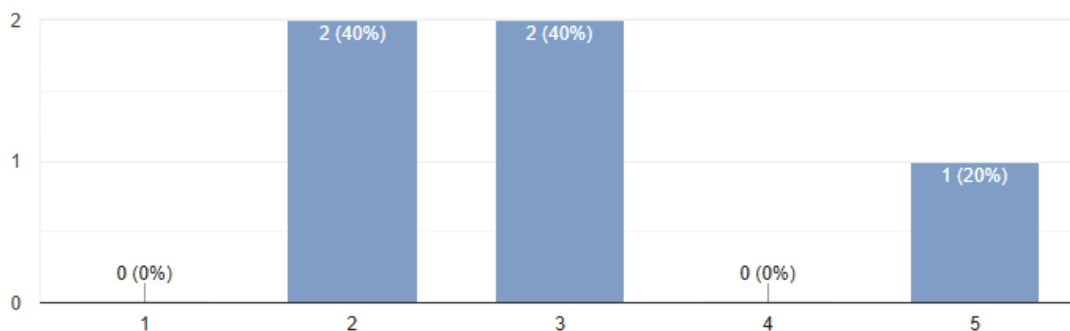
How reliable is the **application's connection?** How often do you experience **unexpected errors or disconnections?**

Copy chart

5 responses

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76
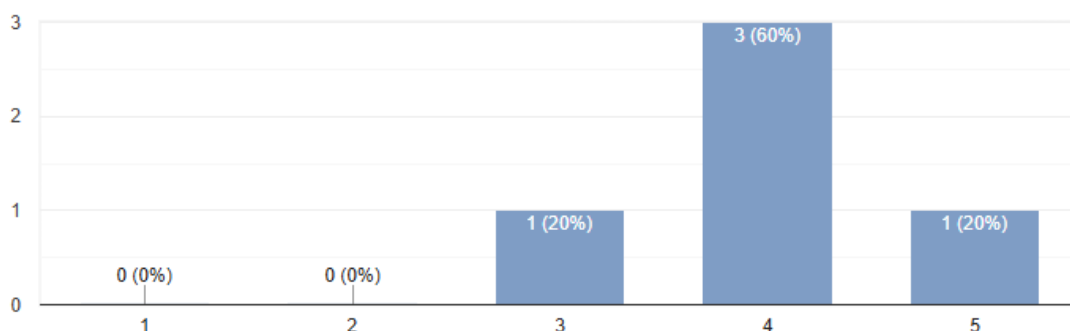
How often do you **encounter functional errors?** (Exp, translation fails, file upload fails, features not working)

Copy chart

5 responses
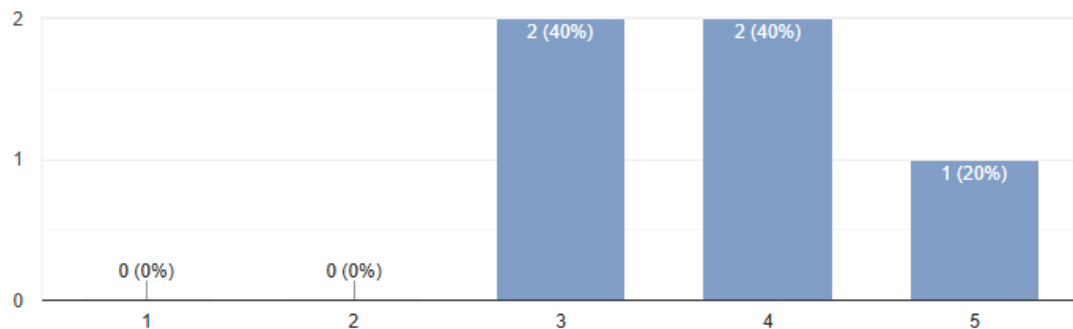
How secure do you feel the **login and account registration** process is?

Copy chart

5 responses
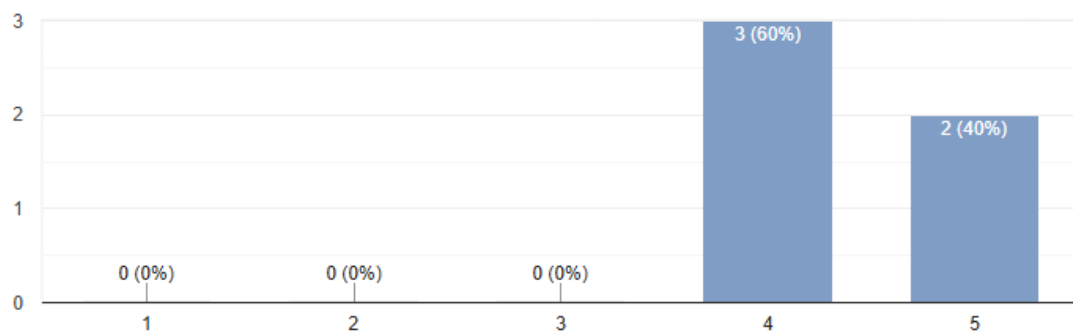
How convenient is the **process of logging in and having your session automatically maintained?**

Copy chart

5 responses

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77
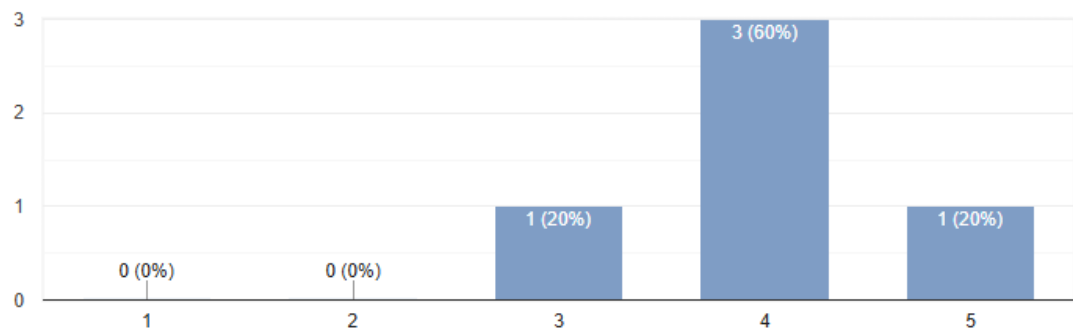
Section G: Overall Satisfaction and Impact

Overall, how satisfied are you with the **Rapid Learning Tool?**   Copy chart

5 responses
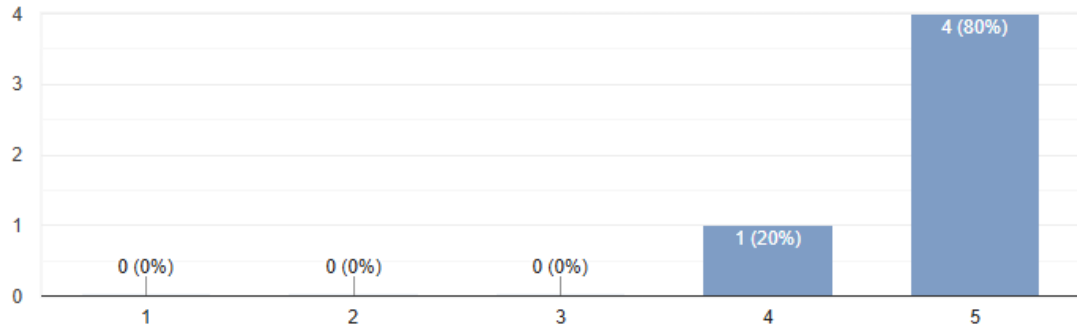
How likely are you to **recommend** this tool to a colleague or classmate?   Copy chart

5 responses

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78
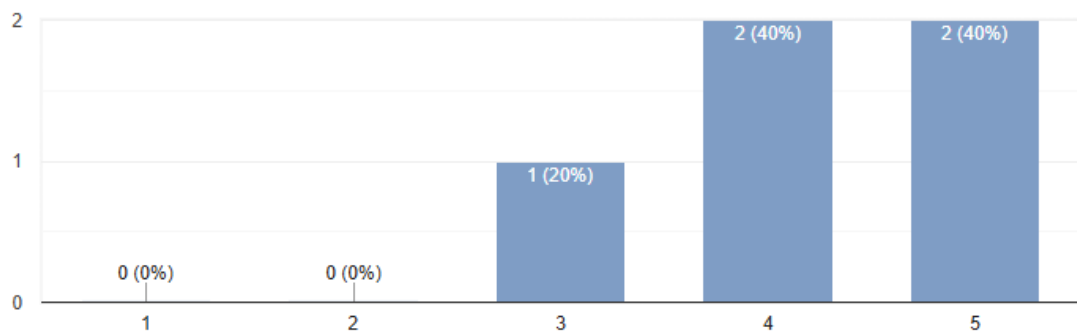
To what extent has this tool **improved your learning or research efficiency**?   Copy chart

5 responses
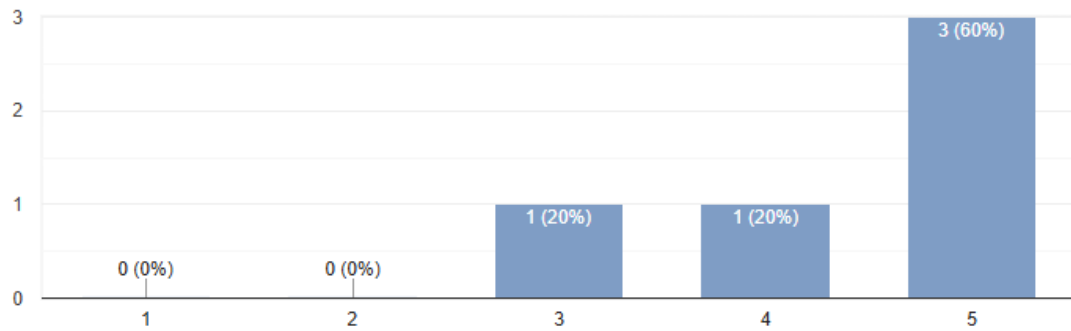
Compared to other methods (e.g., standard search engines, other AI chatbots),   Copy chart
how effective is this tool for your needs?

5 responses

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79
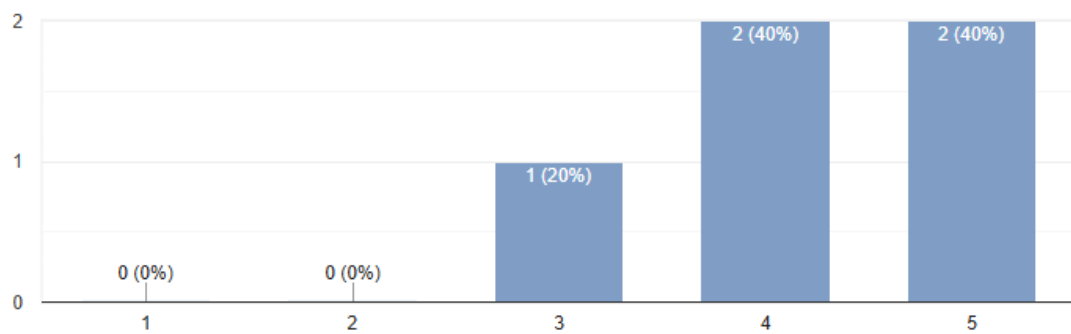
Section H: Open-Ended Feedback

What do you like **MOST** about the Rapid Learning Tool?

5 responses

Easy to acess for any informatik tht I want

Research Methods

Translation

Translate

Word meanings and translations

What do you like **LEAST** about the Rapid Learning Tool?

5 responses

A little bit slow of genting the answer

Ai responded too slow

Speed response are slow

Speed

The speed of generate the answer from the AI

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What is the **one feature or improvement** that would significantly enhance your experience?

5 responses

The respond speed
Can improve the speed of the AI respond and make the system more comprehensive
Response speed
Speed
Word meanings

Did you encounter any **significant bugs or problems**? If so, please describe them.

5 responses

No
Only slow of the respond speed
No
Responses speed

Do you have any other **comments, suggestions, or feedback** for us?

5 responses

No
Excellent on the Journal KIST for the key work, suggest to increase speed of the websute respond
I hope this AI respond can be more detailed. For example, when I upload past year questions, it can help read the data inside and add a memory system to make it easier for me to upload notes.
Can do with two- step verification.

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