



# StudyHub

## Project Report

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## **1. Introduction**

### **1.1. Issue**

In today's digital era, education has seen new possibilities, but finding practical, user-friendly learning platforms is still a challenge. Many students find it hard to connect with peers for academic help, guidance, and collaboration due to various reasons like lack of confidence or convenience. This creates a gap in seeking support for their studies.

### **1.2. Rationale**

The "StudyHub" concept emerged to create a comprehensive academic platform. Our aim is to facilitate student collaboration, accelerate learning, and offer a space for meaningful academic discussions. By combining AI tools with a social media approach, we streamline academic consultations and encourage connections among like-minded students.

### **1.3. Focus and Significance**

Surprisingly, there is a lack of social media platforms dedicated solely to academics. Most academic-oriented platforms lack user-to-user interaction and a clear framework for consultation. Hence, our significance lies in providing students with a space to collaborate, accelerate learning, and engage in meaningful academic discussions, thereby fostering a dynamic learning environment. This initiative addresses the need for accessible and effective academic consultation while promoting connections among students with shared academic goals.

### **1.4. Scope**

Our target audience currently is students between the ages of 12 and 16 due to the limited time frame of the project and we hope to expand our reach to students of all ages in the future. However, we will be test-running our product within the confines of our school.

## **2. Market Research**

### **2.1. Duolingo**

Duolingo is a language-learning app that uses AI to personalize the learning experience for each student, with gamification to make learning fun and engaging. However, like most other learning platforms, it lacks user-to-user interaction, and this is something StudyHub aims to improve on by implementing discussion forums and direct messaging.

### **2.2. Brainly**

Brainly is a social learning platform with a community of over 350 million students and educators. The platform allows students to ask and answer questions, earn points for answering questions, and participate in discussions. Similarly, StudyHub aims to connect students and encourage them to participate in academic discussions. The main difference is that StudyHub provides tools powered by Artificial Intelligence to enhance and streamline students' learning.

## **3. Study and Methodology**

### **3.1. Ideation**

During our brainstorming sessions, we settled on a social media platform. Eventually, after further research and needed analysis, we decided on a platform which emphasizes on academic growth and discussion, while also leveraging on Artificial Intelligence to provide students with the tools to study more efficiently. This forged the bedrock for StudyHub.

### **3.2. Description of Study**

We have conducted market research as well as sufficient needs analysis which collects the perspectives of our target audience, students. We have also delved deeper into students' usage of social media, as well as their fear of seeking academic consultation.

A 2018 Pew Research Center survey of nearly 750 13 to 17-year-olds found that 45% are online on social media almost constantly and 97% use a social media platform.

Additionally, according to [scientificamerican.com](https://www.scientificamerican.com), new research suggests that young children don't seek help in school, even when they need it, as they view it as a form of broadcasting their incompetence.

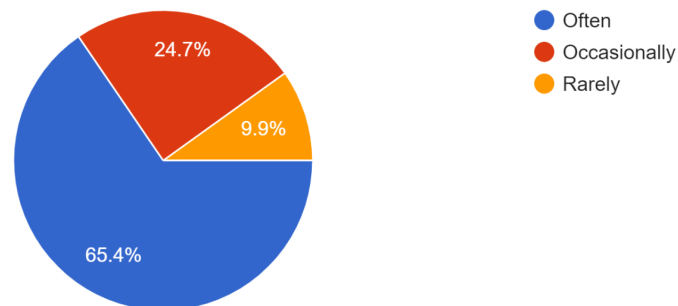
We have decided to capitalize on students' inclination to use social media platforms, as well as their need for a platform to reach out for academic support.

### 3.3. Needs Analysis

The following are some survey results from our student respondents:

How often do you require assistance with your studies?

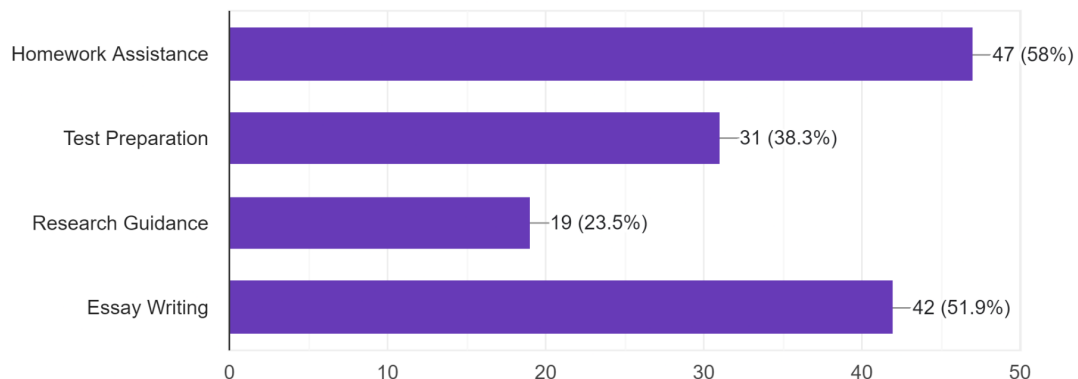
81 responses



This shows that many students encounter difficulties and require assistance when studying.

What kind of study help do you usually require?

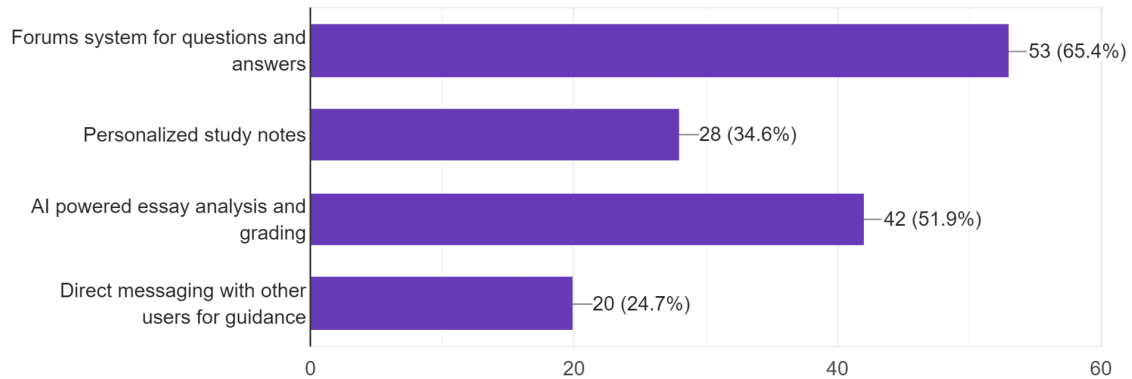
81 responses



Most students require assistance with homework and essay writing.

Below are some features which we plan to implement on our app. Which features is/are most important to you?

81 responses



Students are mostly looking forward to the interactive forums and AI powered tools of our website.

### 3.4. Timeline

January - February	Planning and research
March	Needs analysis and website design
April - June	Website development
June - July	Testing and debugging
July - August	Pilot testing and feedback

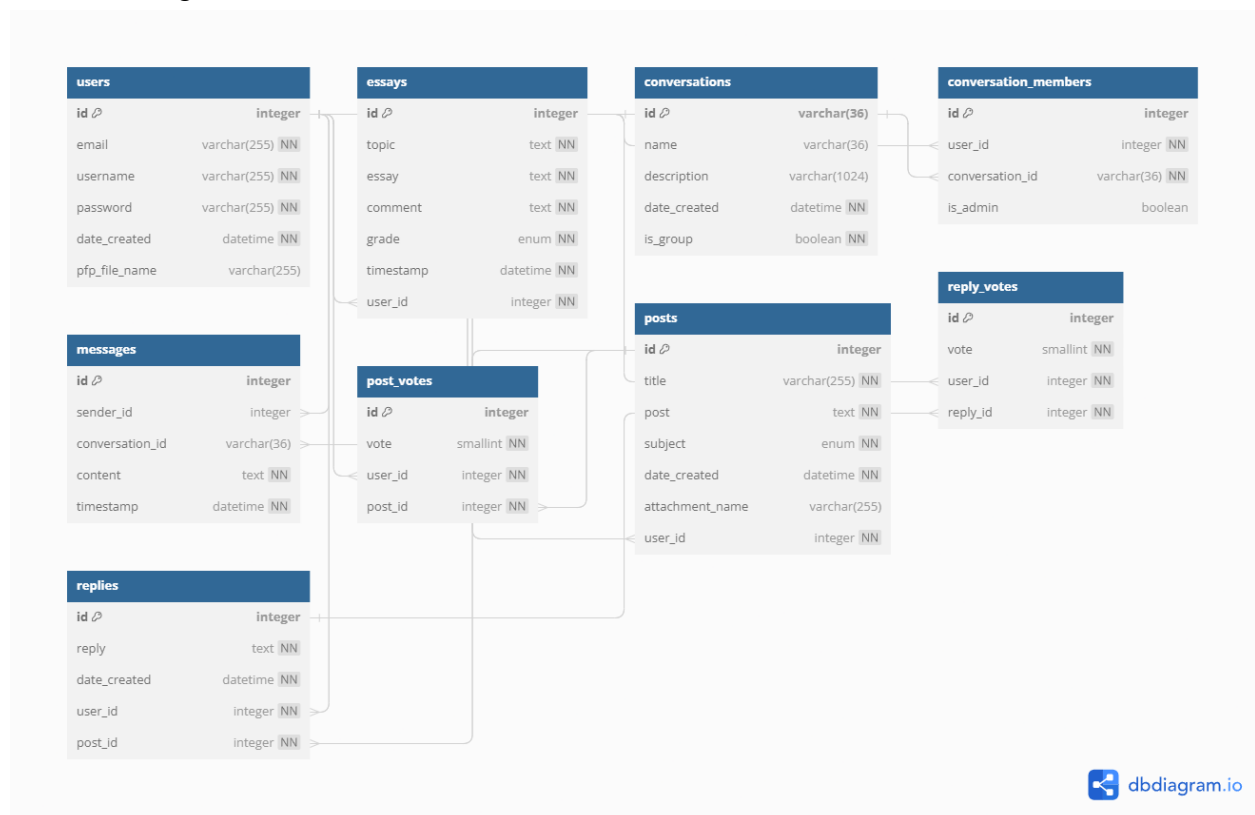
## 4. Outcomes, Analysis, and Discussion

### 4.1. Final Product

Our final product crystallized into a website-run social media platform, Study Hub. We also have an Instagram page from which users can get updates on the latest features of StudyHub.

### 4.2. Framework

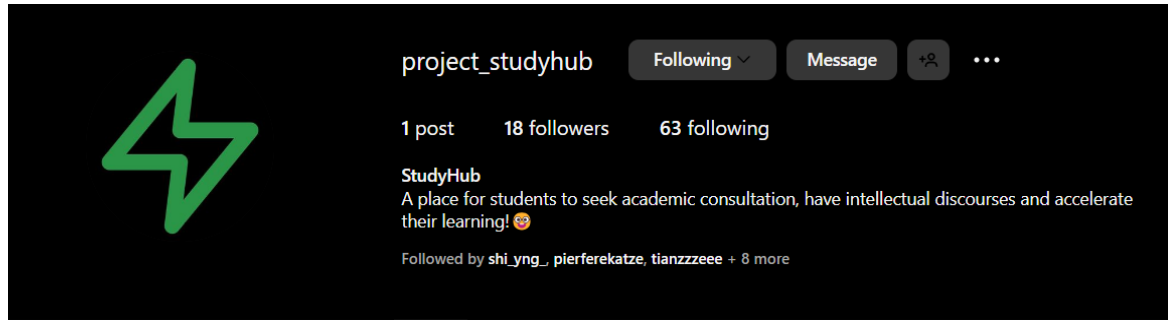
The following is the framework for our SQL database:



Our frontend will be mainly driven by HTML, CSS and Javascript, while our backend will be mostly run by Python, specifically Flask, which is a micro web framework written in Python.

### 4.3 Instagram page

We used Instagram to publicise and promote our website to students.



### 4.4 Artificial Intelligence

Artificial Intelligence powers 2 features of our application as shown below.

#### 4.4.1 Automated essay grading and feedback

Prompt engineering was employed to fine-tune the essay grading prompt, utilizing techniques such as Role and Scenario Setting, Instruction Breakdown, and Specific Guidelines and Expectations. These methods collectively optimized the grading process, ensuring precision and clarity.

The prompt includes a rubric and well-defined evaluation criteria aligned with educational grading standards. This ensures a comprehensive approach, evaluating linguistic proficiency, content relevance, and essay structure. In contrast, a generic "grade my essay" request lacks the depth of StudyHub's tailored prompts.

The StudyHub app streamlines essay grading, allowing easy essay submission, prompt evaluations, and focused feedback. This enhances user engagement and productivity, providing efficient analysis without lengthy interactions. The app offers distinct advantages, delivering insightful analysis and bypassing complexities.

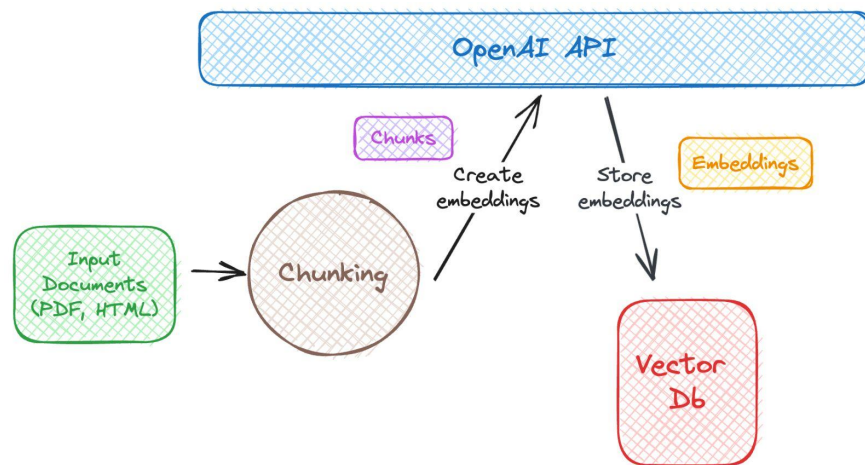
#### 4.4.2 Explaining concepts which align with exam requirements

GPT models provide general knowledge-based responses, which may not consistently align with specific examination criteria like those of O level exams due to distinct



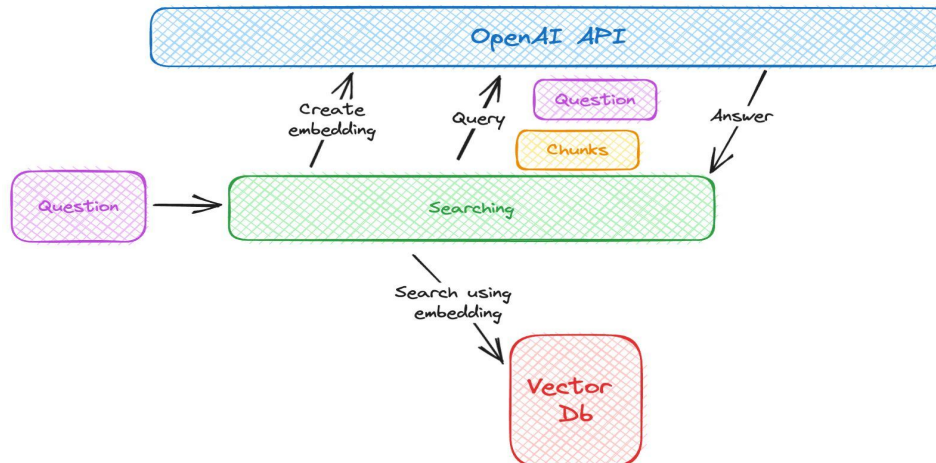
formatting and guidelines. Although using the entire textbook for every AI query is theoretically possible, it is financially impractical.

Instead, a more efficient approach employing text embeddings is employed. The data is divided into smaller segments of around 200 for manageable processing. OpenAI's text-embedding-ada-002 model is utilized to transform these segments into numerical vectors, capturing semantic nuances and contextual structure. These vectors are stored in a specialized vector database like Pinecone, enabling swift and efficient searches.



Upon receiving a user question, the question is first transformed into a text embedding using OpenAI's ADA model. A query is then sent to the Pinecone vector database, retrieving the top k (in our instance, 5) vectors related to the query's embedding. These vectors correspond to relevant text sections.

For a comprehensive response, these selected text segments, along with the original question, are input into the GPT-3.5 model, which uses these texts to generate a contextualized answer that aligns with the question and reference texts. This process ensures that the answers provided are contextually pertinent and backed by information within the recognized text segments.



## 4.5. Code

The programming languages utilized were Python, HTML, CSS, and JavaScript. The following are code snippets from our project. The full codebase can be accessed on [Github](#).

```

class User(db.Model, UserMixin):
    """
    Model that represents a user
    """
    __tablename__ = "users"

    id = db.Column(db.Integer, primary_key=True)
    email = db.Column(db.String(255), unique=True, nullable=False)
    username = db.Column(db.String(255), unique=True, nullable=False)
    password = db.Column(db.String(255), nullable=False)
    date_created = db.Column(db.DateTime, nullable=False, default=datetime.datetime.utcnow)
    pfp_file_name = db.Column(db.String(255), nullable=True)

    essays = db.relationship("Essay", backref="user", lazy="dynamic", cascade="all, delete-orphan")

    posts = db.relationship("Post", backref="user", lazy="dynamic", cascade="all, delete-orphan")
    replies = db.relationship("Reply", backref="user", lazy="dynamic", cascade="all, delete-orphan")
    post_votes = db.relationship("PostVote", backref="user", lazy="dynamic", cascade="all, delete-orphan")
    reply_votes = db.relationship("ReplyVote", backref="user", lazy="dynamic", cascade="all, delete-orphan")

    messages = db.relationship('Message', foreign_keys='Message.sender_id', back_populates='sender', lazy='dynamic')
    conversations = db.relationship('Conversation', secondary='conversation_members', back_populates='users',
    lazy='dynamic')
    read_messages = db.relationship('ReadMessage', foreign_keys='ReadMessage.user_id', back_populates='user',
    lazy='dynamic')
  
```

The *User* model implemented with SQLAlchemy

```

class Conversation {
    static #cache = new Map();

    /**
     * Conversation class constructor
     * @param {number} id - The ID of the conversation
     * @param {string} name - The name of the conversation
     * @param {string} description - The description of the conversation
     * @param {boolean} isGroup - Indicates if the conversation is a group conversation
     * @param {Set} users - The users participating in the conversation
     * @param {moment} dateCreated - The date and time when the conversation was created
     */
    constructor(id, name, description, isGroup, users, dateCreated) {
        if (Conversation.#cache.has(id)) return Conversation.#cache.get(id);

        this.id = id;
        this.name = name;
        this.description = description;
        this.isGroup = isGroup;
        this.users = users;
        this.dateCreated = dateCreated;
        this.history = [];
        Conversation.#cache.set(id, this);
    }

    static async fromJson(json) { ... }

    static async getAll() { ... }

    static async getById(conversationId) { ... }

    static createPrivate(targetUserId) { ... }

    static createGroup(groupName, memberIds) { ... }

    async loadHistory() { ... }

    read() { ... }

    sendMessage(content) { ... }

    getLastMessage() { ... }
}

```

## Middle-end Javascript model of *Conversation*

```

def answer(question):
    search_query_embedding = openai.Engine(id=EMBEDDINGS_MODEL).embeddings(input=[question])[0]["embedding"]

    try:
        query_response = pinecone.Index('studyhub').query(
            top_k=TOP_K,
            include_values=False,
            include_metadata=True,
            vector=search_query_embedding,
        )

        with open('app/ai/qna/file-text-mapping.json', 'r') as fp:
            file_text_dict = json.load(fp)

        files_string = "Extract:\n"

        for i in range(len(query_response.matches)):
            result = query_response.matches[i]
            file_chunk_id = result.id

            score = result.score
            if score < COSINE_SIM_THRESHOLD and i > 0:
                break

            topic = result.metadata["topic"]
            file_text = file_text_dict.get(file_chunk_id)
            files_string += f"\nTopic: {topic}\nContent: {file_text}\n"

        messages = [
            {
                "role": "system",
                "content": "---prompt not shown due to length---"
            },
            {
                "role": "user",
                "content": f"Question: {question}\n{files_string}"
            }
        ]

        response = openai.ChatCompletion.create(
            messages=messages,
            model=GENERATIVE_MODEL,
            max_tokens=1000,
            temperature=0.5,
        )

        return response.choices[0].message.content.strip()

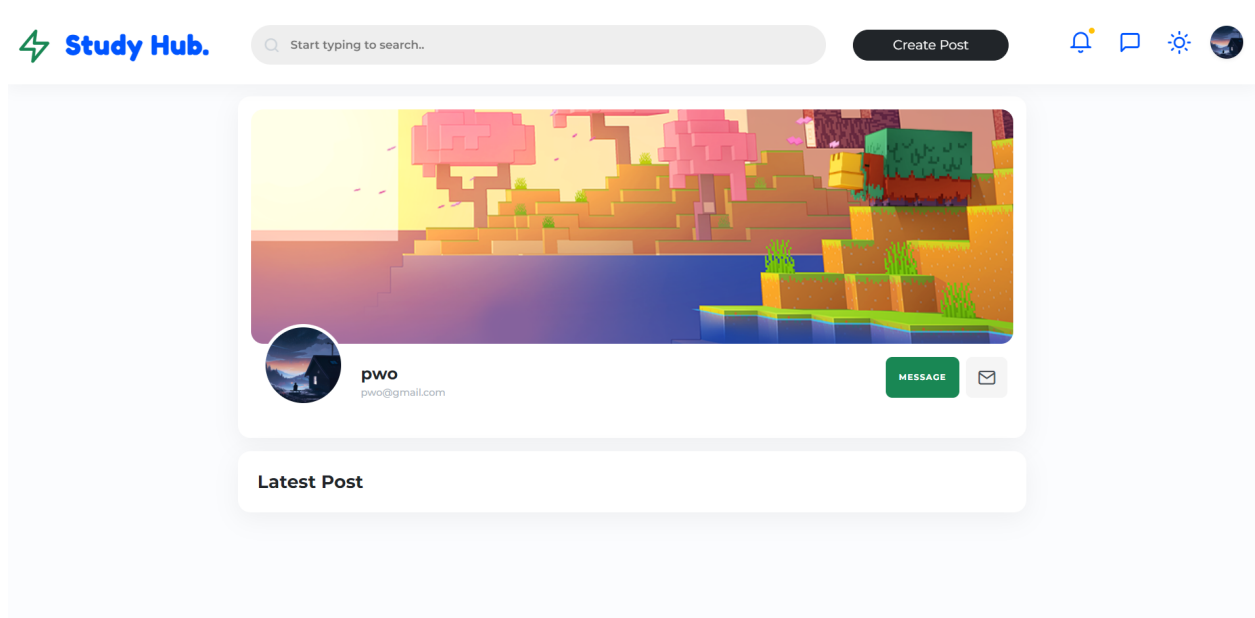
    except Exception as e:
        return str(e)

```

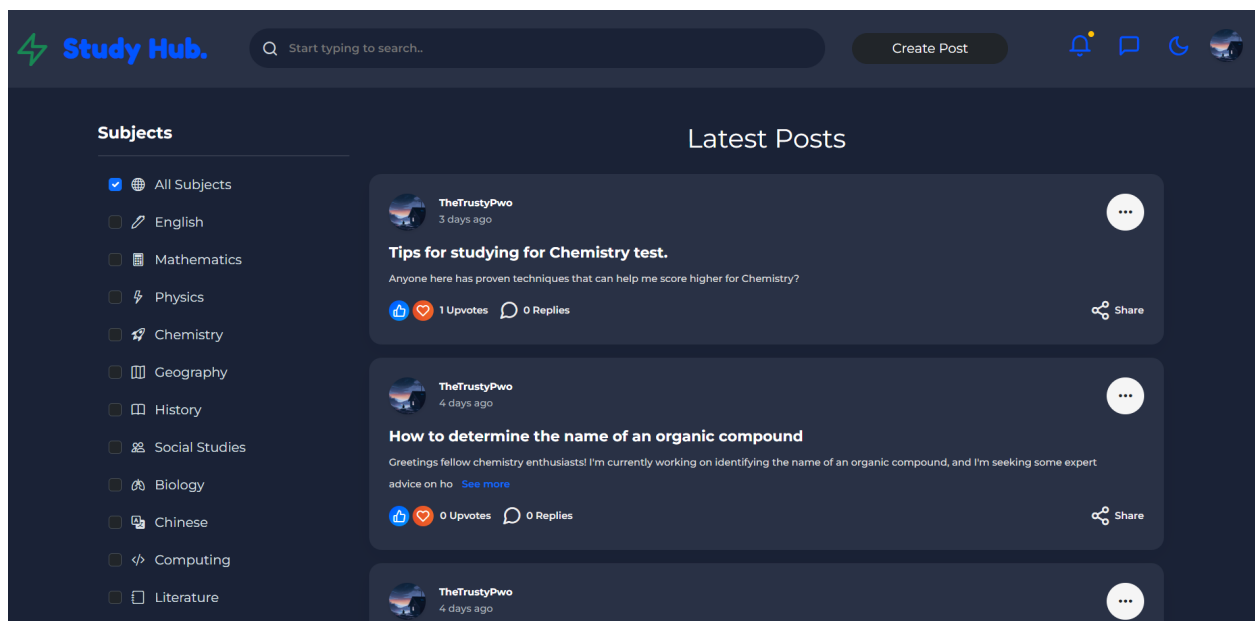
## Backend function for AI QnA

## 4.6. Snapshots

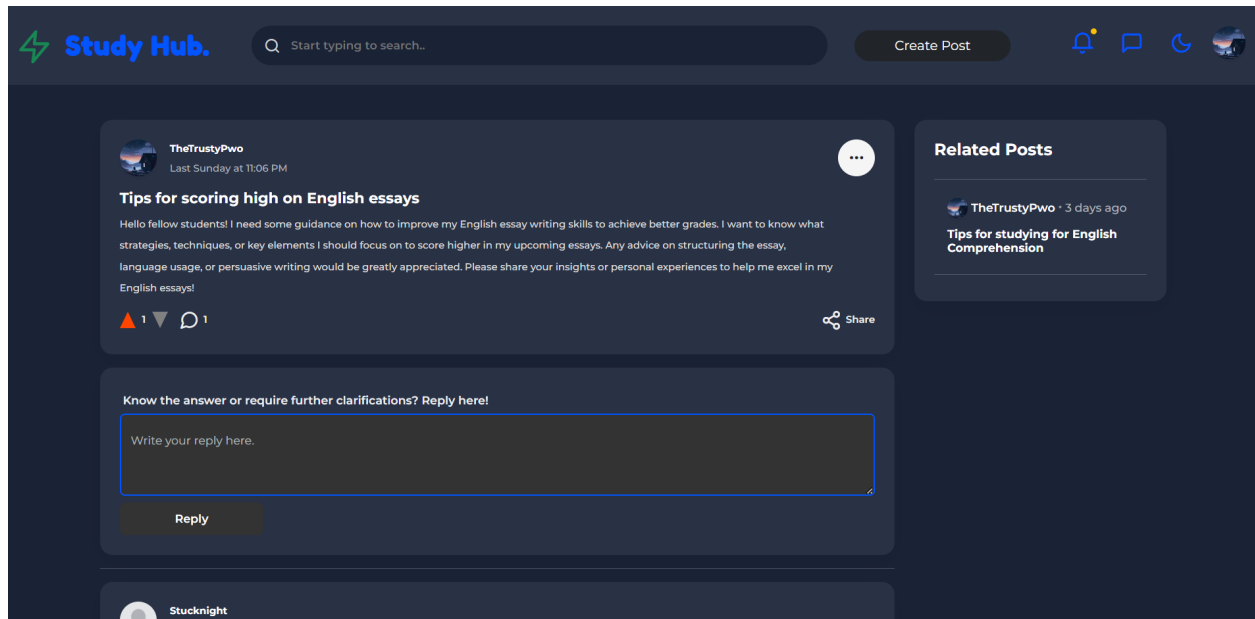
Below are screenshots of different pages on our website.



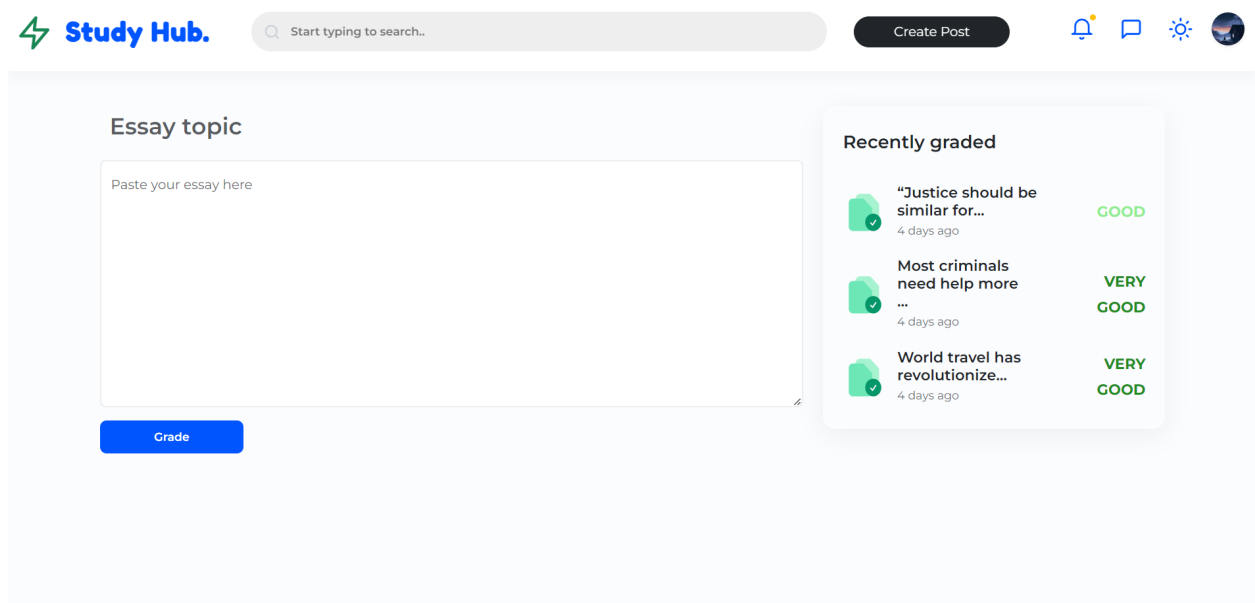
User page with message button



Home page which displays the latest posts (Dark Theme)



Post page which displays replies and related posts (Dark Theme)



Essay grading page

## World travel has revolutionized to the extent that the wor

"Travel is fatal to prejudice, bigotry, and narrow-mindedness." - Mark Twain. The world has transformed into a global village, thanks to the revolutionary impact of world travel. It exposes us to new cultures, ideas, and people, pushing us beyond our comfort zones and into a realm of growth and discovery. However, amidst the allure of exploration, conflicting perspectives emerge regarding the consequences of travel. While some emphasize its potential to foster mutual understanding, others raise concerns about cultural dilution, economic disparities, environmental degradation, and short-term profiteering.

World travel opens the door to immersive cultural experiences, allowing people to see the richness and diversity that exists beyond their immediate surroundings. Stepping outside their comfort zone exposes travelers to new ideas, customs, and perspectives that challenge their preconceived notions. For instance, a traveler venturing to a remote village in the Amazon rainforest may encounter indigenous communities with unique ways of life, unveiling a profound understanding of harmony with nature and the interconnectedness of all living beings.

Moreover, travel encourages personal growth and self-discovery. The act of exploring unfamiliar territories fosters adaptability, resilience, and open-mindedness. It requires individuals to navigate through language barriers, different social norms, and diverse cultural practices, leading to an expansion of their own worldview.

In addition, travel serves as a bridge between cultures, fostering mutual understanding and empathy. By engaging with people from different backgrounds, travelers gain insights into the commonalities that bind humanity together. Through shared experiences and genuine interactions, stereotypes and

Grade: **GOOD**

### Overall Comments:

The essay provides a satisfactory response to the question, but lacks in providing specific examples and addressing all concerns raised. The language used is adequate but there are some areas where the vocabulary could be improved. Overall, the essay is coherent and structured.

### Areas for Improvement:

#### Examples

The essay lacks specific examples to support the arguments made. Add specific

## Essay results page displaying the grade, comments and suggestions

## Unlocking Knowledge: Ask, Learn, Explore

Experience the power of AI-driven learning. Our AI provides explanations aligned with GCE examination requirements. Just ask and embark on a journey of insightful learning!

### Question

"Explain electromagnetism..."

Submit

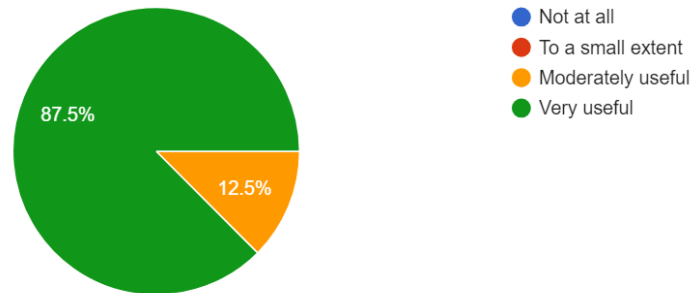
## AI Q&A page

## 5. User Feedback

How far do you think that Study Hub will help students in their learning

 Copy

24 responses

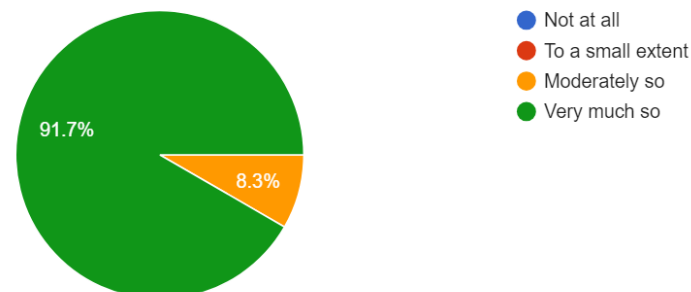


This shows StudyHub has accomplished its goal of assisting students in their learning.

How far do you think Study Hub will become popularized among the student population?

 Copy

24 responses



This suggests that StudyHub does cater to the needs of the students.

### Suggestions:

you can allow students to view their latest post

maybe allow users to toggle between light and dark mode? light mode might be too glaring for some users

for the AI essay grader, rather than providing a grade, I think it is more integral for the AI to provide conducive feedback that address multiple aspects of the students' essays

We have improved the website based on these suggestions.



## **6. Implications and Recommendations**

Even though StudyHub has proven to be a comprehensive learning platform which caters to the needs of the students, there are still many areas it can improve upon.

- The website is only suitable to be viewed on large screens such as tablets or laptops and we hope to create a more mobile friendly UI, and possibly a mobile app in the future.
- We could consider switching to a more powerful AI, GPT-4 to provide more reliable and accurate answers. Furthermore, more AI tools can be implemented such as personalized study notes and mock tests with questions generated by AI.

It goes without saying that we will continue to improve StudyHub even after this project work, as we strive to unlock its fullest potential as an invaluable academic companion.

## **7. Conclusions and Reflection**

Through this project work, all of us have gained a deeper understanding of software development. The progress and development of StudyHub required proper communication, cooperation and flexibility with each other. Although we've encountered some obstacles along the way such as conflicts arising over deadlines, we've still consistently worked hand in hand to push through the troubles and foster an active and enjoyable project work environment. This project was not merely a chance to sharpen our programming skills, but also capitalized on our soft skills and people skills. Overall, it was a fruitful experience for all of us.

## Resources:

1. How to Build a Document-Based Q&A System Using OpenAI and Python, Patrick Kalkman (2023)  
<https://itnext.io/how-to-build-a-document-based-q-a-system-using-openai-and-python-17d1c3cc2081?gi=02dc4d02b922>
2. Why Kids Are Afraid to Ask for Help, Kayla Good, Alex Shaw (2022)  
<https://www.scientificamerican.com/article/why-kids-are-afraid-to-ask-for-help/>
3. Singapore Social Media Statistics and Facts (2023)  
<https://blog.commissionfactory.com/affiliate-marketing/singapore-social-media-statistics>
4. SQL Relationship Diagram Tool  
[dbdiagram.io](http://dbdiagram.io) - Database Relationship Diagrams Design Tool