CPT208 Human-Centric Computing

VidTailor: Your Personalized AI Video Tutor

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VidTailor
AI-PERSONALIZED VIDEO ASSISTANT

1. INTRODUCTION

With the development of technology, video-based learning has become the mainstream learning method for university students. Although video learning reduces learning costs, its rigid process limits the effectiveness of learning [1].
In recent years, **Generative Artificial Intelligence (GAI)** has gained attention due to its content generation capabilities. While there have been attempts to integrate AI with video learning platforms to provide personalized learning solutions, these attempts have been limited by the inability to precisely match students' needs [2]. Furthermore, existing video-based learning platforms still have limitations, particularly in terms of learning support. The main issues include:

- ***Lack of Personalized Learning and Feedback Based on Video*:** Students are unable to receive personalized exercises and real-time feedback based on their learning behavior and grasp of the video content, making targeted improvement and adaptive learning difficult [1, 2].
- ***Lack of Systematic Review and Knowledge Organization Based on Video*:** Students cannot quickly trace back relevant video segments or access recommended content based on their learning records, limiting the process of organizing errors and building a systematic understanding of knowledge, which affects review effectiveness [3].
- ***Limited Peer Interaction and Collaborative Learning Based on Video*:** Students struggle to engage in discussions, interactions, and collaborative learning around specific video content, lacking effective communication and evaluation mechanisms, which diminishes learning motivation and participation [4].

These three factors are crucial because personalized learning can improve efficiency, systematic review strengthens knowledge retention, and interaction and collaboration promote deeper understanding and learning motivation. Meeting these factors better satisfies user needs.
To address these user needs, we propose **VidTailor**: an AI-powered personalized video tutor.

2. METHODOLOGY

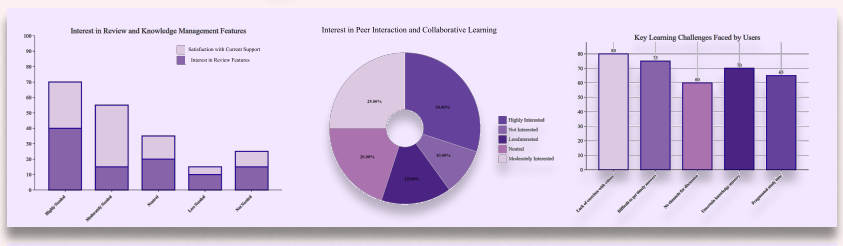
2.1 Requirement

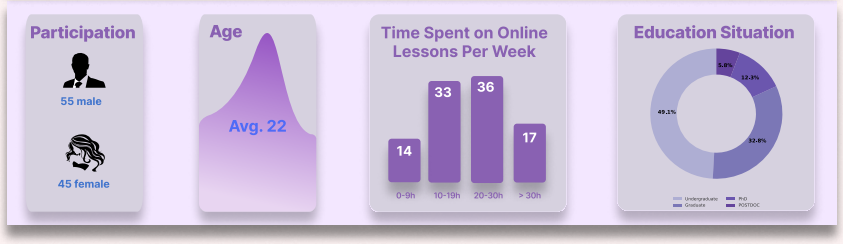
1. **Personalized Video Learning:** Users want personalized practice questions based on video content and their viewing behavior, along with recommendations for relevant video resources.
2. **Review Tools:** Users need personalized review tools, including a mistake notebook, study notes, and knowledge maps, integrated with specific video segments to enhance review efficiency.
3. **Social Video Learning:** Users seek a system that can motivate learning and support interaction with peers who face similar challenges with video content, and discussions enhance engagement.

Requirement Analysis

Interview

Questionnaire





2.2 Design Alternatives

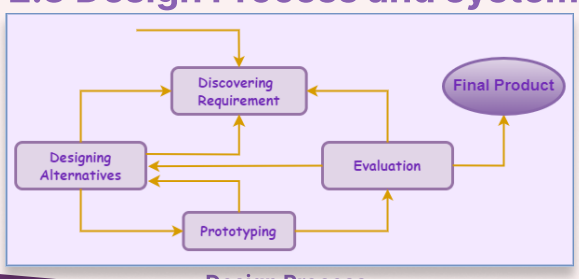
1. **Question Generation Alternatives:**
   - 📹 **Post-Video Review:** VidTailor generates a comprehensive test after the video to review key concepts, but users can not practice questions during the video.
   - ⚡ **Real-Time Practice:** VidTailor allows users to trigger exercises at key points while watching the video, but missing an overall review test.
   - 🔄 **Flexible Hybrid Mode:** VidTailor enables users to choose between mid-video exercises or a final test.

Final Choice: Flexible Hybrid Mode for its balance of active quizzes and final review tests based on feedback of interview and questionnaire.

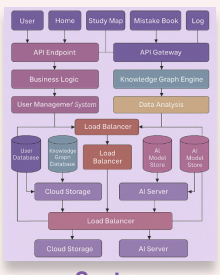
2. **Platform Options Alternatives:**
   - 🔌 **Plugin Version:** VidTailor enables in-video exercises but is less convenient to review tools and community learning features.
   - 🌐 **Web-based Version:** VidTailor provides better review and community interaction but is less suitable for in-video exercises.
   - 🔗 **Plugin + Web Combination:** VidTailor combines in-video tasks via the plugin with review and community features through the web, offering the best of both.

Final Choice: Plugin + Web Combination for its balance of convenience and full functionality based on feedback of interview and questionnaire.

2.3 Design Process and system architecture



Design Process



System Architecture

2.1 Target User

VidTailor is geared toward university students who rely on video-based learning yet often encounter challenges in receiving personalized exercises, organizing and reviewing key content, and engaging in meaningful peer collaboration. These learners seek a flexible, AI-driven approach that dynamically adapts to their grasp of the material, allows quick access to relevant segments for revision, and fosters deeper interaction through targeted discussions. By focusing on individualized learning paths, systematic content review, and enhanced student collaboration, VidTailor empowers users to master course concepts more efficiently, stay motivated, and ultimately achieve better academic outcomes.

User Persona
Muggle

Info
Age: 20
Education: Undergraduate
Major: Information and Computer Science
Gender: Male

Bio
Muggle, a 20-year-old male undergraduate in Information and Computer Science, aims to excel in algorithms and math through structured practice, favoring active learning over videos. He seeks peer collaboration for Q&A to combat self-study isolation, struggles with grasping concepts quickly, and feels demotivated without feedback. He wants a system for targeted practice and collaboration to stay engaged.

14h/week · 8h/week · 2h/week · coursera 1.5h/week

Personality

Introvert	55% ↔ 45%	Extrovert
Thinking	60% ↔ 40%	Feeling
Sensing	74% ↔ 26%	Intuition
Innovative	75% ↔ 25%	Conventional

Goals
- Wants targeted practice for algorithms and math problems rather than passive video-watching, hoping the system can identify weak areas and provide condensed core materials.
- Seeks to form study groups with peers for instant Q&A and knowledge sharing to combat the isolation of self-directed learning, relying on community interaction to overcome comprehension barriers and avoid getting "stuck with no one to ask."

Frustrations
- Struggles to quickly grasp certain concepts during self-study, lacks systematic practice, and finds rewatching videos repeatedly inefficient.
- Lacks real-time Q&A support, finds searching for materials on their own inefficient, and struggles to find peers at a similar pace when facing study problems.
- Feels demotivated from studying alone without feedback and lacks time to sort mistakes, review notes, or build mindmaps manually.

User Story
As a university student studying algorithms and math, I want to receive targeted practice problems based on my weak areas, connect with peers for instant Q&A and knowledge sharing, have my mistakes automatically organized into a review system, and get real-time feedback and quick-check questions after lectures, so that I can learn more efficiently, stay motivated through community interaction, save time on manual organization, and reinforce my understanding promptly.

Scenario
Muggle, a university student passionate about mastering algorithms and math, dedicates his weekends to studying data structures through video-based learning. He often skims through familiar concepts but finds himself repeatedly rewatching challenging sections like the "Shortest Path Algorithm," struggling to grasp the intricacies on his own. Without a tailored system, he has to manually search for relevant practice problems and solutions, a process that is both time-consuming and inefficient. After each study session, he attempts to organize his mistakes and review materials, such as creating mind maps or compiling wrong answers, but this task eats into his already limited time and feels overwhelming without structured support.
When he encounters particularly tough concepts, Muggle yearns for real-time assistance but finds it difficult to locate peers at a similar learning pace for discussion. He spends hours trying to find classmates online or in person to collaborate with, often without success, which leaves him isolated and demotivated. One evening, while stuck on backpropagation, he desperately clicks through forums and messaging apps, hoping to connect with someone who might share his struggles. The absence of instant Q&A support and collaborative learning opportunities makes his self-directed study feel like a solitary battle, with no immediate feedback to confirm his understanding or spark an "aha!" moment. Despite his efforts, the lack of systematic review tools means he struggles to trace back relevant video segments or build a cohesive knowledge framework, further hindering his progress.

3. Implementation and Outcomes

3.1 Plugin

VidTailor detects a key knowledge point, and the logo changes to orange-red. (Refer to Requirement 1)

The user chooses to practice, and VidTailor presents a related question. (Refer to Requirement 1)

VidTailor checks the answer and gives helpful hints or corrections. (Refer to Requirement 1)

VidTailor provides AI-powered explanations to answer any follow-up questions. (Refer to Requirement 1)

3.2 Web

AI-powered mistake book and study notes. (Refer to Requirement 2)

Learning forum and smart group chat connect students with similar questions. (Refer to Requirement 3)

4. Evaluation and Impact

Since VidTailor is in the prototype stage and lacks complete functionality, we primarily used demonstration videos and scenario-based interviews. Our evaluation focused on two aspects:

1. **Demonstration Videos and Scenario-Based Interviews**: Ten university students watched a video showcasing core functions, and we conducted in-depth interviews to gather their intuitive impressions on the system's functionality and interface layout.
2. **Low-Fidelity Prototype Experience**: We provided a limited interactive interface for simple demonstrations, followed by a brief questionnaire or oral feedback.
3. **Heuristic Evaluation and A/B Testing**: We reviewed the prototype against established design principles, and we performed A/B tests on key design elements to determine the most effective configuration.

From these methods, we derived key findings:

- **Iterative Usability Gains**: Poster Fig.1 shows three iterations steadily improved SUS, task success, and navigation efficiency, confirming iterative design enhances usability.
- **Dominant User Priorities**: The word cloud highlights "Personalization," "Timely Feedback," and "Interaction" as top features, indicating strong demand for customized, responsive experiences.
- **A/B Testing Trade-offs**: Poster Fig.3 indicates Prototype B's direct prompt improves task performance but feels intrusive, while Prototype A's subtle icon cue is less disruptive but easily overlooked, emphasizing efficiency versus cognitive load balance.

Impact:

- **Empowering and Motivating Learners:** Frequent mentions of "Personalization" and "Timely Feedback" reflect user preference for control and immediate insights, fostering motivation.
- **Collaborative Engagement**: Terms like "Interaction," "AI Assistance," and "Collaborative Tools" underline social connectivity and AI-enhanced group interactions.
- **Respecting Diverse User Preferences:** Prototype A's subtle cue versus Prototype B's direct prompt caters to varied user preferences, balancing unobtrusive cues and timely suggestions for learner-centric experiences.

4.1 A/B testing

We conducted an A/B test to compare two prompt designs in a video-learning plugin.

- **Prototype A** changes the plugin icon's color as a subtle, non-intrusive cue.
- **Prototype B** shows a text prompt box as a direct suggestion to answer questions.

Using NPS [5], CSUQ [6], NASA-TLX [7], and task testing, we evaluated 10 metrics across performance and experience.
Prototype A had higher task success and fewer errors, showing better efficiency.
Prototype B scored higher in satisfaction but increased task complexity.
Conclusion: Prototype A offers a smoother, less disruptive experience, better suited for focused learning.

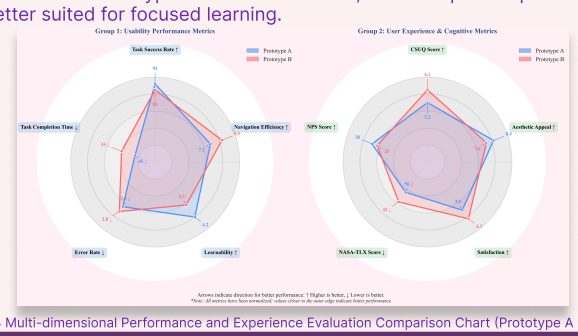


Fig. 3 Multi-dimensional Performance and Experience Evaluation Comparison Chart (Prototype A vs B)

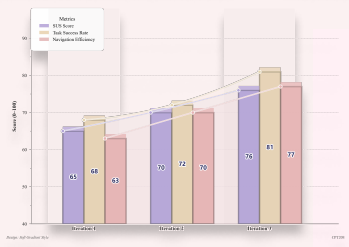


Fig. 1 User Evaluation Metrics Overview

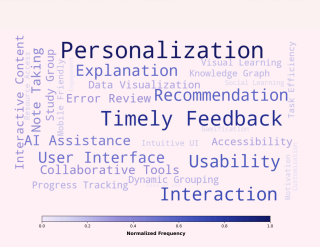
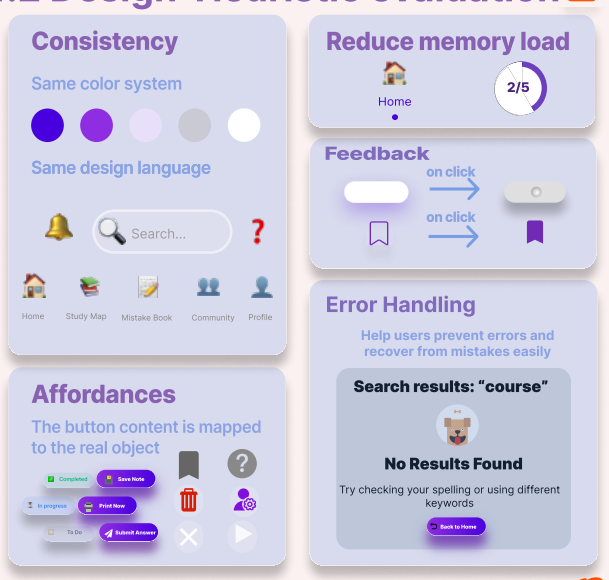


Fig.2 Key Factors Users Value Most in the Product

4.2 Design-Heuristic evaluation



5. Conclusion & Future Work

This project integrates three core functions—video-based personalized learning, systematic review, and social interaction—to provide university students with a more efficient and interactive learning experience. However, there is still room for improvement in the current system, including the accuracy of personalized recommendations, the long-term incentive mechanism for social learning, and the reliability of AI-generated content.
In the future, we will focus on two key areas: first, optimizing AI algorithms to enhance the accuracy of personalized recommendations and feedback; second, designing more effective learning incentive mechanisms to improve social interaction and enhance the collaborative learning experience. Through continuous iterative development and in-depth research, we aim to explore more practical applications for the intelligent transformation of the education sector.

6. REFERENCE

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