

# CS486C – Senior Capstone Design in Computer Science

## Project Description

<b>Project Title: Personalized Education: An AI-Integrated Web Application for Personalized Tutoring</b>	
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### Project Overview:

In an increasingly competitive academic landscape, undergraduate students often face significant challenges in managing their coursework and staying on track. Many struggle to find the personalized support they need to excel, which can lead to frustration and setbacks in their educational journey. This capstone project aims to change that by developing a groundbreaking web application that offers personalized AI tutoring and progress tracking. The heart of this project is the AI Study Partner, designed to provide students with the interactive, adaptive learning experience they need to thrive.

The importance of this project cannot be overstated. In a world where educational success is closely tied to future opportunities, having access to tailored, real-time academic support can be a game-changer. This project tackles a pressing problem—ensuring that every student has the tools and guidance to achieve their best. By leveraging AI technology, we can bridge the gap between students' needs and the support available to them, offering a solution that is not only innovative but essential in today's educational environment.

The core features of this project are designed to empower students, helping them stay engaged, track their progress, and receive personalized feedback that drives improvement. This isn't just another educational tool; it's a transformative approach to learning that puts student success at the forefront. By bidding on this project, students will have the opportunity to contribute to something truly impactful—an application that has the potential to change lives by making education more accessible and effective for all.

### Core Features (MVP):

#### Progress Tracking:

- **Student Activity Monitoring:** Track assignments, quizzes, and completion status.
- **Performance Reporting:** Generate basic performance reports to help students understand their progress.
- **Dashboard Interface:** Develop a user-friendly dashboard to display progress metrics visually.

#### AI Study Partner (Primary Implementation):

- **Interactive Learning Sessions:** Conduct virtual study sessions where the AI Study Partner engages students in interactive Q&A, reinforcing key concepts.
- **Adaptive Learning Paths:** Tailor the study sessions to individual performance, dynamically adjusting the content based on student progress.
- **Customized Feedback:** Provide targeted feedback on assignments and quizzes, identifying areas for improvement.
- **Resource Recommendations:** Suggest relevant resources based on student queries and learning patterns.

## **Stretch Goals (Optional Features):**

### **Additional AI Roles:**

- **AI Friend:** Offer motivational support and wellness tips.
- **AI Mentor:** Provide career guidance and help with goal setting.

### **Gamification and Social Learning:**

- **Engagement Elements:** Incorporate badges, rewards, and leaderboards to motivate students.
- **Social Features:** Enable study groups and peer reviews to foster collaborative learning.

### **Trial and Access Management:**

- **15-Day Free Trial:** Allow users to explore the system before committing.
- **Resource Locking:** Control access to premium features after the trial period.

## **Knowledge, Skills, and Expertise Required:**

### **AI and Machine Learning:**

- **Natural Language Processing (NLP):** To enable the AI Study Partner to conduct meaningful conversations and answer queries. (No required to be an expert)
- **Adaptive Learning Algorithms:** To develop personalized learning paths and dynamic content adjustment.

### **Web Development:**

- **Full-Stack Development:** Proficiency in front-end (HTML, CSS, JavaScript) and back-end (Python, C#, .NET) technologies.
- **Database Management:** For storing and retrieving student performance data efficiently.

### **Educational Technology:**

**Instructional Design Principles:** To ensure the AI Study Partner's interactions are pedagogically sound and effective.

**User Experience (UX) Design:** Creating an intuitive and accessible interface that enhances the learning experience.

## **Equipment Requirements:**

### **Development Infrastructure:**

High-performance computers for AI model development and testing.  
Cloud computing resources (e.g., AWS, Azure) for scalable deployment.

### **Testing Environment:**

Access to various devices (desktops, tablets, smartphones) for cross-platform testing.

## **Conclusion:**

By focusing on the AI Study Partner as the primary implementation, this capstone project aims to provide an interactive and adaptive learning experience that directly supports student success. The project's core features are designed to meet essential educational needs, while optional stretch goals will further enhance engagement.

## **Software Deliverables:**

### **1. Web Application (Core Features):**

- **User Dashboard:** Simple and intuitive interface for tracking student progress, assignments, and quizzes.
- **AI Study Partner:**
  - Interactive Q&A sessions to help students learn.
  - Personalized learning paths based on student performance.
  - Feedback on quizzes and assignments, with suggestions for improvement.
  - Resource recommendations tailored to individual learning needs.

- **Backend Development:**
  - Full-stack implementation using Python, C#, .NET, and database management.
  - Cloud deployment (e.g., AWS, Azure) for scalability.
- 2. **Optional Features (Stretch Goals):**
  - **AI Friend & AI Mentor:**
    - AI Friend: Provides motivation and wellness tips.
    - AI Mentor: Offers career guidance.
  - **Gamification:** Badges, rewards, and leaderboards for student engagement.
- 3. **Deployment:**
  - **Containerization:** Use Docker/Kubernetes for easy deployment and management.
  - **Documentation:** Setup guide and user manuals for smooth installation and use.

**Other Deliverables:**

1. **Documentation:**
  - **Technical Docs:** System architecture, API details, and data flow diagrams.
  - **User Guides:** Step-by-step instructions for students and teachers.
  - **Code Documentation:** Comments and explanations within the code.
2. **Reports and Presentation:**
  - **Progress Reports:** Regular updates on development milestones.
  - **Final Presentation:** Overview of the project and demo of the application.
3. **Testing:**
  - **Testing Reports:** Results from testing the application on various devices.
4. **AI Models:**
  - **Pre-trained Models:** AI models used for tutoring and learning paths, with documentation on how they work.