SOEN 6841: Software Project Management

Winter 2024

PROBLEM IDENTIFICATION

FOR

AI ENHANCED EDUCATIONAL CHATBOT

Date of Submission: February 11, 2024

Submitted to:

JOUMANA DARGHAM

Team Members: (Project Group - 27)

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1. Problem Identification

Title: AI Enhanced Educational Chatbot for Personalized Learning

Objective:

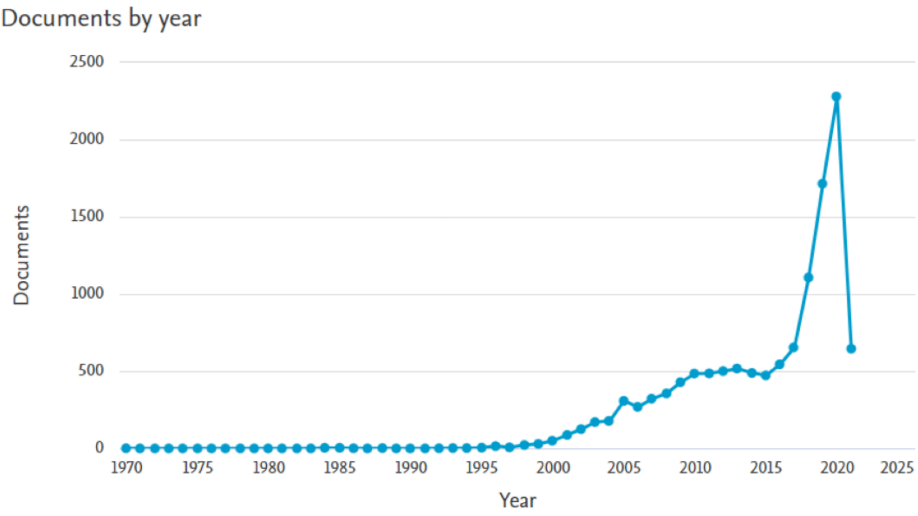
Traditional teaching methods struggle to address the diverse needs and learning styles of students, sometimes leaving many behind. This issue is worsened by the increasing size of classrooms and educators' limited ability to deliver individualized attention. With the rapid advancement of technology, students are increasingly accustomed to personalized experiences, creating an increasing expectation for education to adapt and provide unique experiences. An AI-enhanced chatbot in education can help to solve this problem by assessing each student's learning styles, preferences, and areas of difficulty. This chatbot can function as a virtual instructor, offering focused explanations, additional resources, and customisable learning paths based on each student's unique requirements.

Content:

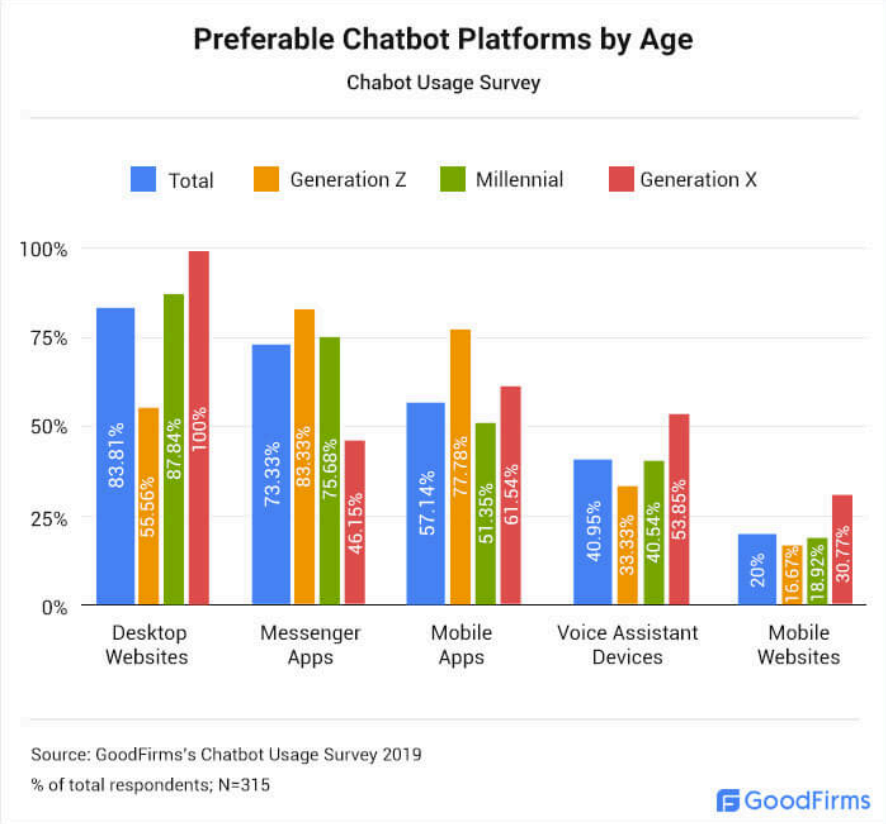
Problem/Opportunity Statement:

The major difficulty in education is to personalize student involvement and help, which frequently fails to satisfy individual learning demands. Traditional teaching methodologies frequently fail to meet these needs. AI can help us develop an educational chatbot that provides personalized assistance, resulting in a more effective and inclusive learning environment. The chatbot we intend to develop will meet customized learning needs, provide immediate assistance outside of class hours, explain complicated ideas, aid in retention and revision, improve time management, provide feedback and assessment, and provide access to educational resources. It will also stand out from other chatbots by employing innovative algorithms to evaluate individual student progress, learning preferences, and difficulty regions. The chatbot will enable real-time communication between children, parents, and educators, addressing immediate learning requirements and concerns. It will also offer extensive evaluation features to continuously evaluate student performance and comprehension. Thus, we feel that developing an AI-enhanced chatbot for individualized learning solves a major need in education today. By using artificial intelligence to provide targeted support and assistance to students, instructors, and parents, we can create a more effective and inclusive learning environment that optimizes the potential of every learner.

Chatbot usage surveys



Increasing number of documents processed by chatbot each year



Chatbot usage survey - Age groups

Project Scope

Project Inclusions:

- Implemented real-time communication capabilities for students, instructors, and parents.
- AI algorithms are being developed to give personalized learning paths and adaptive learning opportunities.
- Collaborative learning capabilities and immediate evaluation systems have been incorporated.
- Implementation of ethical AI technologies, transparency in data usage, and data privacy protections.
- Provide a separate component for educators' continued professional development, such as materials, workshops, and AI-related training, to assist them enhance their teaching abilities.
- Ensure that many languages are provided in order to accommodate a diverse user base.
- Integrate with existing assessment and grading systems used by educational institutions to improve evaluation efficiency.
- Allow instructors to tailor the chatbot's content and capabilities to their specific teaching styles and curriculum requirements.
- Configure analytics tools to monitor user engagement, performance, and usage patterns.

Project Exclusions:

- Hardware buying and setup.
- Marketing and promotion activities extend beyond project stakeholders.
- Network infrastructure changes.

Deliverables:

- Product Initiation Report
- Market Research
- A detailed paper defining the chatbot's functional and nonfunctional requirements.
- Architecture design document outlining the high-level system architecture, components, and interactions.
- Create an AI chatbot with all of the requested characteristics and functionalities.
- User interface designs and wireframes representing the chatbot application's layout, navigation, and visual features.
- Test plans define the approach, technique, and test cases for functional, regression, and performance testing.
- User manuals, instructions, and tutorials describe how to use the chatbot application.
- The support plan outlines how to report problems, seek assistance, and download software updates.

Project Constraints:

- Time limits for project completion
- Budgetary restraints
- Acquire third-party resources.
- Technical limits for AI algorithm development and integration.

Project Charter

Project Objective:

The AI-enhanced educational chatbot seeks to overcome the limitations of traditional teaching methods by assessing each student's learning styles and preferences. It can function as a virtual instructor, offering personalized explanations, resources, and learning paths based on individual requirements.

Project Team

- Project Manager
- Software Developers
- AI Specialists
- User Experience (UX) Designers
- Quality Assurance (QA) Testers

Stakeholders

- Students
- Teacher
- Parents
- School Management
- IT Department

Project Timeline:

- StartDate: Feb 11, 2024
- End Date: March 30, 2024

Risks:

- **Technical Challenges:** Complexity of AI algorithms.
- **Data Privacy and Security:** Security weaknesses may allow for unauthorized access, data breaches, or the exploitation of sensitive user information.

- **Ethical AI Use:** Ethical considerations, prejudices, and unexpected effects from AI algorithms may have a detrimental impact on the chatbot's acceptance and trustworthiness.
- **Integration concerns:** The implementation of new educational systems, platforms, and infrastructure may result in compatibility concerns, data migration challenges, or workflow impediments.
- **Scalability and Performance Issue:** As the number of users starts to grow and their demand increases , scalability and performance concerns may arise which will result in poor response times, system unavailability, and sometimes resource limitation may occur as well.
- **User Interface:** Confusing user interfaces, no definite hierarchy of UI and a lack of user engagement features can all contribute to low user satisfaction and adoption rates.
- **User Adoption:**The user may not be unwilling to utilize the software but may find it confusing to use the features.

Stakeholder Analysis:

Identification of Stakeholders:

1. **Students:**

   Interest: Although there are numerous chatbots available, none of them are specifically engineered for educational objectives; our attention is directed towards students as the principal consumers. Our chatbot endeavors to facilitate effective learning by providing individualized assistance around-the-clock. The system places a high emphasis on safeguarding data privacy and ensuring an intuitive user interface.

   Student Concerns: specifically those pertaining to data security, privacy, and the dependability of educational materials. In order to mitigate these concerns, the chatbot has implemented stringent security measures to guarantee a secure educational setting. We endeavor to address the distinct requirements of each pupil by providing a customized and protected educational environment, so as to achieve this objective.

2. **Tutors/Instructors:**

   The benefits of this software development initiative are more pronounced for educators in comparison to the students. By providing an automated assessment system and facilitating effective communication between instructors and students, the system substantially reduces the time required by tutors. Tutors are granted access to an all-encompassing progress report that details the academic performance of each individual pupil.

   Furthermore, by autonomously uploading content, the system optimizes the examination question generation process, thereby conserving the time and effort of tutors. The objective of this customized methodology is to improve the overall pedagogical experience for educators, maximizing productivity and enabling them to devote greater attention to individualized student assistance.

3. **Parents:**

   Parental Interests: Parents desire timely notifications regarding their child's academic advancement, comprehensive explanations of the educational assistance rendered, such as individualized study plans and supplementary materials, and consistent updates regarding assignments and accomplishments.

   Matters of concern: Parental apprehensions regarding data security are evident, with an emphasis on the necessity for strong safeguards to secure sensitive data, including academic records and personal information. Parents are intent on receiving transparent information regarding the handling and sharing of their child's data, as privacy is a major concern. Furthermore, concerns regarding the potential ramifications of technology on the welfare of students are prevalent. These concerns encompass issues such as excessive screen usage and the efficacy of digital learning approaches. It is imperative to address these concerns by implementing transparent communication practices and effective

privacy policies in order to establish parental trust in the educational chatbot enhanced with artificial intelligence.

4. **School Management:**

   Interests: Optimizing resources and enhancing educational outcomes are areas of interest for school administration. The implementation of the system facilitates streamlined administrative procedures and improved communication, which results in favorable evaluations from both students and instructors. Enhanced organizational efficacy is a significant area of interest.

   Concerns: School administration is primarily concerned with the scalability of the solution, the initial investment, and the training demands. Critical factors to be mindful of include the acceptance of the new solution throughout the educational ecosystem and the assurance of a seamless integration with pre-existing systems. It is crucial to acknowledge and resolve these concerns in order to obtain the backing and dedication of school administration regarding the integration of the AI-powered instructional chatbot.

5. **IT Department:**

   The IT department is concerned with the scalability and effectiveness of the AI-enhanced pedagogical chatbot's implementation. The organization's objectives are to ensure compliance with technological benchmarks, smooth integration with pre-existing systems, and a solution that is in line with its comprehensive technological infrastructure.

   The IT department is primarily concerned with technical obstacles, system upkeep, and possible integration complications. Their objective is to guarantee the software solution's technical integrity, security, and maintainability. It will be imperative to resolve these concerns and offer comprehensive support in order to secure the IT department's cooperation and support during the development and implementation stages.

Relevance to Software Solution:

By providing an interactive, individualized, and effective learning environment, the creation of an educational chatbot powered by artificial intelligence directly addresses the identified issue. The primary objectives are to accommodate the varied requirements of students, enhance instructional procedures, and facilitate streamlined dialogue among stakeholders.

Initial Thoughts on the Scope of the Software Solution

1. **Feature Set:**
   - Adaptive learning paths based on individual student progress.
   - Real-time communication between students, teachers, and parents.
   - Automated assessment and feedback mechanisms.
   - Integration with existing learning management systems.

2. **Technological Considerations:**

    - Utilization of natural language processing (NLP) for effective communication from given prompt and fetching out the best possible results.
    - Implementation of machine learning algorithms for personalized content recommendations.
    - Mobile and web platform compatibility for widespread accessibility.

3. **Training and Support:**

    - Development of comprehensive training materials for stakeholders and continuous testing of the software.
    - Ongoing support and regular updates to ensure system relevance and security.

4. **Pilot Implementation:**

    - Consideration of a phased rollout to address initial concerns and gather feedback from the users.
    - Continuous improvement based on user experiences and changing educational needs.

GINA CODY
SCHOOL OF ENGINEERING
AND COMPUTER SCIENCE

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MARKET ANALYSIS

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Market Analysis Report

Market Size and Growth:

- The global chatbot market was valued at **$17.17 billion in 2020**. It is projected to reach over **$102.29 billion by 2026**. This represents a compound annual growth rate (CAGR) of approximately **34.8% from 2021 to 2026**
- **59%** of customers expect a chatbot to respond within 5 seconds (**Drift**).
- **69%** of consumers were satisfied with their last interaction with a chatbot (**Tidio**).
- **64%** of consumers claim that the best feature of chatbots is their availability 24/7 (**Outgrow**).

The chatbot market is poised for substantial growth, with projections indicating a surge from $17.17 billion in 2020 to over $102.29 billion by 2026, representing a robust CAGR of approximately 34.8%. Consumer demand for chatbot solutions is evident, with a majority expecting quick responses and reporting satisfaction with interactions. The key appeal lies in chatbots' round-the-clock availability, making them valuable tools for businesses seeking to enhance customer service and operational efficiency. With such favorable trends and opportunities, investing in the chatbot market offers promising prospects for innovation and market expansion.

1. Target Audience

1.1 Primary Target Audience: Educators and Teachers

Our primary target audience remains educators and teachers across various educational levels. This group includes:

Elementary School Teachers: These professionals are tasked with teaching foundational subjects to young children. They teach the young students various skills such as reading, writing, speaking , etc. The basics of arithmetic, introductory science and social studies are also discussed.

Middle and High School Teachers: These professionals are tasked with teaching specialized subjects such as mathematics, science, language arts, history, political science, etc. They mostly are tasked with teaching students in their early teens to late adolescence.

College and University Professors: These professionals deal with education, teaching a wide variety of topics in the range of undergraduate to postgraduate level. They also perform research activities in their specialized fields. This also include instructors at vocational and technical colleges.

Educational Facilitators and Trainers: These professionals deal with taking learning in non-traditional settings, such as adult education centers, vocational training facilities, etc. This may also include those professionals which provide online education in an informal setting.

1.1.2 Demographic Characteristics:

Profession: Educators, teachers, professors and academic facilitators across various educational levels, including primary, middle and high school, colleges, universities, etc.

Age: Typically 25 years and older.

Geographic Location: Globally, but focusing on regions with established educational institution professionals and openness to integrate modern technology in their profession.

Education Level: Bachelor's degree as a minimum, with varying higher level degrees specific subject areas.

1.1.3 Psychographic Characteristics:

Professional Goals: Seeking to incorporate cutting edge AI driven teaching tools to enhance lecture delivery, student engagement and productivity.

Adaptability: Openness to integrate new technologies in their day-to-day activities to boost productivity.

Value Efficiency: Looking for solutions that can automate tasks, provide correct evaluations and quick access to a wide range of educational resources.

Community-Oriented: Engaged in educational communities and networks, with the aim to provide education to the community as a whole.

1.2 Secondary Target Audience: School-Going Children, Students (Middle School to University level) and Informal Students.

Our secondary target audience encompasses various levels of children and students across various educational levels. This group includes:

School-Going Children: This group includes young learners in the primary or elementary stage of education. The chatbot could spark curiosity and a love for learning through games, storytelling, and visual aids.

Middle and High School Students: Students in this category are transitioning from primary to more advanced levels of education while high school students are preparing for college entrance exams. The chatbot can provide support by breaking down complex topics into simple cards, offering practice quizzes, etc.

College Students: At the college level, students specialize in their fields of interest and require resources for deeper understanding and research. The chatbot can serve as a study aid providing detailed explanations, supplementary readings, and academic support for their field of study.

University Students: University students, including those pursuing postgraduate studies, need specialized support in their research and advanced study areas. The chatbot can offer assistance with research methodologies,suggest academic papers, and forums for discussion.

Informal Students: This group comprises individuals engaged in self-directed learning outside a formal educational institution. The chatbot can provide curated learning paths, resources for self-study, and interactive platforms for education.

1.2.1 Demographic Characteristics:

Age Group: Primary School Children (Ages 6-10), Middle School Students (Typically ages 11-13), High School Students (Ages 14-18), College Students (Ages 18 and above), Pursuing higher education (Ages 18 and above).

Education Level: Ranging from elementary education to undergraduate and graduate levels.

Geographic Location: Globally focussing on areas with accessible technological infrastructure to support online learning tools.

1.2.2 Psychographic Characteristics:

Learning Methodology: Students in search of supplementary learning tools that offer personalized learning experiences that help in understanding complex subjects, and recollect course material.

Motivation: Motivated to use learning tools which attract curiosity and engagement. Autonomy to explore subjects at their own pace and depth is highly sought after.

Technology Engagement: Comfortability and interest with digital platforms and online resources for learning. Interactive and engaging content such as quizzes, games, and interactive videos are preferred over traditional learning methods.

Peer-Social Influence: Learning with collaborative features and community engagement features are appreciated where they can compete as well as collaborate in learning.

2. Potential Competitors:

1. **IBM Watson Education:**
    - IBM Watson offers various educational solutions, including AI-powered chatbots for personalized learning and assistance.
2. **ChatGPT for Education:**
    - Services that leverage OpenAI's language models, like ChatGPT, could be adapted for educational purposes, providing AI-driven conversational interfaces.
3. **Quillionz:**
    - Quillionz is an AI-powered platform that helps in creating educational content through natural language processing and generation.
4. **Squirrel AI:**
    - Squirrel AI is an adaptive learning platform that utilizes AI to personalize education for students, offering a chatbot for assistance.
5. **Brainly:**
    - Brainly is a collaborative learning platform that incorporates AI-driven features, including a community-based chat for students to seek help.
6. **EdX:**
    - EdX, while primarily a platform for online courses, integrates AI features for personalized learning and assessment.
7. **Duolingo:**
    - Duolingo utilizes AI for language learning and includes chatbot-like interactions for practicing conversations.
8. **Knewton:**
    - Knewton is an adaptive learning platform that uses AI to tailor educational content based on individual student needs.

Competitor	Strengths	Weaknesses	Opportunities	Threats
IBM Watson Education	Extensive expertise in AI and machine learning.	Potential high costs associated with IBM services.	Growing demand for AI in education.	Competition from other tech giants.
ChatGPT for Education	Powerful language generation capabilities.	May require customization for specific educational needs.	Expanding usage in various educational applications.	Concerns over ethical use of AI in education.
Quillionz	Simplifies content creation with AI-generated questions.	Limited awareness compared to larger platforms.	Increasing need for automated content creation in education.	Competition from established educational content providers.
Squirrel AI	Adaptive learning model for personalized education.	Complexity in implementation and integration.	Global expansion opportunities in adaptive learning.	Resistance to AI-based education in some regions.
Brainly	Large user community for collaborative learning.	Reliance on user-generated content may affect quality.	Continuous growth in user base.	Maintaining content quality and accuracy.
EdX	Partnerships with prestigious universities and institutions.	May face challenges in catering to diverse learning needs.	Increasing demand for online education.	Competition from other online education platforms.
Duolingo	Gamified language learning with AI-driven features.	Limited to language learning, potential narrow audience.	Global expansion for language learning.	Dependence on the language learning market.
Knewton	Adaptive learning technology for personalized education.	Integration challenges with existing educational systems.	Increasing adoption of adaptive learning in institutions.	Technological advancements making current models

3. Business values:

1. **Adaptive Learning Paths:**
    - **USP:** Personalized Learning Journeys
    - **Description:** Implement an adaptive learning system that tailors content and assistance based on individual student and educator needs. By leveraging artificial intelligence,the chatbot intelligently adapts to user progress, ensuring a dynamic customized learning experience. This will foster a successful learning journey aligning with the speed, style and level of the learner.
2. **Collaborative Learning Hub:**
    - **USP:** Community Engagement
    - **Description:** Create a collaborative learning environment within the chatbot, allowing students and educators to connect, share resources, and participate in group discussions. This feature encourages information sharing and collective learning by fostering a feeling of community inside the educational ecosystem. The chatbot transforms from a tool for solitary learning into a platform that promotes group participation, cooperation, and idea sharing by enabling user interactions..
3. **Multi-Modal Interaction:**
    - **USP:** Varied Learning Formats
    - **Description:** Offer multimodal interaction capabilities, including text, voice, and visual elements. Acknowledging the wide range of learning styles among users, this feature guarantees an all-encompassing and inclusive educational approach. By allowing students to connect with the chatbot in their preferred way, accessibility is improved and different learning styles are catered to. This USP guarantees that the chatbot meets the unique requirements of a wide range of users, resulting to an engaging and productive learning environment.
4. **Real-time Assessment and Feedback:**
    - **USP:** Instant Performance Evaluation
    - **Description:** Provide real-time assessment tools that evaluate student performance and offer immediate feedback. This allows teachers to gauge student understanding, pinpoint areas for growth, and provide prompt feedback. This helps teachers address challenges promptly and improves the effectiveness of the teaching and learning process. Through enabling tailored learning and continual improvement, the instant feedback loop makes education more responsive and adaptive.
5. **Gamified Learning Elements:**
    - **USP:** Engaging Learning Environment
    - **Description:** Incorporate gamification elements to make learning enjoyable. With interactive and gamified components such as quizzes,challenges and rewards, this

USP seeks to maintain student engagement, keep them motivated, promote a positive learning mindset and enhance their overall learning experience.

6. **Ethical AI and Data Privacy:**
    - **USP:** Transparent and Ethical AI
    - **Description:** Emphasize a commitment to ethical AI practices, ensuring transparent data usage and prioritizing user privacy. Transparent data usage and prioritization of user privacy build trust among educators, students, and parents. By adhering to ethical principles in AI development,the chatbot ensures that user data is treated properly by abiding to ethical norms in AI research, creating a safe and reliable learning environment. This USP sets our chatbot apart as being both morally and technologically sound.
7. **Intuitive Content Creation Tools:**
    - **USP:** Easy Content Generation
    - **Description:** Provide educators with user-friendly tools for creating AI-generated educational content. With the help of this tool, educators may effortlessly modify the resources used in their classrooms to meet the unique needs of each student. The chatbot turns into a valuable tool for teachers by streamlining the process of creating content, making it easier for them to customize lessons, tests, and instructional materials.
8. **Cross-Platform Accessibility:**
    - **USP:** Seamless Integration
    - **Description:** Ensure cross-platform accessibility, allowing users to seamlessly integrate the chatbot into various educational tools and platforms. Compatibility with Learning Management Systems (LMS) enhances usability as well as versatility and the chatbot becomes an integrated part of the educational technology ecosystem.
9. **Continuous Professional Development:**
    - **USP:** Ongoing Educator Training
    - **Description:** Offer a dedicated section for continuous professional development, providing educators with resources, workshops, and AI-related training to enhance their teaching skills.This USP demonstrates a dedication to continuous learning and development, enabling teachers to adapt their instruction in line with technology breakthroughs. By providing a platform for continuous professional development, the chatbot becomes not just a tool for students but a valuable resource for educators seeking to stay current with educational trends and refine their teaching practices.
10. **Parental Involvement Features:**
    - **USP:** Parent-Teacher Collaboration
    - **Description:** Include features that allow parents to track their child's progress, receive updates on achievements, and engage in collaborative discussions with

educators. This USP emphasizes a cooperative strategy to student development by recognizing the significance of parental involvement in the educational process. The chatbot serves as a channel for shared insights and joint decisions in the student's best interest by facilitating communication between parents and instructors.This strengthens the parent-teacher-student relationship.

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