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Case Report

A Chatbot-Based Academic Advising Model for Student in Information Technology: A Case Study

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Abstract

In the credit system, academic advising has become an essential factor for student success in universities. It is a student-centered initiative that promotes student engagement in the institution by supporting students in their academic and career goals. This study presents a comprehensive and effective academic advising model for Information Technology students, combining the traditional role of academic advisors with advanced technologies such as artificial intelligence and machine learning. The proposed model integrates virtual assistants to answer training regulations and curriculum questions, personalizes learning paths, and automatically recommends courses based on real-world data. The pilot study results on 100 IT students from second to four years show that the system significantly improves their access to information, learning resources, and satisfaction. This study marks a significant step forward in the application of AI in higher education, opening the potential to improve learning efficiency and training management on a large scale.

Keywords*:* Learning Consulting, Learning Advisor, Personalized Learning, Credit Systems, Machine Learning.

1. INTRODUCTION

Currently, higher education institutions in Vietnam operate under the credit system. Building an effective academic advising support system plays an important role in students' success in their studies. This need is even more urgent for students majoring in information technology (IT) due to the rapid development of technology and the requirement to constantly update knowledge. The credit system requires students to be able to self-orient and choose appropriate subjects, increasing the need for personalized and flexible academic advising [1].

The trend of integrating technology into the academic advising system is growing worldwide. Leading universities are applying innovative solutions to improve the effectiveness and efficiency of academic advising. Notably, artificial intelligence (AI) and chatbots are being used to provide scalable and personalized advising solutions [2]. Advising models that combine AI-generated recommendations with human expertise are increasingly popular, reducing the administrative burden on advisors and allowing them to focus on more complex and personalized interactions with students.

In Vietnam, the academic advising landscape is evolving with many challenges. Many universities still lack formal academic advising systems, leading to inconsistencies in the quality and accessibility of advising services. Cultural and institutional barriers, coupled with resource constraints, are hindering the implementation of effective advising systems. However, some universities have begun to integrate technology into their advising systems, including the use of online platforms and tools to facilitate communication between advisors and students, as well as monitor academic progress.

In this context, this paper focuses on analyzing the current academic support situation and proposes a comprehensive academic advising system that combines the role of academic advisors and advanced machine learning methods. This study presents an AI-integrated academic advising support model that combines virtual assistant features, predicts academic performance, and recommends personalized courses for college students.

The system is built on natural language processing (NLP) and machine learning algorithms, capable of answering questions related to training regulations, curriculum, basic knowledge questions, and initially predicting course grades based on real-world data. The test results on 100 IT students showed that the system improved user satisfaction by 30% and increased the accuracy of score prediction by 90%. This is an important step forward in applying AI technology to higher education, opening the potential to improve learning efficiency and training management on a large scale.

The research goal is to automate the process of answering students' questions, providing basic knowledge support for students, and suggesting personalized subjects. Help students experience personalized learning. Deploy a virtual assistant capable of natural communication, answering questions related to training regulations, class schedules, and administrative procedures quickly.

This paper not only contributes to improving the learning advising system in Vietnam but also aims to apply the global trend of integrating AI into higher education. We believe that this model can contribute significantly to improving the quality of education and supporting students in the credit system, especially in the rapidly developing IT field.

2. RELATED WORK

The credit system has been applied in Vietnamese universities since 2007 [3], providing greater flexibility for students in building their personal learning paths. This system allows students to have more control and self-determination over their learning paths. However, students, especially in the Information Technology (IT) field, still face many challenges due to heavy curriculum, high self-study requirements, and rapid changes in technology. Without timely support, students may have difficulty in studying, stress, and even drop out of school. Although many universities have implemented support programs, their effectiveness is limited. Counseling services are often general and lack personalization, making it difficult for students to access information that suits their actual needs. Academic advisors play an important role in guiding and supporting students. For IT students, this role is especially important as rapid technological change requires students to make informed decisions about course selection and career direction. However, many academic advisors still struggle due to a lack of effective support tools, inadequate facilities, and possibly a lack of specialized training. Virtual assistants and AI chatbots have been widely used in education and are emerging as potential academic support solutions. These tools can act as virtual academic advisors, helping students choose courses, develop learning strategies, and access resources effectively [4]. This is especially beneficial in higher education, where faculty members can be overwhelmed with teaching and research responsibilities, making it difficult to provide personalized support [5]. Research shows that students have expressed a strong desire to integrate AI chatbots into their educational journey, predicting that these tools will positively impact their academic development [6].

Currently, Vietnamese universities have actively provided information on regulations and training programs, but a more structured support system is still needed. Although academic advising rooms exist, they often lack depth and do not meet the specific needs of each student group. In particular, in the field of IT, the rapid development requires a specialized advising model. The combination of academic advising and intelligent support technology can help students have a clearer direction in their learning and career development. The author [1], briefly assessed the role of IT in student support systems as necessary. According to the research of the authors [7], the model of predicting learning outcomes based on early detection of influencing factors has shown potential in effectively supporting students.

From the above analysis, building a specialized consulting model for each field of study, especially IT, is a necessary step to improve support efficiency and contribute to helping students achieve success in their studies and careers. Applying AI to develop virtual chatbots can play an important role in providing personalized academic advice, supporting students in choosing subjects, building a reasonable learning path, and accessing resources quickly and effectively.

3. CHATBOT-BASED ACADEMIC ADVISING MODEL

To address the above limitations, we propose an effective academic advising model called FIT-Advisor, which combines the important role of an academic advisor with advanced technology based on chatbots to provide the ability to personalize the learning path for each student. The model is tested at the Faculty of Information Technology, Ho Chi Minh City University of Education. The main functions of FIT-Advisor are as follows:

- Question and answer about training programs:
  - Provide information about training programs for each major.
  - Answer questions about study plans and graduation requirements.
- Question and answer about regulations:
  - Provide information about school regulations and rules.
  - Answer questions about issues related to studying, exams, and discipline.
- Question and answer basic IT knowledge:
  - Explains basic IT concepts.
  - Supports searching for information on C++/Python programming language, data structures and algorithms.

- Advice on choosing subjects in the next semester:
  - Suggest subjects suitable for students' abilities and interests.
  - Provide detailed information about each subject.

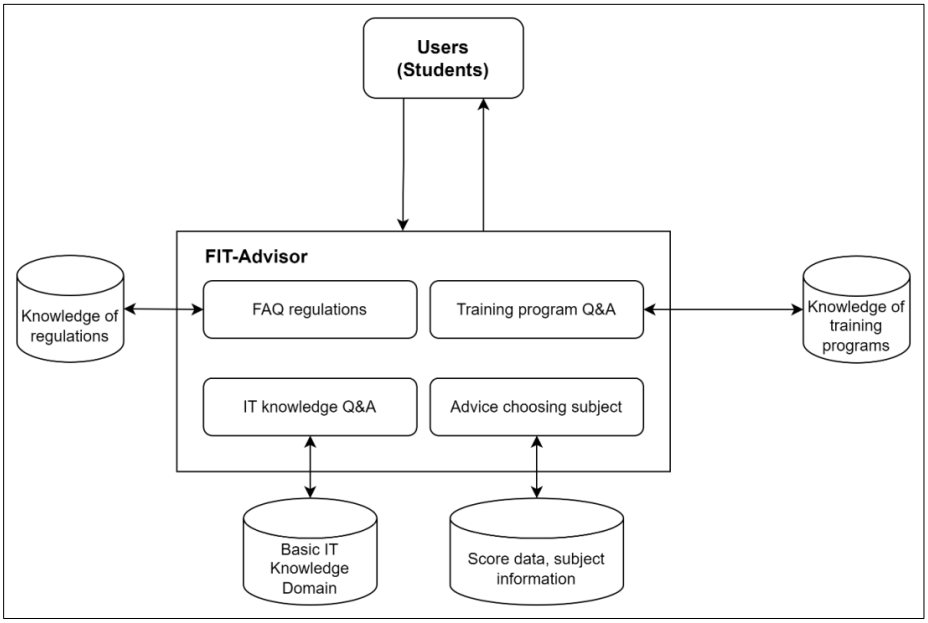

Figure 1: Main functions of FIT-Advisor

3.1. System Architecture and Design

FIT-Advisor is designed using a multi-tier architecture, as shown in Figure 1, to ensure modularity, scalability, and ease of maintenance.

User Interface:

This web-based interface allows students and instructors to interact with the chatbot seamlessly. The interface is intuitive and user-friendly, ensuring accessibility for students with different technical backgrounds.

Natural Language Processing (NLP):

Uses NLP techniques to understand user intent (e.g., questions, requests for information, advice), process Vietnamese language, including unaccented Vietnamese, and common spelling errors.

Knowledge Base:

Stores information on student regulations, training programs, basic IT knowledge on questions and answers in C++/Python programming language, Data Structures and Algorithms. The knowledge base is organized in a structured form for easy searching and updating.

Question and Answer Module:

Uses information retrieval techniques to search and generate appropriate answers in the knowledge base. Combines with machine learning models to generate natural and accurate answers.

Course Selection Advice Module:

Based on scores and learning history, it analyzes student learning data to suggest appropriate courses. Provides detailed information about each course (e.g., content, lecturer, timetable).

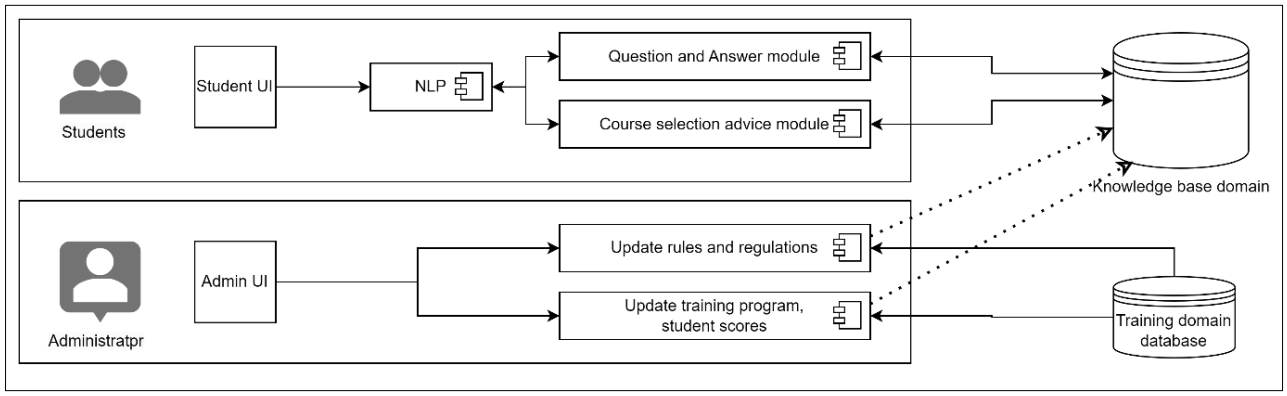

Figure 2: System architecture

3.2. Data Information

Knowledge base data for the academic advising model is collected and continuously updated from many different sources:

1. **Regulations and Training Programs**: Data is manually updated for each course. Information on regulations and rules is collected from the Office of Political Affairs and Student Affairs, while the training program is taken directly from the Training Department combined with the description stored at the faculty.
2. **Subject Knowledge**: Data on subjects such as C++, Python, Data structures and algorithms have been organized and enriched by the group of authors who developed the chatbot before [8, 9], and be improved the accuracy and usefulness of the system.
3. **Student Score Data**: The system automatically collects score data to generate statistics and build score distributions for each subject. This information is combined with student data and schedules for the next semester to assist with course selection advice and can predict grades or grade ranges based on historical data.

3.3. Algorithms and Technology

3.3.1. Chatbot Development Platform

FIT-Advisor is built on the Rasa framework. This is a powerful and flexible platform for building intelligent dialogue systems. It consists of two main components:

- **Rasa NLU (Natural Language Understanding):** This component is responsible for processing user input, identifying intents and extracting entities. It acts as an interpreter, converting user messages into structured data that the chatbot can understand.
- **Rasa Core**: This component manages the flow of the dialogue, deciding what actions the chatbot should take based on the context of the conversation. It uses policies to determine the next best action and maintains the state of the conversation through a tracker.

To deploy a learning advisory chatbot using the Rasa framework, we perform the following steps:

- **Environment Setup**: Install Rasa in a virtual environment, including setting up dependencies and initializing the Rasa project.
- **Intent and Entity Definition**: Define intents and entities related to educational contexts, such as course queries, scheduling, and learning advisory.
- **Conversation Management**: Use Rasa Core to manage conversations, ensuring the chatbot can handle different educational scenarios and provide appropriate responses.
- **Custom Action Implementation**: Implement custom actions to handle specific tasks, such as accessing educational databases or providing course recommendations.

One of the advantages of the Rasa framework is that it supports integration with multiple platforms, allowing learning advisory chatbots to be deployed on websites, messaging apps, and other channels. This ensures that students can access the chatbot through their preferred communication channels, increasing accessibility and usability. In this study, we initially tested it on a web environment.

3.3.2. Natural Language Processing Tools

To effectively process Vietnamese language in learning consulting chatbot, we have integrated and customized NLP algorithms specific to Vietnamese. These algorithms include:

- **Text Preprocessing:** Using VnCoreNLP word splitters to separate Vietnamese text into meaningful units combined with removing stop words (words that do not contribute significantly to the text context); performing data normalization and cleaning.
- **Intent Classification:** Initial testing of machine learning models to classify into predefined topics. Integrating PhoBERT model to extract features from text data.

Using VnCoreNLP and PhoBERT helps to solve some specific challenges in Vietnamese language processing:

- **Tonal Complexity:** Vietnamese has six basic tones, which are more complex than Chinese. This tonal variation can vary by region, adding complexity to NLP tasks such as speech recognition and synthesis.
- **Word Segmentation:** Word segmentation in Vietnamese is important because words are often made up of multiple morphemes. Inaccurate segmentation can lead to nonsensical translations. This is a fundamental challenge in Vietnamese NLP that needs to be addressed to ensure accurate language processing.
- **Part of Speech (POS) Tagging:** Vietnamese sentences can be very ambiguous, with words having multiple meanings depending on the context. This makes part of speech tagging a challenging task, requiring understanding the context to accurately determine the meaning of the word.

To address these challenges, we adopted the following integrated strategy:

- Use VnCoreNLP to preprocess the text by performing word segmentation and other necessary annotations.
- The processed text is then fed into PhoBERT to perform advanced NLP tasks.

This combination leverages VnCoreNLP's powerful preprocessing capabilities and PhoBERT's advanced language understanding capabilities to enhance chatbot performance.

3.3.3. Subject Selection Algorithm

Based on some works [10-12], we have developed a suitable subject selection consulting model. This model works as follows:

- User authentication: Students need to log in to the chatbot system to accurately identify personal information.
- Learning data collection: The system retrieves the student's learning history, including the scores of completed subjects.
- Data synchronization: The system periodically synchronizes student score data to update the general score spectrum for each subject.
- Vector representation: Using deep learning techniques, the system represents the correlation between subjects and student characteristics in vector space.
- Comparison and recommendation: Based on the similarity in the vector space, the system performs comparison and makes appropriate course recommendations.

To improve the efficiency of the course selection algorithm, we have integrated several advanced techniques:

- **Deep Learning Models:** We use deep learning models such as graph neural networks, convolutional neural networks, and recurrent neural networks to improve the accuracy of the recommendation system. These models are capable of handling complex and multidimensional data sets, which is important for making personalized recommendations based on user behavior and preferences.
- **Vector Space Representation:** Using vector space representation in the deep learning-based recommendation system allows modeling the relationship between users and courses in a multidimensional space. This method helps capture the nuances of user preferences and course attributes for more accurate recommendations.
- **Deep Factorization Machine:** We also experimented with integrating a system similar to DORIS [13], based on deep factorization machine, to model the correlation between students and courses. This system utilizes vector space representation to convert textual features into semantic representation, improving the recommendation process.

These improvements help our system initially effectively deal with common challenges in recommender systems such as cold start and missing data and improve scalability to handle large numbers of users and courses.

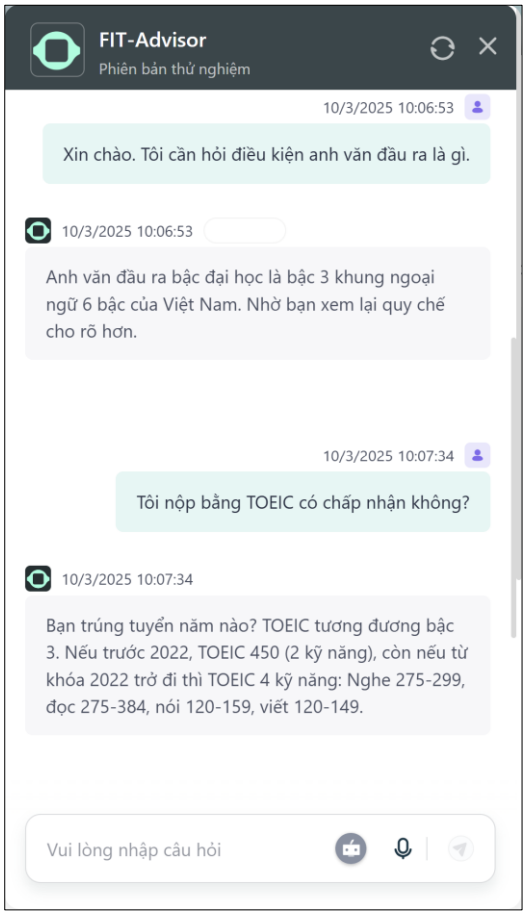

Figure 3: UI chatbot for experimental (Vietnamese language)

4. Experimental Results and Analysis

4.1. Quantitative Results

FIT-Advisor was evaluated using survey data collected from students who interacted with the system to assess the performance and student satisfaction before and after using the system. The results provide insight into the tool's performance in terms of accuracy, usability, and potential for future use. Most participants (71/100) rated FIT-Advisor as "Extremely Useful," while 20 rated it as "Somewhat Useful." Only a small portion (9 participants) selected "Neutral," and no participants rated it negatively. These results highlight the tool's perceived utility in academic advising.

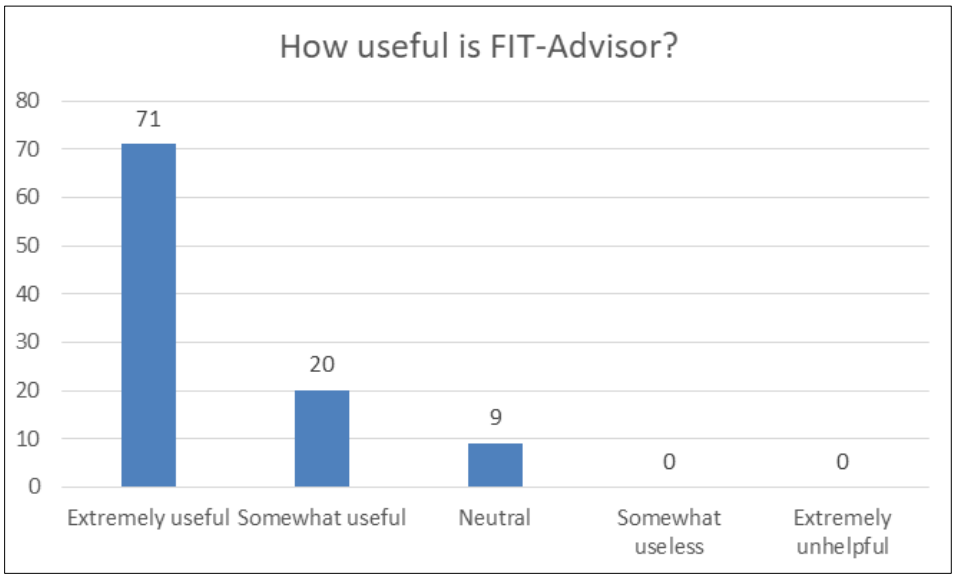

Figure 4: The results answer the question "How useful is FIT-Advisor?"

Most survey respondents (62/100) rated the system's responses as "Completely Accurate," with 33 others selecting "Somewhat Accurate." Only five respondents rated the Chabot's responses as "Neutral," and no one reported significant inaccuracies. This suggests strong confidence in the Chabot's ability to provide reliable, context-aware responses.

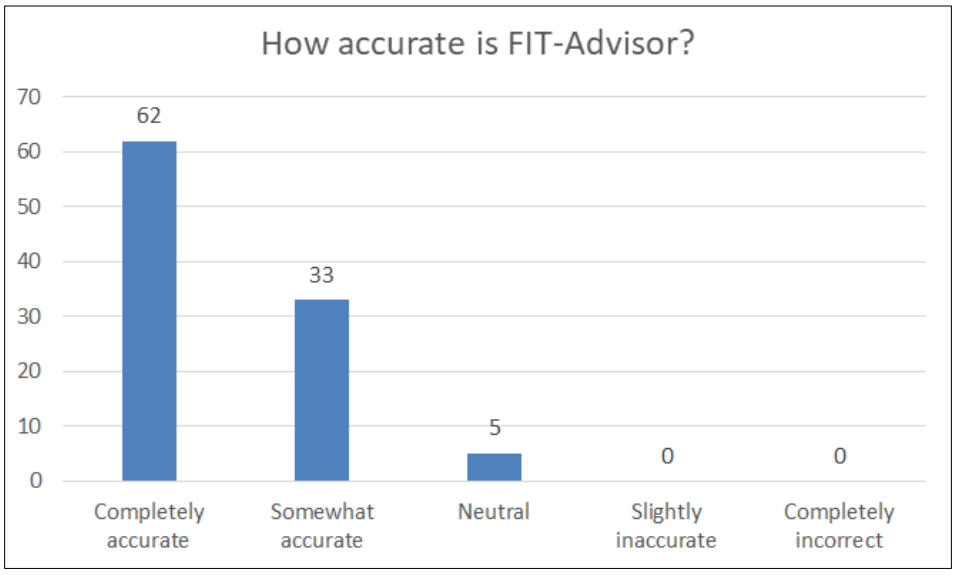

Figure 5: The results answer the question "How accurate is FIT-Advisor?"

When asked about their likelihood of using FIT-Advisor in the future, 39 participants selected "Definitely would use" and 40 selected "Likely". This indicates a high likelihood of continued adoption, with only one participant expressing skepticism ("Not likely to use"). Most participants indicated that they would be likely to recommend FIT-Advisor to a friend, with 45 selecting "Definitely recommend" and 25 selecting "Would recommend". This result underscores FIT-Advisor's reputation for providing valuable academic support. Overall experiences were rated on a scale of 1 (Poor) to 5 (Excellent). The majority (63 participants) rated their

experience as a 5, with 24 giving it a 4. Only a small number of participants rated their experience lower, confirming strong student satisfaction with FIT-Advisor.

4.2. Qualitative Analysis

Open feedback from users provided more detailed insights into Fit-Advisor's strengths and areas for improvement.

Strengths:

Users appreciated the chatbot's ability to provide quick and contextual answers. The intuitive, easy-to-use interface was also one of the prominent advantages mentioned frequently.

Some areas for improvement:

- Some responses are still mechanical, need to increase the naturalness and diversity in the answers.
- Some students wish to be able to ask multiple questions in a row and receive more detailed, relevant responses to each learning situation.
- More frequently asked questions, guidance on the study plan for the entire course or each semester, as well as support for navigating the study schedule according to specific assignments should be added.
- Although the chatbot rarely fails to respond, there are still cases where it is exploited to answer queries outside the scope of the topic. This suggests that the filtering mechanism needs to be improved to ensure the appropriateness of feedback across all scenarios.

Overall, the results show that Fit-Advisor effectively addresses many of the challenges of traditional academic advising, including accessibility, accuracy, and personalization. The overwhelmingly positive feedback on usefulness, accuracy, and user experience reinforces the platform's potential for expansion. However, qualitative feedback also points to some opportunities for improvement, such as expanding features and adjusting conversational tone. These findings provide a clear direction for future iterations, with a focus on optimizing the student experience based on real-world needs and expectations.

5. CONCLUSION

This research proposes an AI-integrated learning advisory model, combining virtual assistants and personalized subject recommendation systems to improve learning performance and student satisfaction. The results of our pilot study at the Faculty of Information Technology show that the model is feasible and has the potential for practical application. In addition to supporting students in choosing a suitable learning path, the model also helps personalize the learning experience through chatbots that support basic knowledge, creating conditions for students to self-study more proactively and effectively. In addition, this system can continuously improve by applying data evaluation and optimization methods, thereby improving the quality of learning advisory over time. Expanding and developing the model not only helps students access accurate and timely information but also contributes to promoting innovation in teaching methods in higher education, which is increasingly innovating and vigorously applying technology. However, it is essential to note that such systems should complement rather than replace human advisors, as human advisors' personal touch and expertise remain crucial in addressing complex student needs.

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