

## PAPER

# The Educational Recommendation System with Artificial Intelligence Chatbot: A Case Study in Thailand

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## ABSTRACT

The educational recommendation system with an artificial intelligence (AI) chatbot is a system designed to operate on smartphones and is intended for use at the College of Industrial Technology in Thailand. Compatible with both iOS and Android operating systems, the educational recommendation system in this research is capable of providing educational recommendations and valuable information about the engineering degree program. It includes information about the Electronics Engineering Technology Department, relevant bodies of knowledge that can enhance awareness and public relations, and a proactive introduction to information. The main objectives of this study are to develop the capacity to analyze educational issues and provide useful and accurate information for educational recommendations, as well as to explore the possibilities for enhancing this system. The results of the study address the three research questions and demonstrate that the process and structure of the educational recommendation system with an AI chatbot can be utilized to create educational recommendation tools in higher education. These tools are accessible anywhere and at any time through small mobile devices. The system is also compatible with popular social media applications and is capable of analyzing user questions precisely and accurately to find the optimal answers that can meet the user's needs. However, there are still gaps in the research that need to be investigated in the future. These studies should include exploring a broader range of applications among the general population and educational settings to assess the effectiveness of the educational recommendation system with an AI chatbot. Additionally, they should examine the skills that impact the utilization of educational technology in various contexts.

## KEYWORDS

artificial intelligence (AI) chatbot, educational recommendation system, higher education

## 1 INTRODUCTION

Today, the rapid development of information technology has led both the public and private sectors worldwide to implement IT systems for the development and

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management of organizational systems. These systems aim to provide their staff with knowledge and learning resources, aligning with policies that promote lifelong learning and self-improvement [1]. For example, the NextGenerationEU instrument was utilized for qualification and requalification programs for the unemployed following the onset of COVID-19. This initiative aimed to revive and expedite the economy in the European Union while fostering lifelong learning in the realms of green and digital skills [2]. All these elements are considered key mechanisms for developing human potential and the capabilities required to meet the dynamic challenges of the world [3], with a focus on acquiring knowledge, developing skills, and fostering positive attitudes towards lifelong learning.

Clearly, learning technologies have become an integral part of education in the digital age, as new technologies are constantly being designed and developed. The exceptional capabilities and features of these new technologies have given rise to what are known as emerging technologies, which can facilitate effective learning and efficient use [4]. For example, the utilization of chatbots for delivering customer services or technical support information enhances the interpretation and comprehension of existing content while also enabling the automatic generation of new content. This includes the use of different languages in the dubbing of films and educational content to support multiculturalism, and the use of ChatGPT to facilitate electronic correspondence, filter information, search for information, and summarize complex information into a coherent story.

## 1.1 Artificial intelligence technology in higher education

In recent years, artificial intelligence (AI) has been recognized as a technology that leverages vast amounts of data to conduct analysis, prediction, and forecasting to uncover new algorithms for more accurate predictions and forecasts. AI has been widely and practically applied in science, industry, medicine, and education. This is why the rapid expansion of AI, as well as its subfields such as natural language processing (NLP) and machine learning, is expected to address the aforementioned challenges [5] and cater to the learning contexts of digital learners.

Recently, AI in education and assessment has received a lot of attention because it can enhance the quality of education, practical learning, teaching methods, and assessment techniques. Russell et al. [6] have stated that AI is a new technology that emerges from the fusion of human ingenuity and technology to develop smarter, more user-friendly tools and equipment with high performance and the capability to analyze problems in a logical manner. A number of AI applications have been created based on machine learning (ML) [7]. Thanks to their ability to forecast or predict data, these AI applications can enhance organizational efficiency by assisting in decision-making, planning, and management. One of the unique features of ML is deep learning (DL), which is an educational approach focused on utilizing advanced cognitive abilities to enhance learners' knowledge and skills [8].

Kingchang et al. [9] stated that AI consists of the following five main components:

1. Machine learning: This refers to a group of methods used in AI in order to predict or forecast new properties of data that align with system improvement [10]. One of the unique features of ML is DL. Therefore, ML technology is utilized to develop predictive tools that offer analysis results to assist in decision-making.
2. Robotics: This component is a model of the human body that is controlled by a computer. It is designed to work in place of humans in operations that require speed and involve risk.

3. Natural language processing system: This system enables computers to comprehend messages and speech as humans do. The techniques and processes in NLP are primarily related to syntax and semantic analysis. This is achieved by deconstructing messages or sentences in human communication into smaller parts or simple language patterns that are easily understandable for the devices. Then, the devices will analyze and process the relationships between the simplified messages to extract information and summarize the main ideas for communication [11].
4. Expert system: This refers to an intelligent computer system equipped with knowledge and the capability to analyze problems using reasoning. The system can also utilize existing knowledge or knowledge derived from experiences to solve one problem and apply the same logic to solve other problems.
5. Speech recognition system: This component is a computer system capable of understanding human language and recognizing human speech in a continuous manner. Speech recognition is a technology that enables machines to recognize words and phrases. This recognition can be further utilized to generate messages through an acoustic and a language model.

From the above content, it is clear that AI technology has been widely applied in the field of education in various contexts. In particular, the recognition system has been used in data analysis and prediction to make valid decisions on the technical basis of a natural language processing system and machine learning technology. The result is a voice recognition system and a face recognition system [12] that can interact effectively with users in real time.

## 1.2 The importance of chatbots in higher education

Chatbots are known as very popular tools in this digital age because they can interact with users through conversations, whether written or spoken, and can analyze users' questions or keywords, then respond appropriately [13]. These programs enable quick, automatic responses in text or voice chat form and are compatible with many social networking applications [14]. Chatbots are divided into five categories based on different functions, as shown below:

1. Scripted or quick reply chatbot: Users are required to choose the questions listed in a menu so that the chatbot can clearly understand what the user desires. It will then respond according to predetermined keywords.
2. Keyword recognition-based chatbot: This kind of chatbot detects patterns in keywords provided by the user and then replies to the user with predetermined messages.
3. Voice-enabled chatbot: The chatbot in this case processes the answers based on the user's voice only.
4. Hybrid chatbot: This chatbot is a combination of some functions. Users simply type or select questions from a menu bar so as to get the most relevant answers.
5. Contextual chatbot: This chatbot is more complicated than the others above because it is developed with both ML and AI. It is capable of developing itself since it can memorize conversations and learn from questions in order to give more efficient responses next time.

The College of Industrial Technology is a faculty of King Mongkut's University of Technology North Bangkok. The college provides a variety of programs, such as the Vocational Certificate Program, the Pre-Engineering Program, which offers bachelors, masters, and doctoral degrees, etc. The undergraduate program discussed in this study

is the Bachelor of Engineering Program at the Department of Electronics Engineering Technology. Instructional management emphasizes mainly theory and practice related to radio and television broadcasting. This approach enables students to apply their knowledge and practical experience to meet the requirements of the industrial sector. Thus, public relations and the dissemination of information related to the field of broadcasting are considered necessary and beneficial for students as well as the general public, both within and outside the university. This is because public relations is one of the media tools that not only helps in building a positive image for organizations but also provides a clear and valid understanding in the same direction.

### 1.3 Research gap

After a thorough review of the relevant concepts, theories, and literature, this study still has research gaps. It is necessary to study the guidelines for developing an artificial intelligence chatbot for the College of Industrial Technology in Bangkok, Thailand. This will enable its use as a tool for analyzing issues, providing educational recommendations, and managing public relations to foster mutual understanding. Existing studies have clearly shown that the integration of AI and chatbots in educational systems can effectively enhance learning outcomes and offer valuable insights into higher education. In this study, the researchers implemented the hybrid chatbot concept to create an educational recommendation system with an AI chatbot. The sample group comprised individuals interested in pursuing studies at the College of Industrial Technology in Bangkok, Thailand. The system is intended to be used as a tool to facilitate communication, which can be accessed anywhere and at any time. This leads to a proactive form of communication that aligns with the current global situation. The system has been designed using digital technologies and innovations. It is expected to deliver maximum benefits in line with educational recommendations in higher education.

The primary objectives of this study are to develop the capacity to analyze issues and provide useful and accurate information regarding educational recommendations. Additionally, the study aims to explore participants' perspectives on the development of this system. Research participants agreed to complete the evaluation form and were well protected by confidentiality and anonymity policies. The aim is to determine whether the educational recommendation system with an AI chatbot is effective in analyzing questions and providing useful and accurate information on education recommendations.

The remainder of this document is organized as follows: Section 2 describes the methodology aspects of this study. The main results are presented in Section 3 and discussed in Section 4. Section 5 is reserved for conclusions and outlook.

## 2 MATERIALS AND METHODS

The development of the educational recommendation system with an AI chatbot is based on the concepts of the systems approach [15], [16], which focus on the design and development of an instructional system. In addition, the system was developed according to the System Development Life Cycle (SDLC) theory [17], which represents the stages and processes of system development. It consists of four stages: planning, design, development, and implementation. This study includes the following research questions (RQs):

- RQ1: What is the methodology for developing the educational recommendation system with an AI chatbot?

- RQ2: What are the elements and work processes of the educational recommendation system with an AI chatbot?
- RQ3: What are the opinions of the participants after using the educational recommendation system with an AI chatbot?

This study uses the pre-experimental research method with a single case study and is designed to address the three research questions mentioned above. To answer question 1, the researchers provide details on the methodology of the educational recommendation system with an AI chatbot to demonstrate that the AI chatbot can be applied in practice. In response to question 2, the researchers discuss the components and workflow of the system architecture, along with a swimlane diagram that validates the AI chatbot's capability and accuracy in analyzing questions. With regard to question 3, the effectiveness evaluation form is used to assess the AI chatbot's development prospects and to determine its ability to answer questions and provide useful information and recommendations in higher education.

## 2.1 Participants

This study involves 50 participants, comprising instructors, staff, and students from the College of Industrial Technology at King Mongkut's University of Technology North Bangkok. Sharing a common interest in AI technology, chatbot technology, and educational recommendations, these participants were selected using cluster sampling to gather a sample group with similar characteristics. It is very important to explore the development prospects of AI chatbots and determine their ability to analyze questions and provide useful and accurate information on educational recommendations. Consequently, these participants were also well protected by the privacy and anonymity policy.

## 2.2 Research instruments and data collection

The data collection instruments are (1) the AI chatbot educational recommendation system and (2) the effectiveness evaluation form for the AI chatbot educational recommendation system. The statistics used for data analysis are the mean and standard deviation (SD). For data collection, the researchers used an evaluation form that had already been tested by experts for its objective item congruence index (IOC). Prior to the voluntary evaluation on this form, participants were informed that they were free to make decisions and accept participation. Above all, they were assured that their identity would not be revealed.

## 2.3 Method

The methodology of this study can be summarized into three stages. It is intended to address the research question.

RQ1: What is the methodology for developing the educational recommendation system with an AI chatbot?

Stage 1: Designing the educational recommendation system with an AI chatbot: This stage primarily involves designing the structure and elements of the education recommendations system with an AI chatbot. The research tools in this stage

include the system architecture of the educational recommendation system with an AI chatbot, the swimlane diagram illustrating the work process of the education recommendations system with an AI chatbot, and the user interface of the educational recommendation system with an AI chatbot.

Stage 2: Developing the educational recommendation system with an AI chatbot: The researchers utilized the Botnoi platform, typically employed for creating chatbots using AI technology. Botnoi can be connected to a variety of database systems and API systems, enabling conversations and interactions to sound flexible and natural. Not only that, it can also support data acquisition and display in the Thai language. In the study of specific techniques in NLP systems, researchers utilized syntax and semantic analysis techniques to examine the questions and answers in messages. This enabled the system to make accurate and intelligent decisions and respond to users until they were satisfied.

Stage 3: Study the results after implementing the educational recommendation system with an AI chatbot: The researchers utilized research tools to analyze the outcomes following the participation of 50 individuals, comprising instructors, staff, and students from the College of Industrial Technology at King Mongkut's University of Technology North Bangkok, in using the educational recommendation system with an AI chatbot. This study aimed to verify the efficiency of the education recommendation system with an AI chatbot in responding to users' demands. It also assessed its ability to analyze questions and provide useful, accurate information on education recommendations. The average score and its interpretation [18] are shown in Table 1.

**Table 1.** Range of average scores and interpretation of results

Range of Average Score	Interpretation of Appropriateness
4.50–5.00	Very high level of efficiency
3.50–4.49	High level of efficiency
2.50–3.49	Moderate level of efficiency
1.50–2.49	Low level of efficiency
0.00–1.49	Lowest level of efficiency

### 3 RESULTS

The primary objective of this study is to demonstrate that an educational recommendation system with an AI chatbot is a tool capable of analyzing questions and providing valuable and precise information about educational recommendation in higher education.

#### 3.1 The design of the educational recommendation system with AI chatbot

This stage focuses on designing the structure and components of the educational recommendation system with an AI chatbot. These design elements are derived from the analysis of current conditions, and the user needs to establish guidelines that align with stakeholders' requirements. Also, this research aims to address the following research question:

RQ2: What are the elements and work processes of the educational recommendation system with an AI chatbot?

The research tools in the educational recommendation system with an AI chatbot can be summarized as follows:

The system architecture represents the structure and elements within the system, including the relationships between users and subsystems.

Figure 1 illustrates the architecture of the AI chatbot educational recommendation system, consisting of four main components: stakeholders, the AI chatbot educational recommendation system, the server and database, and the user interface. The details of each element are as follows:

- Stakeholders refer to those who use the educational recommendation system with an AI chatbot, such as administrators, users, etc. Upon initial access to the system, these users are required to log in to verify their identity and set up their user permissions.
- The educational recommendation system with an AI chatbot is the section designated to analyze and process questions and answers to obtain useful data for educational recommendations. Referring to the work process, once a user asks questions through an application on social media, all data will be processed in Botnoi according to the conversation models that the administrator has created using an NLP system. In this study, the researchers utilized syntax and semantic analysis techniques to examine questions and answers from the texts in order to make accurate and intelligent decisions. The database system will store the data for analysis and processing and connect it via API, making conversations and interactions appear flexible and natural.
- The server and database are components that store various data in the system, including questions and answers, user data, user permission, etc.
- The user interface is utilized to manage the connection between devices capable of displaying conversations through the Botnoi platform and the server and database systems. This facilitates efficient communication between the two systems.

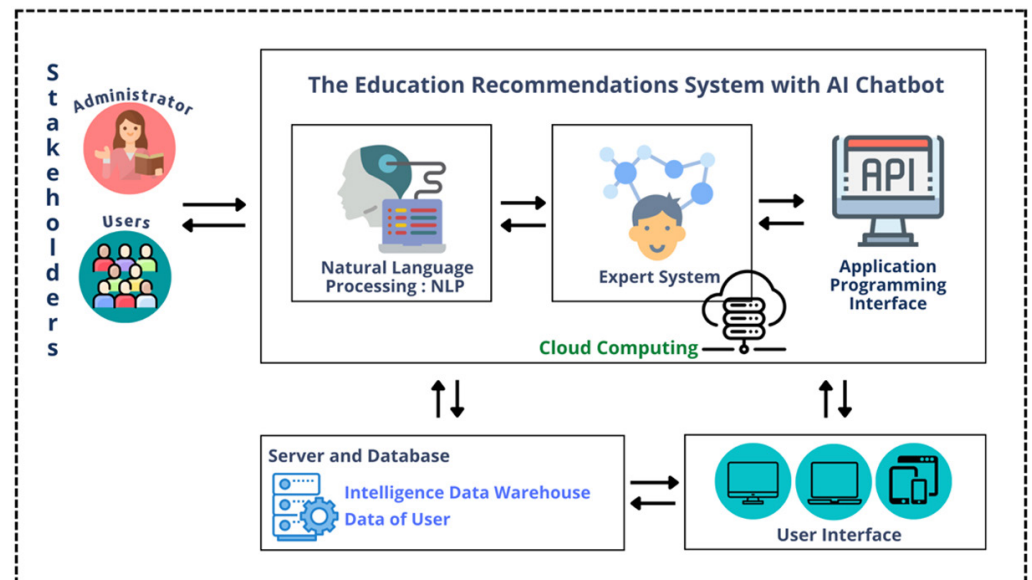


Fig. 1. Educational recommendation system architecture with AI chatbot

Figure 2 shows the swimlane diagram of the educational recommendation system with an AI chatbot, which is divided into two sections. The first section is the administrator section, where the administrator can customize or manage the

chatbot’s parameters using the chatbot engine. For example, the administrator can configure the conversation connection, questions, and answers, analyze and process questions and answers, process and retrieve answers from the database, and so on. The other section is the user section. This section is dedicated to the analysis and processing of questions and answers to generate valuable information for educational recommendations. In this section, when the user initiates the conversation, the system asks for basic information such as first and last name, age, level of education, etc. The user, subsequently, can request the specific information they would like to receive. The user can then request the information they require.

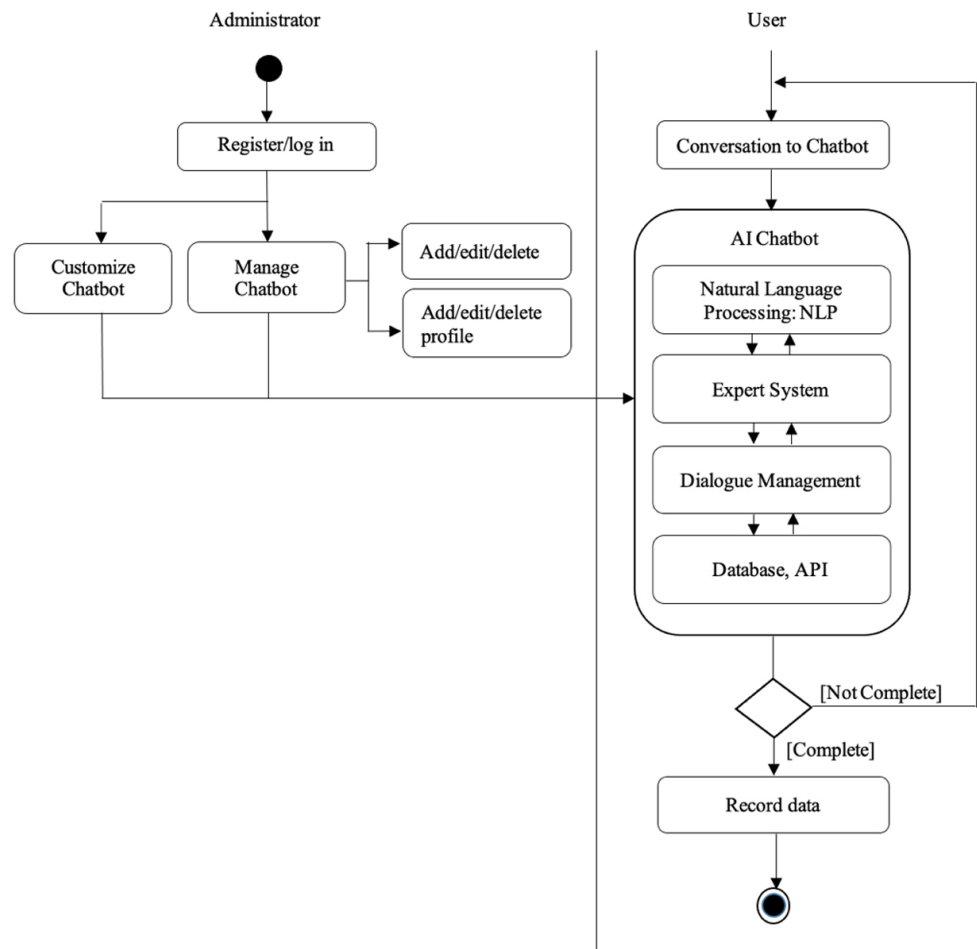


Fig. 2. Swimlane diagram of educational recommendation system with AI chatbot

Regarding the workflow in this system, the researchers utilized the concept of a hybrid chatbot in the development process. Users have the option to type questions or select questions from the menu bar to receive the most optimal answers. Once users ask questions through any applications on social media, all data will be processed through the NLP system. This system utilizes syntax and semantic analysis techniques to study questions and answers from texts, enabling it to make informed decisions through the expert system. The system will continue to respond to users until they are satisfied with the answers. In the meantime, the database system will store the data for analysis and processing and connect it via API, making conversations more flexible.

The researchers designed the user interface using the Botnoi platform for creating chatbots through AI technology. This platform was chosen for its ability to connect to various database systems and the API system. The user interface is shown in Figure 3.



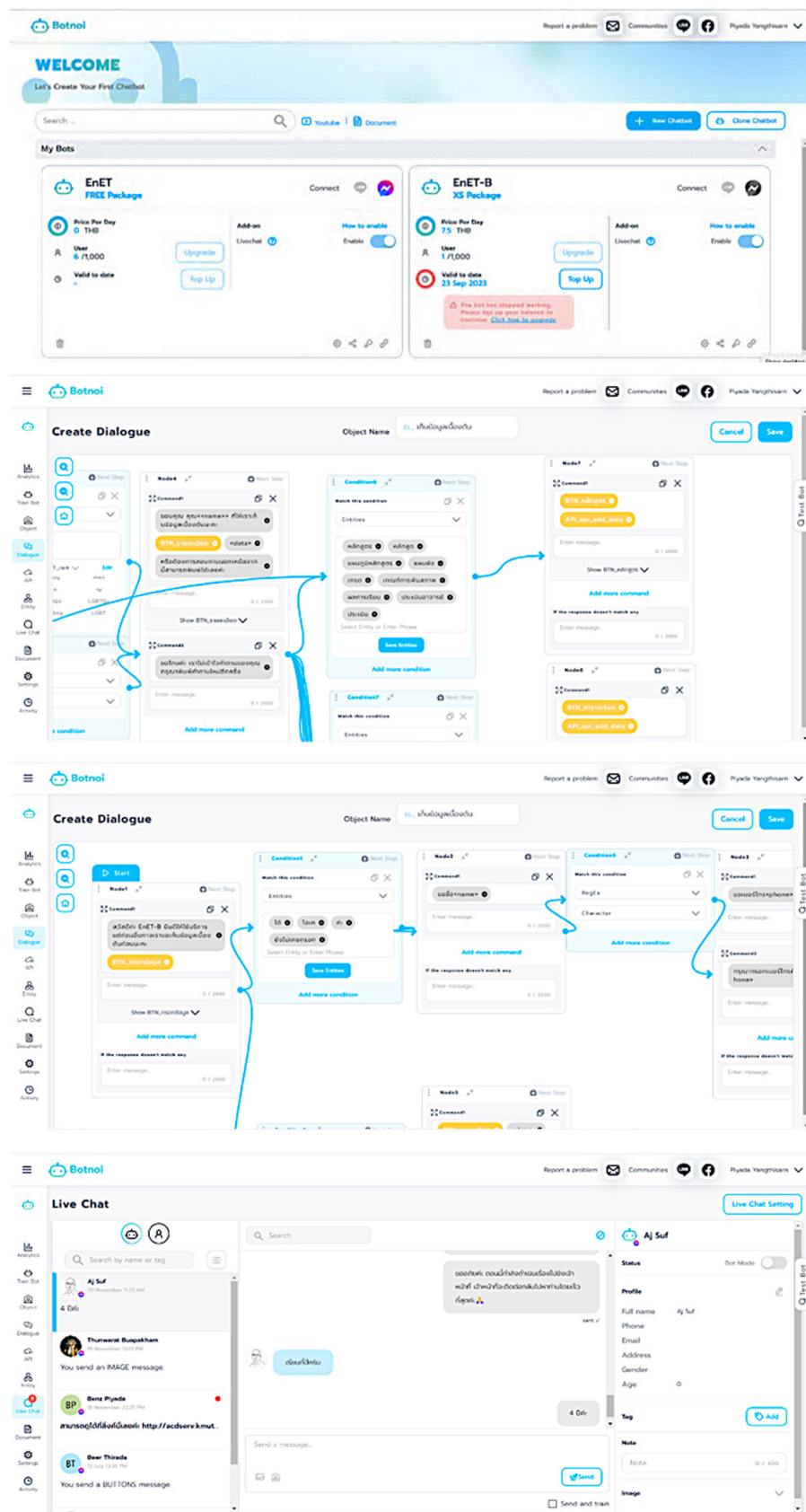


Fig. 3. The user interface of the educational recommendation system with AI chatbot, designed with the Botnoi platform

### 3.2 Developing an educational recommendation system with an AI chatbot

The educational recommendation system with an AI chatbot is a system that can operate on both PC and smartphone applications. This educational recommendation system is designed for use in the College of Industrial Technology. It offers educational suggestions and valuable information about the Bachelor of Engineering program in the Electronics Engineering Technology Department. It includes including relevant bodies of knowledge that can enhance awareness, public relations, and the proactive introduction of information. In this study, the researchers utilized the Botnoi platform, which is commonly employed for developing chatbots using AI technology. Botnoi can be connected to various database systems and the API system. It can also support the acquisition and display of data in the Thai language, as illustrated in Figure 4.

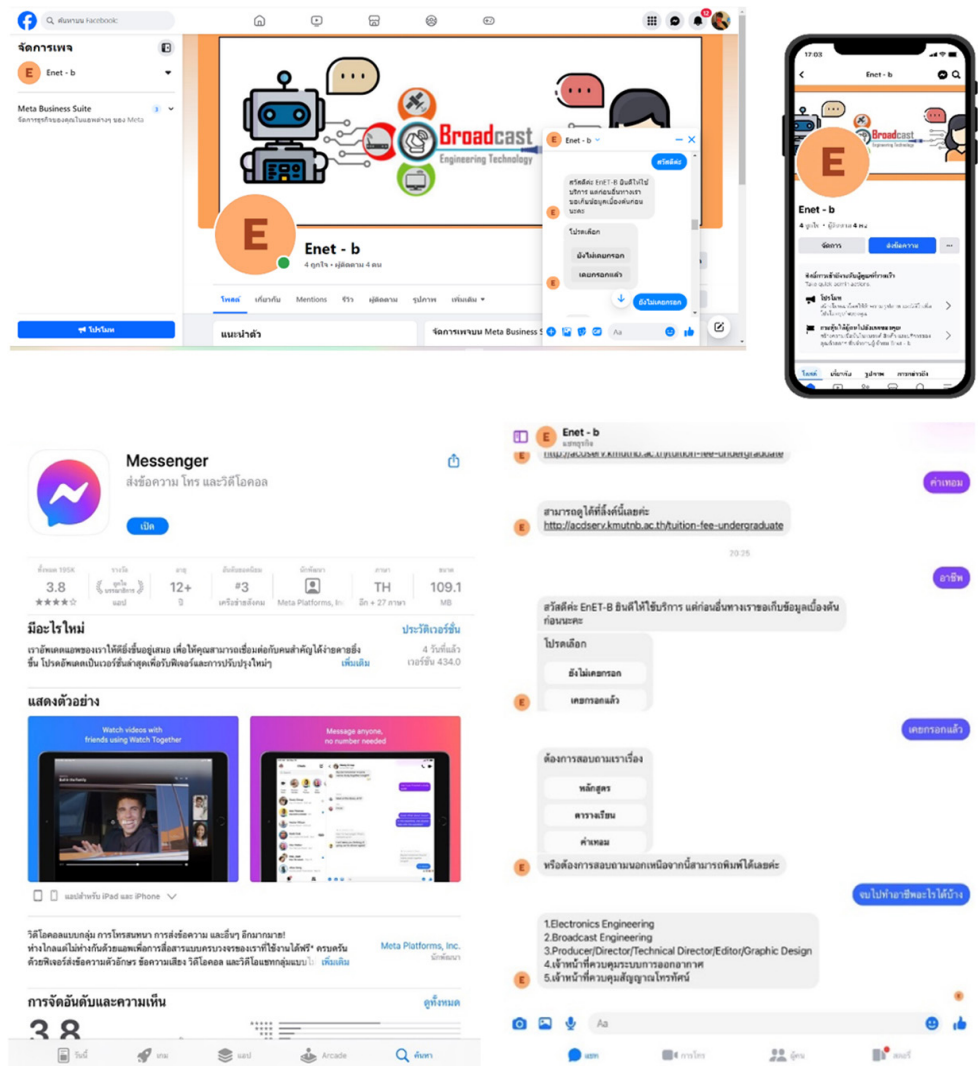


Fig. 4. The educational recommendation system with an AI chatbot: a case study at the College of Industrial Technology (Thailand)

### 3.3 Results of the AI chatbot effectiveness evaluation

This study focuses on exploring perspectives towards the AI chatbot educational recommendation system to verify whether the system is effective in analyzing

issues and providing useful education recommendations. The study was conducted using the pre-experimental research method, employing a single case study with 50 participants. The confidentiality and anonymity of the participants were well protected. In addition, this research aims to address the following research question:

RQ3: What are the opinions of the participants after using the educational recommendation system with an AI chatbot?

According to the evaluation results of the efficiency of the educational recommendation system with an AI chatbot in Table 2, it was found that the overall accuracy is at a very high level (mean = 4.50, SD = 0.66), the overall design is at a very high level (mean = 4.56, SD = 0.58), the overall efficiency is at a high level (mean = 4.48, SD = 0.65), and the overall application for practical use is at a very high level (mean = 4.54, SD = 0.63) as well. Therefore, it is evident that the educational recommendation system with an AI chatbot is effective in analyzing questions, providing accurate answers, and offering valuable educational recommendations in higher education at the College of Industrial Technology in Bangkok, Thailand.

After utilizing the educational recommendation system with the AI chatbot, discussions with all participants revealed that the AI chatbot can accurately analyze questions and provide valuable and accurate information on education recommendations. Users appear to be highly satisfied with the interaction and real-time response provided by the app, which is extremely convenient since it can be accessed from anywhere and at any time.

**Table 2.** AI chatbot effectiveness evaluation results

Items for Evaluation		Mean	SD
Accuracy	1. Ability to review questions	4.38	4.38
	2. Ability to answer questions correctly	4.48	4.48
	3. Ability to provide education recommendations	4.50	4.50
	4. Accuracy of Hybrid Chatbot	4.54	4.54
	5. Ability to present images of the answers corresponding to questions	4.58	4.58
Overall accuracy		4.50	0.66
Design	6. Clarity of images	4.66	0.56
	7. Chatbot's ability to interact	4.46	0.61
	8. Suitability of usability format	4.46	0.61
	9. Consistency of questions with education recommendations	4.58	0.57
	10. Suitability of question arrangement	4.64	0.53
Overall design		4.56	0.58
Efficiency	11. Efficiency in answering questions	4.42	0.64
	12. Efficiency of communication	4.54	0.61
	13. Efficiency in overall speed of response	4.48	0.68
	14. Efficiency and benefits in practical use	4.38	0.70
	15. Efficiency in data management	4.60	0.61
Overall efficiency		4.48	0.65
Application for practical use	16. Ability to recognize up-to-date information	4.52	0.65
	17. Ability to access information	4.50	0.65
	18. Ease of communication and use	4.60	0.61
	19. Coherence in conversation and answering questions	4.48	0.65
	20. Ability to be applied for practical use	4.62	0.60
Overall application for practical use		4.54	0.63

## 4 DISCUSSION

The results of this research align with the main objectives and can address all the research questions. When compared with the results of previous research on the use of an AI chatbot to offer educational recommendations, it is evident that the findings of this study align with those of Charaluk et al. [19]. They suggested that mobile apps can serve as proactive public relations tools to meet users' demands for swift information access through smartphones and tablets. Moreover, the results are consistent with the research of Kingchang et al. [9], who mentioned that the utilization of digital technologies and innovations as tools to support decision-making on small mobile devices, enabling communication anywhere and anytime, can foster proactive communication that responds effectively to current global situations. This is because such technologies and innovations are capable of analyzing and reviewing questions correctly and accurately and selecting responses that are precisely appropriate to users' aptitudes. In addition, this aligns with the research of Chatwattana et al. [20], who stated that utilizing current technologies or platforms in higher education learning management can enhance learning and group activities, enabling students to engage with each other in real time. Moreover, it is also in line with the research by Zaky [21], who stated that utilizing technology to create enjoyable educational experiences can motivate learners to accomplish specific goals while also enhancing their engagement and motivation to learn. The results of this research are also in agreement with the study by Bachiri et al. [22], who asserted that the integration of AI in education can enhance the quality of education and the efficiency of learning and assessment methods. Additionally, AI systems, as well as chatbots, are believed to assist students with personalized feedback and support because these systems utilize ML techniques and automatic natural language processing to acquire quick and accurate results.

## 5 CONCLUSIONS

This study primarily focuses on developing and exploring the potential of an educational recommendation system with an AI chatbot. The aim is to verify the effectiveness of this system in analyzing questions and providing valuable educational recommendations. The main objective was to develop the capability to analyze inquiries and offer valuable and precise information on educational suggestions at the College of Industrial Technology, King Mongkut's University of Technology North Bangkok, Thailand, and subsequently utilize it in creating a practical tool. This tool must facilitate communication and be accessible anywhere, anytime. This should lead to proactive communication, enabling everyone to interact in real-time using any application on PCs and smartphones.

All 50 participants in this research agreed to take part in the study in compliance with confidentiality and anonymity policies by answering the questionnaire using a five-point rating scale. The results of the study help answer the three research questions. It is evident that the process and structure of the educational recommendation system with an AI chatbot can be utilized to enhance educational recommendation tools in higher education. These tools can be accessed from anywhere and at any time using small mobile devices. The system is capable of efficiently and accurately analyzing and answering users' questions. It also provides valuable information on education recommendations at the College of Industrial Technology Bangkok, Thailand.

Despite this, the work still has some significant limitations. Firstly, this study is focused on a specific group of participants with limited abilities. Consequently, the results derived from this research are considered to be the findings of a pilot study only. To confirm the results of the study more explicitly, future studies should be conducted with a larger and more diverse sample of research participants to validate the research's relevance. As for the other limitation, the scope of this study is solely confined to chatbot technology. Future studies may need to encompass a broader range of technologies. In summary, this study still plays a vital role in promoting awareness and proactive public relations by providing accurate and valid information through self-learning. This initiative aims to promote lifelong learning by maximizing the use of digital technologies in higher education instruction management.

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