https://doi.org/10.59865/abacj.2023.55

Special Issue-Application of Structural Equation Modeling in Business, Sport, Tourism, Recreation, Education, and Language Studies

THE DEVELOPMENT OF CHATBOT PROVIDED REGISTRATION INFORMATION SERVICES FOR STUDENTS IN DISTANCE LEARNING

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Abstract

In recent years, chatbots have become crucial, particularly for assisting students with real-time registration information. This research focused on 1) synthesizing registry works related to information provided for students, 2) designing chatbots and conversation structures in the form of interactive conversations between students and robots for answering questions and providing information tailored to their needs, and 3) examining and evaluating the use of chatbots in providing information services to students, while analyzing the accuracy and suitability of the developed chatbot. This study, based on research and development, utilized a sample consisting of 16 staff directly involved in the provision of registration information to students and 255 undergraduate students from Sukhothai Thammathirat Open University, with respondents being selected through a simple random sampling technique. The synthesis of the research results revealed the following findings: 1) A qualitative study revealed that the registration information related to students, called STOU Journey, consisted of 10 issues, and was required for the whole learning period. 2) The result of the design and development of the chatbot revealed that the developer chatbot could be used on both the website and the LINE application. It was also found that the chatbot could answer most questions correctly and completely. The chatbot responded quickly and was easy to use. The chatbot used language that was easy to understand and natural, while 3) satisfactory evaluation results from 255 undergraduate students showed that overall, students who had used the completed version of the chatbot were satisfied with the use of the chatbot at a high level (*Mean* = 4.19, *SD* = 0.98) while they also felt that the chatbot was easy to use (*Mean* = 4.33, *SD* = 0.95) and the using the chatbot felt like a natural conversation (*Mean* = 4.22, *SD* = 0.99).

Keywords: Chatbot; Registration Information; Distance Learning; User Experience

1. INTRODUCTION

Distance education offers flexible, anytime, anywhere learning tailored to individual needs and interests, utilizing various resources such as textbooks and video clips. This approach is well-suited for learners of all ages and genders in the modern "new normal."

As Thailand's pioneering institution for open higher education, Sukhothai Thammathirat Open University has modernized its extensive distance learning programs to align with contemporary, technology driven educational paradigms (Nicol et al., 2018). The university employs an integrated communication framework, encompassing traditional media outlets like television and advertising and digital platforms like YouTube and social media. This multifaceted communication

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strategy is designed to provide students with pertinent information about academic services and administrative procedures, thereby facilitating their scholarly research and academic pursuits.

To ensure that students can efficiently plan and monitor their educational journey, the university disseminates crucial information covering various topics, from teaching methodologies and learning services to detailed registration protocols. This comprehensive dissemination includes various regulations, guidelines, and announcements, that span the entire academic cycle, from initial enrollment and study plan formulation to examinations and, ultimately, graduation.

Registry and measurement data indicate a high daily volume of student inquiries about registration, study plan alterations, and exam format choices. These trends are corroborated by statistics from Facebook inquiries, as documented by the Urai and the Paitoon page on Facebook for the 2018-2020 registration periods, as shown in Table 1.

Statistical data from the Office of Registrar and Evaluation indicates an increasing demand for accurate information among students. Despite the proliferation of communication channels, students need help navigating information in alignment with prior research findings. Studies underscore that distance and open university students perceive learning materials, online systems, and institutional resources, as user-unfriendly and challenging to access (Budiman, 2018; Paepe et al., 2018).

Students frequently turn to Urai and Paitoon's Facebook channel for direct and

Table 1 The Statistical Usage of Online Platforms for Disseminating Registration Information.

Topic	Statistics from Online Inquiries Via the Urai Page on Facebook			Statistics from Online Inquiries Via The Paitoon Page on Facebook		
	2018	2019	2020	2018	2019	2020
1. Enrollment	308	280	30	1,392	1,488	657
2. Major reassignment	52	37	2	246	352	73
3. Re-examination	945	986	63	3,258	3,794	2,207
4. Course withdrawal	17	37	7	686	612	139
5. Educational material	274	170	21	1,571	1,183	316
6. Leave of absence	95	120	8	609	656	310
7. Change of address, test center relocation	117	124	26	646	938	370
8. Re-enrollment	1	5	0	111	82	53
9. Change or title, name, or surname	10	2	0	73	77	15
10. Making a student ID card	53	23	0	386	278	67
11. Credit transfer / course equivalency	58	29	4	489	512	149
12. Applying for graduation	27	54	5	354	398	98
13. Certificate	143	87	11	973	1,241	243
14. Exam results	288	223	18	693	1,392	2,126
15. Attending training	49	43	5	1,427	627	142
16. Credential verification or document authentication	0	0	0	67	51	0
17. Administrative matters or financial transactions	44	0	0	459	913	1,361
Total	**2,481**	**2,220**	**403**	**13,440**	**14,594**	**8,326**

Source: Information Department, Office of Registration and Evaluation, STOU. (2020)

personalized inquiries, with staff responses typically taking 10-15 minutes. However, the limited availability of staff and constrained official working hours can hinder the timely delivery of information. Outside these hours, students must rely on the university's website or phone service for immediate assistance.

The implementation of chatbots holds the potential to address the limitations of in-person query resolution, offering a swifter and more efficient student service. Chatbots present cost-effective and scalable solutions to meet both individual and group informational needs, aligning with the trends in enhancing service efficiency (Bii, 2013; Rahman et al., 2017; Fryer et al., 2019; Khanthavit & Khanthavit, 2023).

This research aims to utilize registry data to assess student needs and guide the design of chatbots for improved information services. By evaluating the accuracy and suitability of the chatbots, this study seeks to enhance both student planning processes and the university's technological capabilities for registration information.

2. LITERATURE REVIEW

2.1 The Concept of Distance Learning

Three core terms in distance learning are prevalent: Distance Education, Distance Teaching, and Distance Learning. While they often appear interchangeably, they carry nuanced differences:

1) Distance Education: This refers to an organized learning environment where teachers and students are not co-located (Srisaan, 1986; Sangsri, 2017; Bond, 2021; Putri & Sari, 2021). This educational modality leverages various media for instruction and emphasizes pedagogical interactions (Whalen, 2020).

2) Distance Teaching: This concept emphasizes flexibility in both timing and location, catering to learners' convenience and readiness (Moorhouse & Wong, 2022; Srisaan, 1986; Putri & Sari, 2021). It opens the door to many teaching methods, regardless of the learners' geographical locations (Sangsri, 2017; Bond, 2021).

3) Distance Learning: This learning modality enables individuals to acquire knowledge and skills via various media through mass communication systems (Whalen, 2020). Unlike traditional settings, learners are not bound to any classroom or specific teacher (Sangsri, 2017; Bond, 2021; Putri & Sari, 2021).

The confluence of distance learning and academic writing capitalizes on digital platforms to enhance students' writing abilities. Within this framework, students can engage in diverse writing exercises, receive instructor feedback, and collaborate with peers virtually, thus underlining the importance of proficient written communication in remote learning settings.

2.2 The Registration Information Related to Students

1) University Regulations Sukhothai Thammathirat Open University Regarding Undergraduate Education 2004, 2) University Regulations Sukhothai Thammathirat Open University on Registration and Study Leave of Undergraduate Students, 2008, 3) Sukhothai Thammathirat Open University's Regulations on Tuition Fee Tuition fees and educational material costs Undergraduate degree 2015, 4) University Regulations Sukhothai Thammathirat Open University Thammathirat on Renewal of Status of Undergraduate Students 2008, 5) Announcement of Sukhothai Thammathirat Open University on maintaining the status of students enrolled in the last semester, and 6) Sukhothai Thammathirat Open University Regulations on Diploma Education, B.E. 2528, Section 2, Name and Curriculum Structure.

2.3 The Concept of Chatbots

Chatbots are software robots deployed in messaging applications to answer frequent questions or provide in-chat services. Current trends favor chatbot usage due to its cost-effectiveness compared to traditional methods (Fryer et al., 2019; Rahman et al., 2017;

Suksomwat, 2019).

2.3.1 Classification of Chatbots According to their Intelligence

1) Script Bot / Rules-Based is a chatbot that can only understand what is programmed.

2) A Smart Bot / Smart Machine is a chatbot that relies on probabilities as information to respond to users.

3) Intelligence Bot / General AI is a chatbot that is created to be able to work independently. The first two types of commanders are not required.

2.3.2 Classification of Chatbots by User Experience

Phillips (2020) categorizes chatbots according to user experience based on the nature of the question and answer. These can be divided into three types, ranked in order of ease of creation as follows:

1) Menu / Button-Based Chatbot is the chatbot's response by the system's creator. There is a form of questions and answers in advance. This chatbot cannot respond to complex questions other than the built-in options.

2) Keyword Recognition Chatbot is a chatbot response which allows users to type conversations into the system. The system's creator will define a keyword (Keyword) in advance. When a conversation with a user is started, the system will capture keywords and enter predefined answers.

3) Contextual Chatbots (ML/AL) respond using Machine Learning and Artificial Intelligence to recognize and learn question patterns, improving themselves to better support future user needs. Dialogue interactions are similar to those of humans.

2.3.3 Classification of Chatbots by Purpose of Use

Botnerds (2020) and Hyatt (2020) classified the types of chatbots according to the consistent purpose of use of the chatbot, divided into eight types as follows:

1) Chatbots for trading (Transactional Chatbot)

2) Chatbots for public relations (Communicative Chatbot)

3) Educational Chatbot

4) Chatbots for building relationships with others (Social Chatbots)

5) Chatbots for entertainment (Play Chatbot)

6) Chatbots for administration (Administrative Chatbot)

7) Diagnostic Chatbot

8) Behavioral Chatbot

2.4 Designing and Developing Chatbots

In the burgeoning field of conversational interfaces, the efficacy of chatbots hinges on multiple factors. For automated systems to work at their best, it is important to consider design elements that consider how users interact with the system and its capabilities. Research from Suksomwat (2019) and Chatbot Pack (2020) support establishing guiding principles for designing effective chatbots.

1) Establish clear objectives: The preliminary step in conversation design entails a deep understanding of the chatbot's primary function. One must clarify who the target user is and what objectives they aim to achieve through interaction with the chatbot. Concurrently, an examination of the automated responder's interaction style is pivotal. The objectives should be specified with an actionable level of granularity to prevent any ambiguities regarding the chatbot's intended functionalities.

2) Adopt a user-centric design approach: The user experience fundamentally determines the yardstick of a chatbot's success or failure. It is imperative to ensure that chatbots furnish users with the precise information or solutions they seek. A lackluster user experience can prompt immediate disengagement. Therefore, conversational options should be structured from the onset to facilitate swift and direct solutions for the user.

3) Manage user expectations at the outset: Transparent communication regarding the scope of functionalities of the chatbot can mitigate unwarranted user expectations. Providing an initial appraisal to the user about

what the chatbot can or cannot do, aids in setting realistic expectations.

4) Tailor the system's personality to match user demographics: A user is more likely to engage effectively with a chatbot whose language and tone mirror human interaction. The choice of language should be contextually appropriate and relatable, enhancing the conversational experience to approximate human interaction.

5) Prioritize brevity in user-bot communication: Users generally disfavor verbose or lengthy conversational threads. The design should focus on delivering succinct yet comprehensive responses that directly address the issue at hand.

6) Optimize response formats: User discomfort often arises from the necessity to type extensive text. Multiple response formats, ranging from visual cues to multiple-choice options, should be implemented to alleviate this.

7) Ensure consistency and memory in conversational flow: Users expect continuity in conversation, negating the need to re-enter previously discussed information. The system should be capable of retaining context throughout the user session.

8) Graceful handling of unanticipated responses: A well-engineered chatbot is susceptible to errors and unexpected user queries. Robust systems incorporate contingency plans, such as verification steps or 'emergency exit' options, to safeguard against conversational derailments.

9) Facilitate human intervention when necessary: There may be instances where a chatbot falls short of handling intricate user queries. A seamless transition to human operators should be available, given that many users often prefer human interaction over automated responses.

10) Conclude interactions effectively: Conversations should have a clearly defined endpoint to prevent user fatigue. The closing should give users the sense that they have engaged in a productive interaction, resembling the fulfillment experienced in human dialogues.

Judiciously adhering to these principles can significantly enhance the efficacy and user satisfaction associated with chatbot interactions.

2.5 User Interface and User Experience in AI-Driven Chatbot Development

As chatbots become increasingly integrated into various domains, including healthcare, consumer services, and education (Kuhail et al., 2022), attention to their design and usability becomes imperative. The User Interface (UI) and User Experience (UX) play critical roles in this context and are deeply interconnected. The UI encompasses the hardware and software components that facilitate human-computer interaction (Nguyen, & Sidorova, 2018). It sets the stage for the UX, which is a more holistic term involving users' emotions, beliefs, and overall satisfaction with the system (ISO, 2019; Hassenzahl, 2018; Liao, Geyer, Muller & Khazaen, 2020).

Natural Language Processing (NLP), a branch of AI, enhances both the UI and UX by enabling more intuitive and human-like interactions. While traditional usability heuristics offer some guidance for UI design, they often fall short in the realm of conversational interfaces (Sugisaki & Bleiker, 2020). For these interfaces, specialized heuristics and metrics have been proposed to evaluate their effectiveness and usability (Følstad & Skjuve, 2019).

In customer service applications, UX is often evaluated based on pragmatic factors such as effectiveness and efficiency (Brandtzaeg & Følstad, 2017; van der Goot et al., 2020). However, hedonic factors, such as emotional engagement facilitated by anthropomorphic design cues, also contribute to a well-rounded user experience (Adam et al., 2021).

In summary, the successful development of AI-driven chatbots hinges on a well-designed UI that effectively supports a positive UX. AI technologies, particularly NLP, offer exciting opportunities for advancing UI/UX design in chatbots, promoting user satisfaction, and broadening their applications across various sectors.

3. CONCEPTUAL FRAMEWORK

In the present study, the research methodology leverages the frameworks Botnerds (2020) and Clark (2020) proposed to categorize chatbots based on their underlying robotic intelligence. Specifically, a rules-based chatbot, termed "Script Bot" is being developed, which functions through a predefined question-and-answer schema. This chatbot is intended to assist students by providing them with prompt and accurate responses to queries related to registration.

The foundational framework for this research was constructed by synthesizing registration documents and collating data from the administrative staff responsible for disseminating essential information to the student body. Following this, the research team will design and develop chatbots, tailoring the user interface to student-friendly platforms such as Facebook or the application LINE. Before its official student-use release, the system will undergo rigorous testing to evaluate its operational efficacy. Furthermore, an assessment will be conducted to ascertain the validity of the chatbot implementation within the context of the established conceptual framework, as delineated in Figure 1.

4. RESEARCH METHODOLOGY

This study adopted a research and development (R&D) approach encompassing three main objectives: 1) synthesizing essential registry information for students, 2) developing chatbots and interactive conversation structures, and 3) evaluating the chatbots for accuracy and suitability.

Population

Two distinct groups were examined: Registration and Assessment Office staff from eight centers/divisions and students from Sukhothai Thammathirat Open University who engaged with the chatbot. Staff participants were purposively selected, whereas student participants (n=255) were chosen through simple random sampling.

The research method was divided into 3 phases. Each phase is detailed as follows.

Phase 1: Registry Information Synthesis

In this foundational phase, exhaustive efforts were devoted to meticulously collecting, analyzing, and synthesizing an array of administrative documents. These included, but were not limited to, university regulations, official announcements, and nuanced registration policies. Interviews and focus group discussions with 16 key staff personnel enriched the data corpus, ensuring a multifaceted perspective.

Phase 2: Chatbot Design and Iterative Development

Building upon the robust foundation of Phase 1, this phase ventures into the intricate chatbot design process. The chatbot was engineered to be accessible via the university's

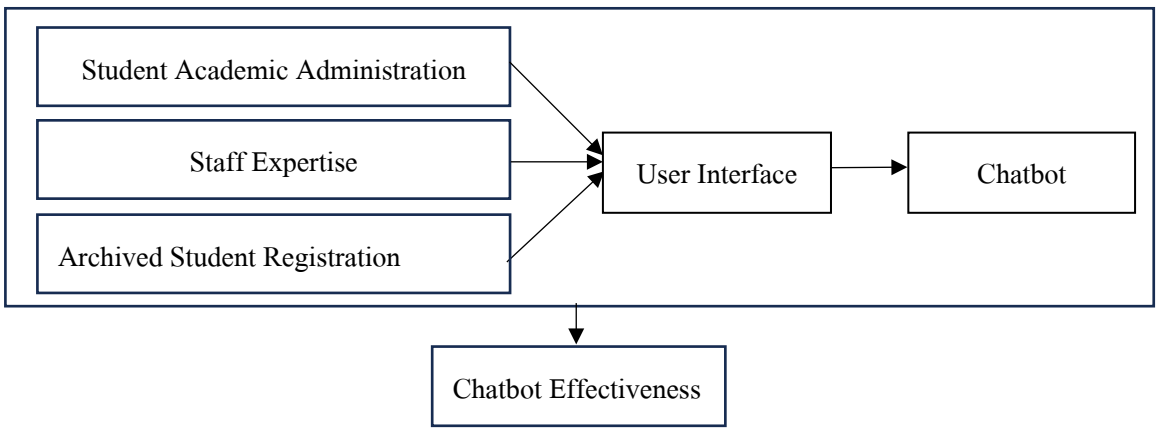

Figure 1 Conceptual Framework

official website and the application LINE. The chatbot underwent three successive cycles of iterative development. Expert feedback was continually integrated, sourced initially from professionals in software engineering and system testing in Round 1, followed by insights from selected staff members in Round 2, concluding with empirical observations from a random sample of 50 students in Round 3.

Phase 3: Chatbot Evaluation

The final phase evaluated the chatbot's accuracy, information completeness, and usability. Evaluation criteria included the speed of obtaining answers and the chatbot's linguistic attributes. The methodology ensured a comprehensive, user-centric approach to chatbot development and assessment, enhancing its potential as a vital tool for student information services.

Data Collection and Analysis

Data sources included university regulations, focus group discussions, interviews, and user experience metrics. Chatbot evaluation metrics were deployed to gauge both information accuracy and user experience.

5. RESULTS

5.1 Synthesis of Registry Operations Pertinent to Student Information

The comprehensive analysis of institutional documents, in-depth interviews, and focus group discussions with personnel from the Registrar and Assessment Office yielded a nuanced understanding of the student registration process at Sukhothai Thammathirat Open University. The research identifies a continuum of ten pivotal stages in a student's academic life cycle, collectively termed the "STOU Journey" for the context of this study.

1) **Enrollment:** Prospective students seek information regarding the array of study plans, pedagogical approaches, and evaluation metrics.

2) **Course Registration:** Students opt for an educational plan aligned with their learning styles and time management capabilities.

3) **Course Adjustment:** Information about adding or withdrawing from courses facilitates students in streamlining their academic progression.

4) **Educational Materials:** Students gain access to teaching materials requisite for their academic success post-registration.

5) **Personal Information Updates:** Provisions for updating student profiles exist to ensure accurate record-keeping.

6) **Media Instruction:** Multiple media channels are deployed to augment the distance learning experience.

7) **Examination Scheduling:** Students adhere to university-mandated timelines for various modes of examination.

8) **Skill Enhancement:** Supplemental training activities are offered to aid students with academic difficulties.

9) **Assessment and Evaluation:** Performance metrics are synthesized from various activities and examinations.

10) **Graduation:** Final guidelines and document requisition processes for graduation are communicated to students nearing course completion.

5.2 Chatbot Design and Iterative Development

The chatbot, a Rules-Based or Script Bot, was formulated according to the conceptual frameworks proposed by Botnerds (2020) and Clark (2020). The iterative development process was conducted in three distinct rounds:

5.2.1 Round 1

- **Design and Architecture**: The initial design enabled free-text input for student queries about undergraduate registration.
- **Technical Implementation**: Utilizing Google's Dialogflow, the bot was equipped with ten categories corresponding to the STOU Journey.
- **Preliminary Testing**: Error rates of 4-12% were observed as detailed in Table 2.
- **Expert Feedback**: IT experts recom-

mended involving stakeholders for refining intents.

5.2.2 Round 2

- **Interface and Usability**: Additional user satisfaction metrics were incorporated.
- **Implementation**: Enhanced for both desktop and mobile interfaces.
- **Usability Challenges**: Mobile users reported interface difficulties, specifically the keyboard obscuring the text input.
- **Staff Feedback**: Excessive detail in bot responses were noted as an area for improvement.

5.2.3 Round 3

- **Design Modifications**: The bot was integrated with the LINE application for a better mobile experience.
- **Expanded Database**: Additional intents and responses were incorporated.
- **User Testing**: Positive feedback on the accuracy and user experience was received from undergraduate students.

5.3 Evaluation and User Satisfaction

A comprehensive satisfaction survey involving 255 undergraduate students was executed to gauge the chatbot's effectiveness. The overall satisfaction was observed to be high, with a mean score of 4.19 (*SD*=0.98) (Table 3). The factors receiving the highest satisfaction scores included speed of response (*Mean*=4.42, *SD*=0.82), ease of use (*Mean*=4.33, *SD*=0.95), and natural language processing capabilities (*Mean*=4.22, *SD*=0.99).

By synthesizing this multifaceted data, this research presents an academically rigorous evaluation of chatbot utility in educational settings, emphasizing real-world applications and implications.

6. DISCUSSION

Discussions of the research results were divided into two issues: Registration related to students and the design and development of chatbots. Details are as follows:

6.1 Significance and Classification of Undergraduate Student Registration Procedures

The registration process serves as a linchpin in shaping the academic journey for students, who are not merely recipients of this service but active stakeholders directly en-

Table 2 Chatbot Test Results Round 1

Testing	Number of Questions	Number of Wrong Answers	Percentage of Error
1	25	2	8
2	25	2	8
3	25	3	12
4	25	1	4

Table 3 Evaluation and User Satisfaction of Chatbots (*n*=225)

Satisfaction After Using the Chatbot	*Mean*	*SD*	Meaning
1. The information received is correct.	4.09	0.97	Satisfied
2. Information received is complete.	3.98	1.01	Neutral
3. Get answers quickly.	4.42	0.82	Satisfied
4. Chatbots are easy to use.	4.33	0.95	Satisfied
5. Chatbots provide precisely the information needed.	4.09	1.07	Satisfied
6. Conversation with chatbots feels natural	4.22	0.99	Satisfied
Total	**4.19**	**0.98**	**Satisfied**

gaged with its various facets. The registration workflow is critical not only to students but also to the educational institutions themselves. It operates as a nexus of essential information, including but not limited to curriculum structure, study plans, pedagogical management, examinations, and educational assessments. Additionally, the process generates comprehensive student statistics and data (Chuchuen, 2018; Khasasin et al., 2022).

Scope and Components of Registration Work

The responsibilities of a registration office extend from the inception of a student's academic career to its culmination through graduation or other forms of termination. For analytical clarity, registration-related tasks can be classified into ten categories. In a systematic approach, registration tasks that are directly relevant to students can be taxonomically classified into ten principal categories: 1) Initial Application for Studies, 2) Curriculum and Study Plan Selection, 3) Course Enrollment and Withdrawal, 4) Dissemination of Academic Resources, 5) Management of Student Information, 6) Provision of Instructional Materials, 7) Examination Procedures, 8) Training Activities, 9) Grading and Academic Evaluation, and 10) Graduation Preparations.

Given the multifaceted nature of these tasks and the burgeoning student population, the complexity of registration workflows is escalating annually (Sangchueapho et al., 2021)

Imperatives for Technological Intervention

Universities must prioritize creating an environment conducive to smooth registration workflows, given their direct impact on the student experience. Despite the availability of various channels, including university websites, social media platforms, and dedicated applications for disseminating information, a gap remains in the real-time resolution of queries. The number of staff designated for this service often requires improvement due to the volume of inquiries among the current and potential student body.

Considering these challenges, technological interventions such as chatbots present a promising avenue for enhancing the efficiency and reach of registration services. Chatbots can be designed to offer automated Frequently Asked Questions & Answers (FQAs) services, catering to a broad spectrum of queries without time constraints. This mitigates the limitations imposed by staff availability and aligns with the working hours mandated for governmental and educational institutions. Therefore, such technology serves as a tool for both maximizing resource utilization and minimizing delays in service provision.

Integrating automated services like chatbots into registration workflows may offer a viable solution for managing increasing complexity and demand, thereby fostering an improved student experience.

6.2 Chatbot Design and Iterative Development

6.2.1 Types of Chatbots

Chatbots have been increasingly deployed across various sectors, including marketing (Transactional AI), public relations (Communicative AI), education (Educative AI), social interaction (Social AI), entertainment (Play AI), management (Administrative AI), diagnostics (Diagnostic AI), and behavioral analytics (Behavioral AI) (Rosruen & Samanchuen, 2018; Suksomwat; 2019, Hyatt, 2020; Priadko et al., 2020; Mındajao, 2023). The wide adoption is attributable to their ease of use and ability to furnish instant information based on users' textual or vocal inputs (Thaiware, 2023).

Classification of Chatbots for Information Services

1. **Scripted/Quick Reply Chatbots:** These chatbots offer a menu-driven interface

where users can select queries based on predefined keywords.

2. **Keyword Recognition Based Chatbots:** Operating without a menu, these chatbots analyze textual input based on keyword recognition to generate responses.

3. **Voice-Enabled Chatbots:** These chatbots, like Amazon's Alexa or Apple's Siri, process voice commands to deliver responses.

4. **Hybrid Chatbots:** A fusion of menu-driven and keyword recognition functionalities characterizes these chatbots.

5. **Contextual Chatbots:** Employing machine learning and artificial intelligence algorithms, these chatbots can learn from user interactions to enhance the quality of their future responses.

Design Considerations in the Academic Context

In the study, a Script Bot or Rules-Based model chatbot was utilized. Its design aimed to offer users a smooth and uninterrupted interaction, enabling them to communicate without any limitations imposed by a fixed menu. This approach successfully addressed the problem of navigating through multiple levels of nested categories to find the relevant information.

The Script Bot or Rules-Based design also offers flexibility for real-time updates, allowing for the accommodation of continuously emerging queries. Furthermore, it can evolve through learning phrases generated from previously unanswerable queries. Consequently, this continuous adaptation process yields an ever-expanding repertoire of "Intents" within the chatbot. Despite its advantages, one limitation of the Script Bot or Rules-Based design is that achieving a comprehensive 'Intents database is a perpetual endeavor due to the ceaseless influx of new queries, informational needs, and terminologies (Mindajao, 2023).

In summary, the Script Bot or Rules-Based format is particularly suited for providing registration information services within academic institutions. Its design allows for flexibility, timely updates, and the accommodation of an ever-expanding set of student inquiries, thus aligning with the dynamic nature of academic registration processes.

6.2.2 Platform Selection for Chatbot Development

Utilization of Google's Dialogflow for AI-Enabled Conversational Interfaces

Google's Dialogflow was selected as the platform for chatbot development, as it leverages artificial intelligence (AI) in concert with machine learning techniques such as Natural Language Processing (NLP). Dialogflow facilitates decoding user "intents" and "entities" in a conversational context, thereby enabling more nuanced and contextually appropriate responses. This design decision aligns with prior research conducted by Suksomwat (2019), which focused on developing chatbots to encourage student entrepreneurship via crowdsourcing and text analysis. It is also congruent with the work of Sakulwijitsinthu (2022), who examined chatbot development to automatically answer queries for Master's degree students at Sukhothai Thammathirat Open University, leveraging Google's Dialogflow.

Advantages of Dialogflow and Natural Language Understanding

Dialogflow's compelling advantage lies in its natural language understanding capabilities, which significantly simplifies the complexities associated with building an NLP engine from scratch (Qasem, Ghaleb, Mahdi, Al-Khateeb, & Al Fadda; 2023; Mındajao, 2023). This platform supports the integration of a conversational User Interface (UI) across diverse channels, such as mobile applications, web interfaces, and other digital systems, thereby accommodating text, visual, and audio interactions.

Implications for User Experience and Development Complexity

Given these features, using Google's Dialogflow in the present study offers a two-fold benefit: first, it reduces the

developmental complexity inherent in building a natural language processing engine. Second, it allows for a multiplicity of user interaction modalities, from text to audiovisual, thus enhancing the user experience and expanding the range of contexts in which the chatbot can operate effectively.

By leveraging Dialogflow's robust capabilities, the current study aims to offer a versatile and user-friendly chatbot system to meet diverse informational needs within an educational context.

6.2.3 Implementation and Management of Intents in Chatbots

Defining the Role of "Intent" in Intelligent Conversational Agents

In chatbot development, the term "intent" acquires a specialized significance, diverging from its commonplace dictionary definition of a deliberate plan or aim. In this context, "intent" encapsulates the user's purpose in interacting with the chatbot—essentially, what the user seeks to understand or learn about a specific topic or inquiry. Such intents could manifest in diverse linguistic forms, such as full-fledged questions, keywords, or phrases, depending on the design paradigms followed by the developers.

Methodological Approaches in Chatbot Design and Development

The research design for developing the chatbot was anchored in the R&D framework and involved three iterative rounds. Each round consisted of four operational stages: 1) Preliminary drafting and design (planning), 2) Execution of the planned design and data incorporation (acting), 3) Pilot testing and results documentation (observing), and 4) Reflection on the gathered data and insights (reflecting).

Variability of User Intents and Challenges in Management

The creation of numerous intents characterized initial iterations, each correlating to a distinct user question. For instance:

Intent 1: Inquiries about failed exams ("How many subjects did I fail?")

Intent 2: Queries regarding exam success ("Have I passed all the exams?")

Intent 3: Questions about grading ("What are my grades/scores?")

Intent 4: Requests for exam results ("Where can I find my exam scores?")

While this approach facilitated a granular level of specificity, it led to operational difficulties regarding updates and management, particularly when changes to linked information resources were required.

Evolving Insights and Recommendations for Effective Intent Creation

A more efficient approach emerged after analyzing the data generated in the second and third iterative cycles. Instead of creating multiple intents for varying formulations of a similar query, it was discovered that the underlying intent or purpose often remained consistent, regardless of the lexico-syntactic variations in how the question was posed. Consequently, it became apparent that a single, well-crafted answer could address multiple variations of the same fundamental question, thus reducing the number of intents and simplifying future management tasks.

For example, queries concerning failed exams, grades, and exam results—despite their apparent lexical diversity—essentially share the same intent: the user wants to understand their academic performance. Therefore, a unified answer such as, "You can check your academic performance at the link [link]," efficiently addresses this clustered category of intents.

In summary, the development of this research study yielded crucial insights into the art of intent creation in chatbots. The salient takeaway is the necessity to group intents based on the underlying user objective rather than specific questions. This strategy facilitates more manageable, practical, and effective chatbot operations by reducing the number of intents and easing the process of future updates. Furthermore, it ensures that the chatbot remains a reliable, up-to-date, and responsive tool for information dissemination.

6.2.4 Evaluation of User Experience in Chatbot Development

Methodological Framework for Chatbot Development

In the second phase of this research, devoted to the design and development of the chatbot, an R&D approach was employed, encompassing three iterative cycles. Each of these cycles consisted of four principal stages: (1) Preliminary chatbot design and drafting (Planning), (2) Execution of design and data integration into the chatbot (Acting), (3) Usability testing and result documentation (Observing), and (4) Reflection and analysis based on the collected data (Reflecting).

The Imperative of User Experience

User experience (UX) is a critical determinant in the design of technological interfaces, and its importance extends beyond technology to other service-related domains (Allanwood & Beare, 2014; Al-Shamaileh & Sutcliffe, 2023). Consistent with the insights from Suksomwat (2019), the User Interface (UI) is a vital aspect that contributes to enhanced user engagement and willingness to utilize the chatbot.

In the quest to develop sophisticated and user-friendly chatbots, focusing on three critical pillars—usefulness, usability, and user satisfaction—has become non-negotiable.

Firstly, the dimension of usefulness can be gauged through the chatbot's ability to resolve queries and execute tasks efficiently. Advanced technologies like Natural Language Processing (NLP) contribute by better understanding user intent, while machine learning algorithms assist the chatbot in learning from past interactions to improve future responses. This not only translates to higher user engagement but also paves the way for greater adoption rates (Haugeland, Følstad, Taylor, & Bjørkli, 2022).

Secondly, usability emphasizes the need for an intuitive interface, adapting classical usability heuristics to the unique requirements of chatbot interactions. Factors such as response time, accuracy in understanding queries, and the quality of solutions provided are paramount (Al-Shamaileh & Sutcliffe, 2023). Moreover, specialized heuristics like maintaining conversational context and effective error recovery mechanisms add another layer to usability (Duijst, 2017; Liao, Geyer, Muller & Khazaen, 2020).

Thirdly, user satisfaction, often the end result of high usefulness and usability, goes beyond task completion to include the emotional experience. Anthropomorphic cues, design elements, and conversational tone can significantly impact emotional engagement (Haugeland, Følstad, Taylor & Bjørkli, 2022; Al-Shamaileh & Sutcliffe, 2023).

Empirical backing, such as case studies or data, can substantially strengthen the analysis of these three pillars. For instance, user feedback through satisfaction surveys can provide insights into what areas need improvement (Følstad, & Taylor, 2021). As chatbot technology continues to evolve, developers should also keep an eye on future trends and emerging technologies. Augmented reality, for example, could offer an immersive UX, while the integration of blockchain could provide secure and personalized experiences (Brandtzaeg, & Følstad, 2017).

In summary, focusing on these three pillars and continually assessing them through analytics and user feedback is essential for developing chatbots that offer a well-rounded user experience. Key performance indicators (KPIs) such as user retention rate, task success rate, and user satisfaction scores should be rigorously monitored to ensure that chatbots meet or exceed user expectations.

Insights from Iterative Testing Rounds

During the first testing round, UX-related issues were relatively minimal, primarily due to the technological proficiency of the test users and the primary focus on evaluating the accuracy of question and answer sets within intents. In the second round, officials at the registry office faced some challenges with the user interface, which varied depending on their technological proficiency. Some had difficulty locating the "start chat" button, while others experi-

enced interference from their keyboard with the conversational text lines. These observations proved valuable in identifying areas for improvement in the chatbot's design, ensuring it caters to the diverse needs of its users.

In the third testing cycle, the chatbot's platform was shifted to the LINE application, aiming to accommodate users less familiar with online chat channels. At the same time, this change eliminated previous UX frustrations, issues related to the chatbot's response accuracy persisted, necessitating ongoing refinements in intent classifications and the inclusion of a broader FQA database.

User Experience for Chatbot Administrators

Beyond end-user experience, the study also sheds light on another critical demographic: chatbot owners or moderators. Ensuring a positive UX for this user group is crucial for effectively maintaining and managing the chatbot. These administrators must comprehensively understand the Dialogflow environment, with particular attention to the creation, naming, and categorization of intents to ensure robust chatbot moderation.

The multi-phase, iterative research design yielded significant insights into optimizing UX across user demographics. While addressing the UX challenges identified in each iterative cycle, the study also emphasizes the necessity for administrators to have a nuanced understanding of chatbot management tools and practices. These findings serve not only to enhance the existing chatbot but also to offer foundational principles for future research and development in this area.

ACKNOWLEDGEMENTS

The Distance Education Research Fund of Sukhothai Thammathirat Open University supported this research.

REFERENCES

Adam, M., Wessel, M., & Benlian, A. (2021). AI-based chatbots in customer service and their effects on user compliance. *Electronic Markets*, *31*(2), 427-445.

Al-Shamaileh, O., & Sutcliffe, A. (2023). Why people choose Apps: An evaluation of the ecology and user experience of mobile applications. *International Journal of Human-Computer Studies, p. 170,* 102965.

Al-Shamaileh, O., & Sutcliffe, A. (2023). Why people choose Apps: An evaluation of the ecology and user experience of mobile applications. *International Journal of Human-Computer Studies*, *170*, 102965.

Allanwood, G., & Beare, P. (2014). *Basics interactive design: User experience design: Creating designs users really love*. A&C Black.

Bii, P. (2013). Chatbot technology: A possible means of unlocking student potential to learn how to learn. *Educational Research*, *4*(2), 218–221.

Bond M. Schools and emergency remote education during the COVID-19 pandemic: A living rapid systematic review. *Asian Journal of Distance Education.* 2021;15(2):191–247.

Bond, M. (2021). Schools and emergency remote education during the COVID-19 pandemic: A living rapid systematic review. *Asian Journal of Distance Education*, *15*(2), 191–247.

Botnerds. (2020) *Types of bots: An overview*. Botnerds. http://botnerds.com/types-of-bots/

Clark, M. (2020, September 29). A chatbot framework. Digital Engagement Blog. https://info.contactsolutions.com/digital-engagement-blog/a-chatbot-framework

Brandtzaeg, P. B., & Følstad, A. (2017). Why people use chatbots. In *Internet Science: 4th International Conference, INSCI 2017, Thessaloniki, Greece, November 22-24, 2017, Proceedings 4* (pp. 377-392). Springer International Publishing.

Budiman, R. (2018). Factors Related to Students' Drop out of a Distance Language Learning Programme. *Journal of Curriculum and Teaching, 7*(2), 12–19.

Chatbot Pack. (2020). 10 key principles for designing effective conversational

interfaces.ChatbotPack.https://www.chatbotpack.com/design-conversational-interfaces

Chuchuen, P. (2018). Register Reminder: Application for Register Reminder Service [Doctoral dissertation Mahachulalongkornrajavidyalaya University]. MCU IR Theses database.

De Paepe, L., Zhu, C., & DePryck, K. (2018). Drop-out, retention, satisfaction and attainment of online learners of Dutch in adult education. *International Journal on E-Learning*, *17*(3), 303–323.

Duijst, D. (2017). Can we improve the user experience of chatbots with personalisation. *Master's thesis. University of Amsterdam*.

Eslahi, M., Salleh, R., & Anuar, N. B. (2012, November). Bots and botnets: An overview of characteristics, detection and challenges. In *2012 IEEE International Conference on Control System, Computing and Engineering* (pp. 349–354). IEEE.

Følstad, A., & Skjuve, M. (2019, August). Chatbots for customer service: user experience and motivation. In *Proceedings of the 1st international conference on conversational user interfaces* (pp. 1-9).

Følstad, A., & Taylor, C. (2021). Investigating the user experience of customer service chatbot interaction: a framework for qualitative analysis of chatbot dialogues. *Quality and User Experience*, *6*(1), 6.

Fryer, L. K., Nakao, K., & Thompson, A. (2019). Chatbot learning partners: Connecting learning experiences, interest and competence. *Computers in human Behavior*, *93*, 279–289.

Hassenzahl, M. (2018). The thing and I: understanding the relationship between user and product. *Funology 2: from usability to enjoyment*, 301-313.

Haugeland, I. K. F., Følstad, A., Taylor, C., & Bjørkli, C. A. (2022). Understanding the user experience of customer service chatbots: An experimental study of chatbot interaction design. *International Journal of Human-Computer Studies*, *161*, 102788.

Hyatt, J. (2020, September 29). Here's the 8 types of Artificial Intelligence, and what you should know about them. WORLD ECONOMIC FORUM https://www.weforum.org/agenda /2018/11/chatbots-without-a-cause-why-conversational-ai-wont-work-without-purpose/

ISO (2019). ISO 9214-210:2019 (E). Ergonomics of human system interaction-Part 210: human-centred design for interactive systems. International Organization for Standardization (ISO) Retrieved from: https://www.iso.org/obp/ui/#iso:std:iso:9241:-210:ed-2:v1:en.

Khanthavit, A., & Khanthavit, S. (2023). ChatGPT and Stress. *ABAC Journal*, *43*(3).

Khasasin, R., Petchthai, W., Jeamjiraset, C., Suphaskuldamrong, W., Chokprasoet-som, B.,& Khasasin, K. (2022). Student Satisfaction with the Service Provision of the Registration Office Thai-Nichi Institute of Technology (During the Coronavirus 2019 Pandemic). *APHEIT Journal, 28*(1), 80–97.

Kuhail, M. A., Farooq, S., & Almutairi, S. (2023). Recent Developments in Chatbot Usability and Design Methodologies. *Trends, Applications, and Challenges of Chatbot Technology*, 1-23.

Liao, Q. V., Geyer, W., Muller, M., & Khazaen, Y. (2020). Conversational interfaces for information search. *Understanding and Improving Information Search: A Cognitive Approach*, 267-287.

Mındajao, B. Y. (2023). Effectiveness of chatbot as an innovative modality in grade reporting in the new normal. *European Journal of Education Studies*, *10*(2).

Moorhouse, B. L., & Wong, K. M. (2022). Blending asynchronous and synchronous digital technologies and instructional approaches to facilitate remote learning. *Journal of Computers in Education*, *9*(1), 51–70.

Nguyen, Q. N., & Sidorova, A. (2018). Understanding user interactions with a chatbot: A self-determination theory approach.

Nicol, A. A., Owens, S. M., Le Coze, S. S., Maclntyre, A., & Eastwood, C. (2018). Comparison of high-technology active learning and low-technology active learning classrooms. *Active Learning in Higher Education, 19*(3), 253–265. https://doi.org/10.1177/1469787417731176

Nicolescu, L., & Tudorache, M. T. (2022). Human-computer interaction in customer service: the experience with AI chatbots—a systematic literature review. *Electronics*, *11*(10), 1579.

Office of Registration and Evaluation. (2020). Statistics of online registration information services [Reports]. The 2nd Joint Meeting of the Advisors of the Academic Evaluation Center with the Student Registrar: Problems in the Work of the Student Registrar, Nonthaburi, Thailand.

Phillips, C. (2020, September 29). The 3 Types of Chatbots & How to Determine the Right One for Your Needs.Medium. https://chatbotsmagazine.com/the-3-types-of- chatbots-how-to-determine-the-right-one-for-your-needs-a4df8c69ec4c

Priadko, A., Osadcha, K., Kruhlyk, V., & Rakovych, V. (2020). Development of a chatbot for informing students of the schedule.

Putri N.R., Sari F.M. Investigating English teaching strategies to reduce online teaching obstacles in the secondary school. *Journal of English Language Teaching and Learning.* 2021;2(1):23–31.

Qasem, F., Ghaleb, M., Mahdi, H. S., Al Khateeb, A., & Al Fadda, H. (2023). Dialog chatbot as an interactive online tool in enhancing ESP vocabulary learning. *Saudi Journal of Language Studies*, *3*(2), 76–86.

Rahman, A. M., Al Mamun, A., & Islam, A. (2017, December). Programming challenges of chatbot: Current and future prospective. In *2017 IEEE region 10 humanitarian technology conference (R10-HTC)* (pp. 75–78). IEEE.

Rosruen, N., & Samanchuen, T. (2018, December). Chatbot utilization for medical consultant system. In *2018 3rd technology innovation management and engineering science international conference (TIMES-iCON)* (pp. 1–5). IEEE.

Sakulwijitsinthu, S. (2022). Development of chatbot for automatic answering for master's degree students, sukhothai thammathirat open university. https://ird01.stou.ac.th/researchlib/ShowDataResearch.php?AutoID=2565_039

Sangchueapho, N., Chaiyong, P.,& Udon, N. (2021). Students' satisfaction towards registration services of Faculty of industrial technology. *Journal of Engineering Technology Access. 1*(2): 48–57.

Sugisaki, K., & Bleiker, A. (2020). Usability guidelines and evaluation criteria for conversational user interfaces: a heuristic and linguistic approach. In *Proceedings of Mensch und Computer 2020* (pp. 309-319).

Suksomwat, C. (2019). Development of chatbot to enhance students' entrepreneurship: crowdsourcing and text analysis [Master's thesis Chulalongkorn University]. Office f=of Academic Resources Chulalongkorn University database.

Sungsri, S. (2017). A Model of Educational Services to Enable Graduate Students of Sukhothai Thammathirat Open University to Achieve Learning Success in the Distance Education System. *STOU Education Journal*, *10*(2), 65–78.

van der Goot, M. J., Hafkamp, L., & Dankfort, Z. (2020, November). Customer service chatbots: A qualitative interview study into the communication journey of customers. In *International Workshop on Chatbot Research and Design* (pp. 190-204). Cham: Springer

International Publishing.
Whalen, J. (2020). Should teachers be trained in emergency remote teaching? Lessons learned from the COVID-19 pandemic. *Journal of Technology and Teacher Education*, *28*(2), 189–199. Wichit, S. A. (1986). *Distance Education: The STOU Approach*.