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Academic Mentoring Enquiry Chatbot: Design, Evaluation, and Educational Integration

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ABSTRACT

Academic mentoring in higher education is frequently constrained by limited staff time, scheduling conflicts, and the repetitive nature of routine student enquiries. This study designed and evaluated the Academic Mentoring Enquiry Chatbot (MSU ChatBot) as a lightweight conversational interface for academic programme enquiries, subject add/drop workflows, and mentor information access. The system was developed using a prototype-driven Agile approach and the open-source Rasa framework, with natural language understanding used for intent recognition and dialogue management used to coordinate multi-turn interactions. Requirements were gathered from 20 undergraduate students at Management and Science University, Malaysia, through a questionnaire and were analysed using thematic analysis. The findings showed unanimous demand for programme and major information (100%, n = 20) and for an integrated subject add/drop function (100%, n = 20). Mentor-detail access was supported by 90% of respondents (n = 18), while a minority raised privacy-related concerns. Functional verification further confirmed the feasibility of student-facing programme search, transactional course-adjustment flows, authenticated mentor retrieval, and administrator monitoring functions. The study demonstrates how an intent-driven, open-source chatbot can support routine academic advising while preserving a role for human mentors in complex or sensitive cases. The findings provide a practical basis for larger-scale usability and outcome evaluation in future deployments.

1. Introduction

Academic mentoring remains an important mechanism for supporting student progression, academic adjustment, and institutional engagement. However, the effectiveness of mentoring is

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often constrained by staff workload, limited appointment availability, and the repetitive administrative nature of many student enquiries. Recent research has linked mentoring quality and frequency with student engagement, academic performance, and persistence, while also documenting the time pressures experienced by educators and mentors [1,3,8,12,13]. These pressures create a practical need for support mechanisms that can answer routine questions quickly without displacing the relational and judgement-based functions of human mentoring.

Conversational agents have increasingly been explored as one such mechanism. Educational chatbots have evolved from simple rule-based interfaces toward intent-aware systems capable of supporting multi-turn interactions and administrative services [6,7,10,14]. In higher education, chatbots have been used for programme enquiries, registration support, admissions, learning assistance, and general student services [4,10,19]. Their value is particularly associated with immediate availability, consistent responses, and the ability to reduce repetitive service demands. At the same time, technology acceptance research shows that usefulness, ease of use, trust, and perceived reliabilities are central to whether students are willing to engage with AI-enabled educational systems [2,4,9,16-18].

A key design challenge is therefore not simply whether a chatbot can answer questions, but whether it can combine reliable task-oriented behaviour with sufficiently flexible dialogue. Static frequently asked question systems may be easy to control but can be poorly matched to non-linear student language. More open-ended AI systems offer conversational flexibility, yet they may introduce concerns regarding accuracy, privacy, and deterministic control in formal academic processes [5,9]. Inclusive deployment also requires attention to differences in student needs and digital accessibility [11]. These tensions are especially relevant to functions such as subject registration changes and mentor-detail retrieval, where the interface must be usable while still respecting institutional rules and access controls.

Against this background, this study develops and evaluates the Academic Mentoring Enquiry Chatbot (MSU ChatBot), an open-source, Rasa-based prototype intended to support routine academic mentoring enquiries. The study focuses on three related questions: which advising functions students most strongly expect from such a chatbot; how those requirements can be translated into an intent-driven system architecture; and whether the resulting prototype can execute the targeted student and administrator workflows. The study contributes by linking user-derived requirements to concrete chatbot functions, demonstrating a lightweight implementation route for academic advising, and clarifying how automated support can complement rather than replace human mentors.

2. Methodology

The study used a prototype-driven software development design combined with a qualitative requirements survey and functional verification. The methodology comprised four stages: iterative Agile development, system architecture design, student requirement gathering and thematic analysis, and verification of the implemented administrative and conversational functions.

2.1 Agile-Prototype Development

Development followed an iterative Agile-prototype cycle selected to support early feedback and progressive refinement of conversational flows. The cycle began with the collection and organisation of student mentoring questions relating to academic programmes, course-management processes, and mentor information. These requirements were translated into dialogue intents and

conversational scripts, implemented in short development iterations, evaluated with undergraduate users, and refined in response to observed usability issues and system exceptions. The final optimisation stage focused on intent thresholds, dialogue rules, and conversational policies relevant to the targeted mentoring tasks.

2.2 System Architecture and Technical Configuration

The MSU ChatBot was implemented using the open-source Rasa framework, which supports modular natural language understanding and dialogue management for task-oriented conversational systems [14]. The reported implementation separates language interpretation from dialogue control. The natural language understanding layer preprocesses user input, tokenises text, extracts features, classifies user intent, and identifies entities such as course codes or mentor names. The dialogue-management layer then tracks conversational context and selects the next system action. Deterministic rules are used for critical transactions, while learned dialogue policies support more flexible conversational turns.

System requirements were classified as usability, functional, and non-functional requirements. As summarised in Table 1, the requirements covered browser-compatible interface behaviour, secure sessions, programme-search intent mapping, mentor-database retrieval, course-code transaction handling, password protection, and secure transaction confirmation. This classification provided a traceable link between user-facing needs and the corresponding system components.

Table 1
System requirements and implementation mapping

Requirement ID	Class	Requirement / implementation mapping
REQ-US-01	Usability	Custom HTML/CSS chat-window calibration
REQ-US-02	Usability	Multi-browser CSS template verification
REQ-FN-01	Functional	Rasa session credential-token validation
REQ-FN-02	Functional	Rasa NLU course-search intent mapping
REQ-FN-03	Functional	Rasa Core database entity mapping to mentor table
REQ-FN-04	Functional	SQL schema transaction execution for course codes
REQ-NF-01	Non-functional	PBKDF2 hashing with SHA-256 encryption
REQ-NF-02	Non-functional	Secure transaction-confirmation flow

2.3 Participants and Requirement-Gathering Procedure

A purposive sample of 20 undergraduate students from Management and Science University (MSU), Selangor, Malaysia, participated in the requirements-gathering and prototype-evaluation stage. The sample included students from different academic levels and fields of study to capture a range of advising expectations. Table 2 presents the demographic profile reported in the source study.

Table 2
Participant demographic profile (n = 20)

Characteristic	Category	n	%
Gender	Female	12	60.0
Gender	Male	8	40.0
Academic level	Bachelor Year 1-2	9	45.0
Academic level	Bachelor Year 3-4	11	55.0
Field of study	ISE	10	50.0
Field of study	Business	6	30.0
Field of study	Health	4	20.0
Prior chatbot use	Daily	14	70.0
Prior chatbot use	Weekly	4	20.0

The reported prior-chatbot-use categories account for 90% of the sample; the remaining 10% requires author verification before submission and has not been assigned to an unreported category.

2.4 Thematic Analysis and Functional Verification

Questionnaire responses were analysed using a six-stage thematic procedure: familiarisation with responses, initial coding, theme searching, theme review, theme definition and naming, and synthesis of themes into formal system requirements. Two independent coders reviewed the responses and resolved discrepancies by consensus. The resulting themes were used to prioritise the prototype functions most relevant to student advising. Functional verification was then conducted across the administrator-facing dashboard and the student-facing conversational interface. Verification focused on whether the prototype could execute the documented high-priority tasks: user authentication, student and subject registration support, mentor-student association, student-request monitoring, natural-language programme search, subject add/drop workflows, and authenticated mentor-detail retrieval.

3. Results

3.1 Student Requirement Consensus

The student responses showed strong agreement on the functions that should be prioritised in an academic mentoring chatbot. All 20 respondents (100%) supported on-demand access to information about academic programmes and majors. The same level of agreement was recorded for an integrated subject add/drop function. Access to assigned mentor information was supported by 18 respondents (90%), while two respondents (10%) expressed reservations. Table 3 summarises these requirement-consensus results.

Table 3

Core student requirement consensus

Requested function	Yes, n (%)	No, n (%)
Academic programme and major information	20 (100%)	0 (0%)
Integrated subjects add/drop function	20 (100%)	0 (0%)
Access to assigned mentor details	18 (90%)	2 (10%)

The pattern indicates that students regarded the chatbot as more than a static information page. Programme discovery and course-management support were both treated as essential, suggesting an expectation for a conversational interface that can support administrative action as well as information retrieval. The comparatively lower, although still high, support for mentor-detail access also highlights the need for authenticated access and careful handling of staff and student information.

3.2 System Implementation and Functional Verification

The implemented prototype provided separate administrator-facing and student-facing functions. The administrator dashboard supported secure authentication, student-profile and subject-management functions, mentor-student association, and monitoring of student requests. The student-facing interface supported natural-language programme enquiries, transactional subject add/drop dialogue, and retrieval of assigned mentor information following authentication. These verified functions are summarised in Table 4.

Table 4

Verified functions of the MSU ChatBot prototype

Interface	Verified function	Operational purpose
Administrator	Authentication	Restricts access to administrative functions
Administrator	Student and subject registration	Creates or updates student and subject records
Administrator	Mentor-student association	Maintains assigned mentor relationships
Administrator	Student-request monitoring	Tracks requests such as subject add/drop actions
Student	Natural-language programme search	Returns programme and major information from user queries
Student	Subjects add/drop dialogue	Guides users through a multi-turn course-adjustment workflow
Student	Authenticated mentor retrieval	Displays assigned mentor information after access validation

The verification results demonstrate that the architecture could translate the user requirements into working dialogue and administrative functions within the prototype scope. Separating intent recognition from dialogue control allowed information-seeking queries and transactional processes to be handled through different conversational paths. The administrator monitoring component also provided a mechanism for institutional oversight of actions initiated through the chatbot.

3.3 Discussion and Educational Implications

The strong demand for programme information and subject-management functions is consistent with wider higher-education evidence showing that students value chatbots when they provide useful, immediate, and service-oriented support [4,10,19]. Technology acceptance research similarly indicates that perceived usefulness and ease of use are central to adoption [2,9,16], while trust and context-specific reliability affect willingness to rely on a technology for consequential tasks [17,18]. The present findings therefore support a design approach in which advising chatbots prioritise a small number of high-value functions rather than attempting to automate the full mentoring relationship.

The preference for dynamic conversational interaction also aligns with experimental evidence that interactive educational chatbots can outperform static support materials for some learning-related outcomes [15]. At the same time, the present study reinforces the need to maintain human involvement. Administrative queries, programme searches, and structured course-management workflows are suitable for automation, whereas complex academic decisions, exceptional cases, and sensitive personal matters remain better suited to human mentors. This complementary model is consistent with research emphasising the social and developmental role of mentoring [3,12,13].

From an implementation perspective, the use of an open-source Rasa architecture offers a controllable alternative to fully generative interfaces for formal advising workflows. Intent-driven dialogue can provide predictable transaction paths while still accepting natural-language input [6, 14]. However, the pilot findings should not be interpreted as evidence of institution-wide effectiveness. The sample was limited to 20 students at one university, the reported evaluation concentrated on requirements and functional feasibility, and the study did not provide validated longitudinal outcomes such as retention, grade progression, or sustained user satisfaction. Future work should therefore evaluate the system with larger and more diverse cohorts, formal usability instruments, accuracy and latency measures, privacy and security testing, and longitudinal academic-support outcomes.

4. Conclusions

This study designed and evaluated an Academic Mentoring Enquiry Chatbot intended to support routine university advising through an open-source, intent-driven conversational architecture. The student requirements study identified programme and major information, subject add/drop support, and mentor-detail access as the principal expected functions. Programme information and subject-management functions received unanimous support from the 20 participants, while mentor-detail access was supported by 90% of respondents. Functional verification showed that these requirements could be translated into student-facing conversational flows and administrator-facing coordination functions within the prototype.

The main implication is that academic advising chatbots are most defensible when they automate clearly bounded, repetitive processes while retaining human mentors for judgement-intensive and sensitive interactions. The study provides an initial design and implementation basis for this complementary model. Its conclusions are limited by the small single-institution sample and the absence of longitudinal outcome measures. Subsequent research should extend the evaluation to larger cohorts and examine usability, trust, security, response accuracy, administrative workload reduction, and measurable student outcomes over time.

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