

LIST OF AI TOOLS THAT USED TO RESEARCH

- Perplexity.ai (sonar,claude sonnet 4.0,GPT -5,Gemini 2.5 pro)
- Microsoft Copilot
- Chat gpt
- Scispace.ai
- Claude.ai
- Consensus.ai
- Meta.ai
- Google gemini
- Poe.ai
- Groke.ai
- Chat hub.ai

Research papers:

➤ Frame work comparison

1. Rasa Open Source Best for: Complete control and customization Advantages:- Free and open source- Excellent multilingual support- Advanced context management- Custom training data control- Strong privacy protection- Detailed conversation logging- No vendor lock-in- Active community support Disadvantages:- Requires more setup time- Needs ML knowledge for optimization- Self-hosting responsibility Implementation Complexity: Medium to High Cost: Free (hosting costs only) Maintenance Effort: Medium
2. Google Dialogflow Best for: Quick development with GUI Advantages:- Drag-and-drop interface- Built-in multilingual support (30+ languages)- Google Cloud integration- Easy webhook setup- Good documentation- Quick prototyping- Automatic speech recognition Disadvantages:- Usage-based pricing after free tier- Less customization control- Vendor lock-in- Data privacy concerns Implementation Complexity: Low to Medium Cost: Free tier available, then pay-per-use Maintenance Effort: Low
3. Microsoft Bot Framework Best for: Enterprise integration Advantages:- Strong Azure integration- Good multilingual capabilities- Comprehensive SDK- Enterprise security features Disadvantages: - Steeper learning curve- Microsoft ecosystem dependency- Licensing costs for advanced features Implementation Complexity: Medium to High Cost: Free tier available, enterprise features paid Maintenance Effort: Medium
4. Botpress Best for: Visual development Advantages:- Visual flow builder- Open source option available- Good for non-technical users- Built-in analytics- Easy deployment Disadvantages:- Limited advanced NLP features- Smaller community- Less flexibility for complex scenarios Implementation Complexity: Low to Medium Cost: Open source version free Maintenance Effort: Low to Medium

➤ **User-Friendly Programming Languages**

- Python - Most popular for chatbot development (especially with Rasa)- Easy to learn and maintain- Rich libraries for NLP, translation, and logging
- JavaScript / Node.js - Ideal for web integration and messaging platforms- Works well with Dialogflow and Microsoft Bot Framework
- TypeScript- Adds safety and structure to JavaScript, great for scaling
- No-code platforms (like Tars or Landbot)- Perfect for non-CS students or quick MVPs
- Bonus Features to Consider
 - Translation APIs: Google Translate, Azure Translator, or AI4Bharat for Indian languages
 - Context Management: Use session variables or conversation state tracking
 - Fallback to Human: Integrate with WhatsApp or web chat escalation
 - Daily Logs: Store in Firebase, Google Sheets, or a simple SQLite DB
- Essential Maintenance Tools

1. Content & Flow Management

- Dialogflow CX / Botpress- Visual interfaces for updating intents, responses, and conversation flows.- Easy for non-programmers to tweak and test.
- Rasa (with Rasa X)- Open-source and customizable.- Rasa X allows student volunteers to review conversations and improve training data.

2. Conversation Logging & Analytics

- Google Sheets or Airtable- Store daily logs for review and improvement.- Easy to filter by language, intent, or unresolved queries.
- Firebase / Supabase- Real-time database for storing logs and user interactions.- Scalable and integrates well with web apps.
- Botpress Analytics Dashboard- Built-in insights on user behavior, fallback rates, and language usage.

3. Language & Translation Management

- Google Cloud Translation API / Azure Translator- Automatically translate new content or responses.- Helps maintain multilingual consistency.
- AI4Bharat Tools- Tailored for Indian languages, ideal for regional accuracy.

4. Version Control & Collaboration

- GitHub / GitLab- Track changes to bot logic, training data, and documentation.- Enables collaborative updates by student teams.

5. Monitoring & Escalation • Slack / Microsoft Teams Integration- Notify human staff when the bot escalates a query.- Helps ensure timely responses to complex

- questions.
- Uptime Robot / Cron Jobs- Monitor bot availability and schedule regular health checks.
 - 6. Documentation & Training
 - Notion / Google Docs- Maintain guides for updating FAQs, adding languages, and onboarding new volunteers.- Centralized knowledge base for student maintainers

➤ Final Recommendation

Language:

Python

Framework:

Rasa + Rasa X

Add-ons:

- AI4Bharat or Bhashini for regional language support
- Firebase or Google Sheets for logging
- WhatsApp/Telegram integration for reach

Maintenance Tools:

- Rasa X for flow updates
- Google Sheets or Firebase for logs
- GitHub for version control
- Notion or Google Docs for documentation

➤ Multilingual Campus Chatbot Prototype Script

1. Configuration

Supported languages

-  English
-  Hindi
-  Marathi
-  Marwadi

Channels

Embedded website widget

WhatsApp messaging, Telegram

1. Key features:

Automatic language detection

Intent classification (fee inquiries, scholarship, timetable, general FAQ)

Context tracking across multiple turns

Human-fallback escalation

Daily interaction logging

2. Cast

Bot (CampusAssistant)

Student

Staff

Testing:

Scene 1: Greeting & Language Detection

Student sends “नमस्ते”

Bot detects Hindi, replies in Hindi: Bot: नमस्ते! मैं CampusAssistant हूँ। मैं आपकी कैसे मदद कर सकता हूँ?

Student switches to English: "Hi"

Bot switches to English, resets context: Bot: Hello! I'm CampusAssistant. How can I help you today?

Scene 2: Scholarship Query

Student: "स्कॉलरशिप फॉर्म की आखिरी तारीख क्या है?"

Bot (Hindi): Bot: स्कॉलरशिप फॉर्म भरने की अंतिम तारीख 30 सितंबर है। क्या आप डाउनलोड लिंक चाहते हैं?

Student: "हाँ, भेज दीजिए!"

Bot: Bot: यहाँ है आपका फॉर्म  [Download Link] (Context tag: scholarship)

Student: "कौन-कौन से दस्तावेज़ चाहिए?"

Bot: Bot: आपको आधार कॉपी, मार्कशीट और आय प्रमाण पत्र अपलोड करने होंगे.

5. Scene 3: Fee Payment Inquiry

Student: "When is the semester fee due?"

Bot (English): Bot: Semester fee payment is due by October 15. You can pay online here  [Payment Portal Link]. Need step-by-step guidance?

Student: "Yes, please."

Bot: Bot: Sure—first log in with your student ID, then select "Fee Payment" from the dashboard. Would you like screenshots?

Scene 4: Timetable Update in Regional Language

Student (Hindi): "मैं नई समय सारिणी कहाँ देख सकता हूँ?"

Bot (Hindi): Bot: नई समय सारिणी 10 सितंबर से प्रभावी है। यहाँ देखें  [Timetable PDF]

Scene 5: Fallback to Human Support

Student: "My scholarship status says rejected but I submitted all documents."

Bot: Bot: I'm sorry to hear that. This issue requires personal review. Connecting you to a scholarship officer now—please hold on.

Staff joins chat to take over

8. Logging & Continuous Improvement

Logged Fields

Timestamp

Detected language

Intent name

User query

Bot response

Context tags

Escalation flag

Review Cycle

Volunteers review logs daily

Update FAQs and response templates weekly

9. Integration & Maintenance

No-code Builder

Dialogflow or Microsoft Bot Framework Composer

Content Sync

FAQs ingested from Google Sheets / CSV daily

Volunteer Workflow

Simple UI for editing intents and responses

Privacy

Discard personal data after session end

Accuracy Checks

Weekly audit of top-10 unanswered queries

Faculty and quality

A state audit of Rajasthan Technical University (RTU) highlighted a “large shortage of qualified faculty” in sampled engineering colleges, alongside poor research infrastructure and rising vacant seats—symptoms of systemic quality gaps that directly affect teaching and learning standards. Weak maintenance of laboratories, technological backwardness, and limited technical support staff have been flagged in government college self-assessments, underscoring difficulties in keeping equipment functional and classrooms upgraded to smart standards.

Affiliation and accreditation

The Comptroller and Auditor General (CAG) found RTU’s affiliation process irregular and unstructured, with affiliation orders not issued to most engineering colleges in 2014–15, which undermined quality assurance and regulatory oversight. Even at the flagship University College of Engineering, none of the UG/PG programs were accredited by the National Board of Accreditation at the time of audit, signaling an accreditation shortfall in core programs.

Industry relevance and skills

State and national skills analyses note a persistent mismatch between training and industry needs, with district-wise skill gap studies underscoring the need to re-align curricula and seats with sectoral demand. The state’s draft Skill Policy explicitly acknowledges that both the quantity and quality of training in ITIs/polytechnics are a concern, calling for employment-oriented, industry-designed programs to address employability.

Student outcomes and employability

Training outcomes at the vocational end remain mixed: the draft policy records that in 2022–23, over 113,000 ITI trainees appeared for exams in Rajasthan with a pass rate of 56.1%, indicating significant room to improve completion and competency levels. At the degree level, NIRF-linked placement data for RTU shows only part of graduates securing campus offers, reflecting uneven employability and limited absorption, despite some top offers; this points to a broader gap between program outcomes and labor market expectations.

Governance and funding delays

Institutional self-evaluations cite delays in approvals, fund sanctioning, and allocation—along with frequent faculty transfers and short tenures for heads—which collectively disrupt academic continuity, curriculum upgrades, and capital maintenance. Such administrative frictions slow syllabus revisions aligned to job profiles and impede timely modernization of labs and classrooms.

Regional imbalance and access

Seats and institutions have historically clustered in urban centers like Jaipur, which can limit equitable access and industry exposure across the state's districts and amplify disparities in quality and placements. Skill-gap studies further argue for district-wise rebalancing of capacity to match local economic opportunities, reinforcing the need for a more distributed technical education footprint.

Evidence snapshots

Faculty shortage, poor research infra, rising vacant seats, irregular affiliation, and limited accreditation were all formally recorded in the CAG performance audit of RTU.

Institute-reported weaknesses include technological backwardness, inadequate technical staff, and delays in funds/approvals.

State policy draft records ITI pass rate of 56.1% (2022–23) and calls out quality concerns in training provisioning.

District-wise skill gap study highlights persistent demand–supply mismatches in skilled manpower, calling for realignment of training with market needs.

What this means

The core demerits are structural: uneven quality assurance (affiliation/accreditation), human resource constraints, insufficiently modernized infrastructure, and curricula not consistently mapped to industry demand. These issues manifest as lower pass rates in vocational streams and partial graduate placement outcomes at the degree level, indicating a need for tighter QA, stronger industry linkages, and targeted investments in faculty and labs.

Language barriers represent a fundamental challenge in Rajasthan's technical and higher education system, creating a significant divide between students from different linguistic backgrounds. While initiatives like regional language technical courses and English proficiency programs show promise, the persistent preference for English in industry and higher education continues to disadvantage students from Hindi-medium backgrounds.

The challenge requires a multi-pronged approach involving curriculum reform, teacher training, industry engagement, and gradual transition programs that help students develop English proficiency while maintaining the option to learn in their native language. Without addressing these language barriers, Rajasthan's technical education system will continue to exclude talented students who lack English proficiency, limiting both individual opportunities and the state's overall human resource development.

Causes

Recruitment delays: Even when new colleges are set up, hiring permanent faculty and support staff is slow.

The Times of India

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Budget constraints / inadequate funding allocations or delayed disbursement.

Geographic challenges: Remote, rural, desert districts have difficulty attracting qualified faculty and staff; low student density makes economies of scale hard.

Bureaucratic and administrative inefficiencies.

Possibly low awareness or incentive among students for certain fields, especially where employment opportunities locally are limited.

Infrastructure maintenance issues – old buildings, delayed repairs.

Budget and Funding:

Institutions, particularly in economically disadvantaged areas, struggle with limited government grants, restricting their ability to upgrade infrastructure and implement new programs.

Technology Integration:

Even with the push for digital learning, challenges persist with the lack of professional training for staff, poor network infrastructure, and an absence of clear integration strategies for technology into education.

➤ Survey of students details in Rajasthan collages and universities

Overall State-Level Enrollment Statistics

According to AISHE 2021-22 and 2022-23 data, Rajasthan ranks among the top 6 states nationally for higher education enrollment with approximately 13.04 lakh students enrolled across all levels of higher education. The state recorded its lowest enrollment growth of just 0.14% in 2022-23, adding only about 2,000 students to the previous year's total.

Gender Distribution:

Female students: 6.65 lakh (51% of total enrollment)

Male students: 6.19 lakh (49% of total enrollment)

Rajasthan shows a positive trend with girls superseding boys in enrollment since 2017-18

1. University of Rajasthan (UNIRAJ), Jaipur

Total Students: Over 11 lakh students (2013-14 data)

Campus Students: 28,000+ (including 26,000+ regular students)

Undergraduate Students: 20,000+

Postgraduate Students: 5,000+

Student-Faculty Ratio: 37:1 with 700+ faculty members

Affiliated Colleges: 1,200 colleges across 8 eastern districts

2. Rajasthan Technical University (RTU), Kota

Total Affiliated Institutions: 92 colleges

Departments: 10 departments/centers offering UG, PG, and PhD programs

Major Engineering Specializations:

Computer Science Engineering

Civil Engineering

Electrical Engineering

Electronics & Communication Engineering

Mechanical Engineering

Electronics Instrumentation & Control

Information Technology

Production and Industrial Engineering

Aeronautical Engineering

Petroleum Engineering

Petrochemical Engineering

Course Distribution:

B.Tech: 20+ specializations

M.Tech: 15+ specializations

B.Arch: Architecture

MBA: Business Administration

PhD: Engineering, Management, Computer Applications

5. Other Major State Universities

Mohanlal Sukhadia University (MLSU), Udaipur:

Campus Students: 2,500

Maharishi Dayanand Saraswati University, Ajmer:

Campus Students: 600

Jai Narayan Vyas University, Jodhpur:

Campus Students: 4,000

Kota University:

Campus Students: 100

Universities: Structure and Scale

Major State Public Universities

University Name	Campus Students	Affiliated Colleges	Major Disciplines	Region Served
University of Rajasthan (UniRaj), Jaipur	28,000+	1,200+	Arts, Science, Commerce, Law, Education, Fine Arts	8 eastern districts
Jai Narayan Vyas University, Jodhpur	4,000+	Not specified	Arts, Science, Commerce, Law, Social Sciences	Western Rajasthan
Mohanlal Sukhadia University, Udaipur	2,500+	Not specified	Arts, Science, Commerce, Law, Social Sciences	Southern Rajasthan
Maharishi Dayanand Saraswati Univ., Ajmer	600+	Not specified	Arts, Science, Commerce, Law, Social Sciences	Central Rajasthan
Kota University, Kota	100+	Not specified	Arts, Science, Commerce, Law	Kota region

Major Technical & Professional Universities

Institution Name	Campus Students	Departments/Specializations	Affiliates	Type
Rajasthan Technical University (RTU), Kota	Not specified	Engineering, Architecture, Management	92 engineering colleges	State technical
Malaviya National Institute of Technology (MNIT), Jaipur	4,500–5,000	Engineering, Science, Architecture	None	Central (NIT)
Central University of Rajasthan (CURAJ), Kishangarh	2,500+	Engineering, Sciences, Humanities, Social Sciences, Management	None	Central
National Law University, Jodhpur	Not specified	Law	None	National Law University

➤ Real life proof

Link 1: <https://www.perplexity.ai/search/give-the-real-life-suvye-of-de-VCeRjWyRSWKMV7aDs4XsuA>

Above data that collected from perplexity it shows the major points it gives abandon courses ,it cant handel complex topics so it prefer the human for that topics

Solution :

Hybrid AI-Human Architecture for Complex Topics

The Problem

Educational chatbots fail when handling complex, nuanced, or emotionally sensitive topics, leading to student frustration and course abandonment.

The Solution: Intelligent Human Handoff System

Architecture Components:

AI First Response Layer:

Handle 80% of routine queries (basic facts, definitions, scheduling)

Use natural language processing for intent recognition

Provide immediate responses for simple questions

Smart Escalation Triggers:

Complexity Detection: When AI confidence score falls below 70%

User Frustration: Sentiment analysis detecting negative emotions

Repeated Failures: After 2-3 unsuccessful attempts to resolve query

Explicit Request: User asks "I want to speak to a teacher"

Subject-Specific Topics: Advanced concepts requiring human expertise

Link 2: <https://www.mdpi.com/2078-2489/16/3/235>

Above link i noticed the security and privacy concerns ,language limitations and accessibility, misinformation and source reliability issues. and in this web had some basic details about chatbot , it mainly say about chatgpt

Solution :

Multilingual and Accessibility Enhancement

The Problem

Language barriers and accessibility issues exclude many learners from effectively using educational chatbots.

The Solution: Comprehensive Multilingual and Accessibility Framework

Multilingual Implementation:

Core Language Features:

Real-time Translation: Support for 50+ languages with context-aware translation

Cultural Adaptation: Responses adapted to cultural contexts and learning styles

Native Language Learning: Explanations provided in student's first language when needed

Code-switching Support: Handle mixed-language queries common in multilingual environments

Technical Implementation:

Language Detection: Automatic identification of user's preferred language

Dynamic Language Switching: Users can change language mid-conversation

Regional Dialects: Support for regional variations and colloquialisms

Voice Input/Output: Text-to-speech and speech-to-text in multiple languages

Accessibility Features:

Visual Accessibility:

Screen Reader Compatibility: Full ARIA role implementation

High Contrast Mode: WCAG AA compliant color schemes (4.5:1 contrast ratio)

Font Size Customization: Adjustable from 12pt to 24pt

Dyslexia-Friendly Options: OpenDyslexic font and reduced visual clutter

Motor Accessibility:

Keyboard Navigation: Full chatbot functionality accessible via keyboard

Voice Commands: Hands-free operation for students with motor impairments

Switch Control: Support for assistive devices

Adjustable Response Time: Extended time limits for input

Cognitive Accessibility:

Simplified Language Mode: Complex responses automatically simplified

Visual Aids: Automatic inclusion of diagrams and infographics

Step-by-Step Breakdown: Complex topics divided into manageable chunks

Repetition Options: "Explain again" functionality with varied approaches

➤ Reference that taken from this links to develop our chat bot :

❖ Youtube links:

Link 1: https://youtu.be/GLmyM1AO_Hw?si=CWBRxttgFjgCzvba

Link 2: https://youtu.be/6uBk0xq2hhk?si=ZP_D5-f0U7KsjSeU

Link 3: <https://youtu.be/YxQNVe0M7j8?si=DJEx17JESJ6AXYT1>

Link 4: https://youtu.be/q5HiD5PNuck?si=kJ_3HLytMduFNUn3

Link 5: <https://youtu.be/Co7QtrJBkpY?si=pYrFB8RbBRui9bMi>

❖ Web links:

Link 1: <https://www.analyticsvidhya.com/blog/2024/06/multilingual-chatbot-using-langs/>

Link 2: <https://medium.com/@lars.chr.wiik/how-to-create-a-simple-multilingual-chatbot-from-scratch-1cf5e9876f8d>

Link 3: <https://www.gptbots.ai/blog/multilingual-chatbot>

Link 4: <https://wotnot.io/blog/multilingual-chatbot>

Link 5: <https://chatfuel.com/blog/create-a-multilingual-chatbot>

❖ AI links :

Link 1 (**perplexity.ai**): https://www.perplexity.ai/search/how-to-create-a-multilingual-c-yvmbF_CmRjeMLUfozGw0Ew#0

Link 2(**Microsoft copilot.ai**):

<https://copilot.microsoft.com/shares/7Dsg6NbYGA5LajvHk7au9>

Link 3(**Claude.ai**): <https://claude.ai/share/3d83b698-889c-4af7-8793-b7699f26c11a>

Link 4(**chat gpt**):<https://chatgpt.com/share/68d970cc-2ad8-8012-90ff-8235e22afb41>

Link 5(**scispace.ai**): https://consensus.app/search/how-to-create-a-multilingual-chat-bot-from-strach/GHGY2CU_S2a7V0vgPj1SDw/?utm_source=share&utm_medium=clipboard