Chat Memory & Bloom’s Taxonomy Implementation Summary

Overview

This document summarizes the implementation of chat memory functionality and Bloom’s taxonomy integration in the educational chatbot platform.

Features Implemented

1. Chat Memory Functionality

Problem Solved:
- AI had no memory of previous conversations, leading to repetitive questions
- Students couldn’t see their chat history when rejoining sessions
- No context window management for long conversations
- Poor learning continuity with each message treated in isolation

Implementation Details:

Enhanced Chat API (`/app/api/chat/route.ts`)

- **Context Window Management**: Limited to last 20 messages for optimal performance
- **Conversation History**: LLM now receives recent chat history for context
- **Memory Efficiency**: Full history stored in database, only recent context sent to LLM
- **Backward Compatibility**: Maintains all existing functionality

New Chat History API Endpoint

- **Route**: `GET /api/sessions/[id]/chat-history`
- **Purpose**: Retrieves existing chat history for session resume
- **Security**: Validates student name and session access
- **Error Handling**: Graceful fallback mechanisms

Enhanced Student Chat Component

- **Automatic History Loading**: Loads existing conversation on component mount
- **Seamless Resume**: Students see full conversation history when rejoining
- **Progressive State Management**: Correctly restores difficulty level and progress
- **Fallback Handling**: Shows welcome message for new sessions

2. Bloom’s Taxonomy Integration

Transformation:
Replaced generic prompts with universal educational framework based on Bloom’s Revised Taxonomy.

New Question Generation Structure:
- Level 1–2: Remembering & Understanding (definitions, concept recall, explain in own words)
- Level 3–4: Applying & Analyzing (apply concepts in scenarios, interpret data, compare/contrast ideas)
- Level 5–6: Evaluating & Creating (judgment, critique, defend a position, design a solution)

Key Rules Implemented:
1. Clear progression from easier → harder questions
2. No repetition or rephrasing of previously asked questions
3. Never circle back to earlier levels unless instructed
4. Questions become deeper and more complex over time
5. Age-appropriate and precise questioning
6. Internal tracking of question types and levels

Technical Implementation

Database Schema

No schema changes required - leverages existing `chatLogJson` field in `StudentSession` table.

API Endpoints Modified/Added

- **Modified**: `POST /api/chat` - Enhanced with conversation context and Bloom's taxonomy prompts
- **Added**: `GET /api/sessions/[id]/chat-history` - Retrieves chat history for session resume

Frontend Changes

- **Student Chat Component**: Automatic chat history loading, session resume functionality
- **State Management**: Proper restoration of difficulty levels and progress
- **Error Handling**: Graceful fallbacks for failed history loads

Benefits Achieved

1. **Enhanced Learning Experience**: AI maintains conversation context for better educational flow
2. **Session Continuity**: Students can resume conversations seamlessly
3. **Pedagogical Improvement**: Questions follow established educational taxonomy
4. **Universal Applicability**: Platform now works for any subject
5. **Performance Optimization**: Efficient context window management
6. **Backward Compatibility**: All existing functionality preserved

Testing & Quality Assurance

Features Tested

- Context window management (20-message limit)
- Bloom's taxonomy prompt structure
- API endpoint functionality
- Component integration
- Session resume functionality
- Error handling and fallbacks

Test Cases Covered

- New session creation with welcome message
- Existing session resume with full history
- Context window management for long conversations
- API error handling and graceful degradation
- Progressive difficulty level restoration

- Mastery status preservation across sessions

Implementation Date

September 14, 2025

Version

Enhanced from v3.0.0 with chat memory and Bloom’s taxonomy features