

Introduction to Software Engineering

Data Design



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1.1 Data Diagram

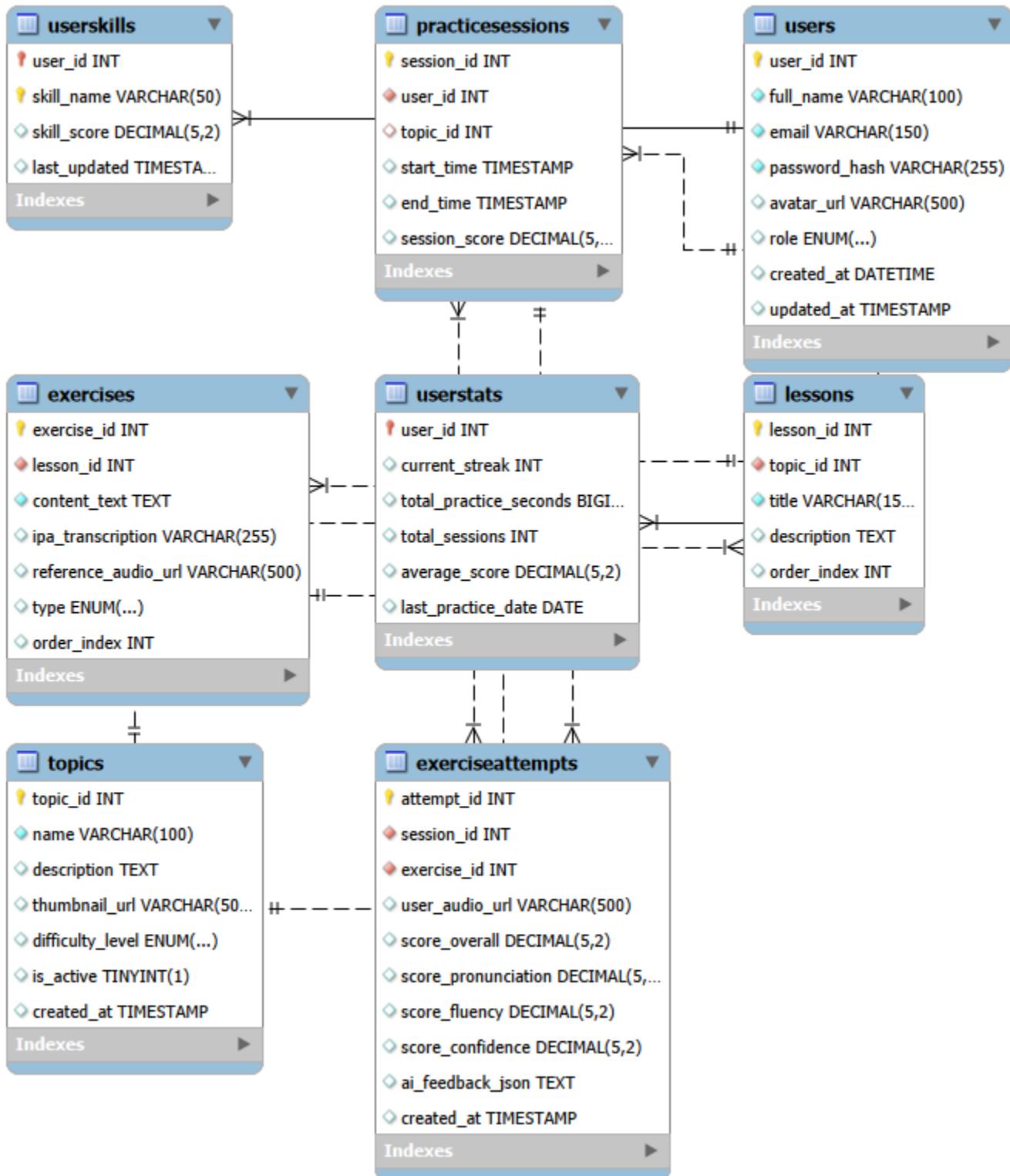


Diagram Description:

The data system is designed following the Relational Database model, focusing on managing users, the learning curriculum (Topics/Lessons/Exercises), and practice results.

- **Core:** The `users` table manages user identity and authentication.
- **Learning Content:** Organized hierarchically: `topics` contain multiple `lessons`, and `lessons` contain multiple `exercises`.
- **Practice Activity:** When users practice, high-level data is recorded in `practicesessions`, while specific details for each attempt are stored in `exerciseattempts`.
- **Statistics:** The `userstats` and `userskills` tables aggregate performance data to generate reports and track user progress

1.2 Data Specification

1. Table `users`

Stores user account information and personal profiles.

Attribute Name	Data Type	Constraints	Key Type	Description
<code>user_id</code>	INT	Auto Increment, Not Null	PK	Unique identifier for the user.
<code>full_name</code>	VARCHAR(100)	Not Null		User's full display name.

email	VARCHAR(50)	Unique, Not Null		User's login email address.
password_hash	VARCHAR(255)	Not Null		Encrypted (hashed) password.
avatar_url	VARCHAR(500)	Nullable		URL to the user's avatar image.
role	ENUM(...)	Values: 'USER', 'ADMIN'		User role within the system.
created_at	DATETIME	Default NOW()		Account creation timestamp
updated_at	TIMESTAMP	On Update CURRENT_TIMESTAMP		Last profile update timestamp

2. Table topics

Stores broad categories or themes in the curriculum.

Attribute Name	Data Type	Constraints	Key Type	Description
topic_id	INT	Auto Increment, Not Null	PK	Unique identifier for the topic.
name	VARCHAR(100)	Not Null		Name of the topic (e.g., Travel, Business).
description	TEXT	Nullable		Detailed description of the topic.
thumbnail_url	VARCHAR(500)	Nullable		URL for the topic's cover image.
difficulty_level	ENUM(...)	Values: 'Easy', 'Medium', 'Hard'		Difficulty level of the topic.
is_active	TINYINT(1)	Default 1 (True)		Topic activation status.
created_at	TIMESTAMP	Default NOW()		Record creation timestamp.

3. Table lessons

Stores individual lessons belonging to a specific topic.

Attribute Name	Data Type	Constraints	Key Type	Description
lesson_id	INT	Auto Increment, Not Null	PK	Unique identifier for the lesson.
topic_id	INT	Not Null	FK	Foreign key linking to the topics table.
title	VARCHAR(1 50)	Not Null		Title of the lesson.
description	TEXT	Nullable		Introduction or summary of the lesson.
order_index	INT	Not Null		Display order of the lesson within the topic.

4. Table exercises

Stores specific exercises within a lesson.

Attribute Name	Data Type	Constraint s	Key Typ e	Description
exercise_id	INT	Auto Increment, Not Null	PK	Unique identifier for the exercise.

lesson_id	INT	Not Null	FK	Foreign key linking to the lessons table.
content_text	TEXT	Not Null		The text content for reading/practice.
ipa_transcription	VARCHAR(255)	Nullable		Standard IPA transcription of the text.
reference_audio_url	VARCHAR(500)	Nullable		URL for native speaker reference audio.
type	ENUM(...)	Values: 'Speaking', 'Listening'		Type of exercise.
order_index	INT	Not Null		Order of the exercise within the lesson.

5. Table practicesessions

Stores high-level data about a user's practice session.

Attribute Name	Data Type	Constraints	Key Type	Description

session_id	INT	Auto Increment, Not Null	PK	Unique identifier for the session.
user_id	INT	Not Null	FK	The user who performed the session.
topic_id	INT	Not Null	FK	The topic practiced during the session.
start_time	TIMESTAMP	Not Null		Session start time.
end_time	TIMESTAMP	Nullable		Session end time.
session_score	DECIMAL(5, 2)	Min 0, Max 100		Aggregate score for the entire session.

6. Table exerciseattempts

Stores detailed results of every attempt (recording/answer) for an exercise.

Attribute Name	Data Type	Constraints	Key Type	Description
attempt_id	INT	Auto Increment, Not Null	PK	Unique identifier for the attempt.

session_id	INT	Not Null	FK	Links to the practicesessions table.
exercise_id	INT	Not Null	FK	Links to the exercises table.
user_audio_url	VARCHAR(500)	Nullable		URL to the user's recorded audio file.
score_overall	DECIMAL(5,2)	Min 0, Max 100		Overall score generated by AI.
score_pronunciation	DECIMAL(5,2)	Min 0, Max 100		Component score for pronunciation.
score_fluency	DECIMAL(5,2)	Min 0, Max 100		Component score for fluency.
score_confidence	DECIMAL(5,2)	Min 0, Max 100		Component score for confidence.
ai_feedback_json	TEXT	JSON format		Detailed AI feedback (phoneme errors, etc.).
created_at	TIMESTAMP	Default NOW()		Timestamp when the attempt was submitted.

7. Table userstats

Stores aggregated statistics for a user (1-to-1 relationship with users).

Attribute Name	Data Type	Constraints	Key Type	Description
user_id	INT	Not Null	PK, FK	Links 1-to-1 with the users table.
current_streak	INT	Default 0		Current count of consecutive practice days.
total_practice_seconds	BIGINT	Default 0		Total time spent practicing (in seconds).
total_sessions	INT	Default 0		Total number of completed sessions.
average_score	DECIMAL(5, 2)	Min 0, Max 100		Average score across all exercises.
last_practice_date	DATE	Nullable		The date of the most recent practice.

8. Table userskills

Stores specific skill ratings for a user (e.g., Intonation, Pronunciation).

Attribute Name	Data Type	Constraints	Key Type	Description
user_id	INT	Not Null	PK, FK	Links to the users table.
skill_name	VARCHAR(50)	Not Null	PK	Name of the skill (Part of Composite PK).
skill_score	DECIMAL(5, 2)	Min 0, Max 100		Current score/rating for this skill.
last_updated	TIMESTAMP	Default NOW()		Timestamp of the last score update.