

# Database Architecture

## Database Design

Normalized MySQL schema with 12 interconnected tables

### Core Tables

- Admins & Authentication
- Grades, Subjects & Subtopics
- Worksheets & Content Management
- Payment & Email Processing

### Relationships

- Grade ↔ Subject (Many-to-Many)
- Subject → Subtopic → Worksheet
- Worksheet → Previews & Requests
- Admin → Activity & Security Logs

## Optimization Features

**Indexing:** Primary keys, foreign keys, and unique constraints

**Normalization:** Separated concerns with junction tables

**Security:** Login attempt tracking and admin activity logs

**File Management:** S3 integration with preview URLs and thumbnails

# Security and Best Practices

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## Data Protection

- Input validation & sanitization
- Password hashing (bcrypt)
- Environment variables
- HTTPS/SSL encryption

## System Security

- Role-based access control
- Session management
- CORS configuration
- SQL injection prevention

## Monitoring

- Admin activity logging
- Payment verification
- Error tracking
- Performance monitoring

## Backup & Recovery

- Automated daily backups
- Version control (Git)
- Database redundancy
- Disaster recovery plan