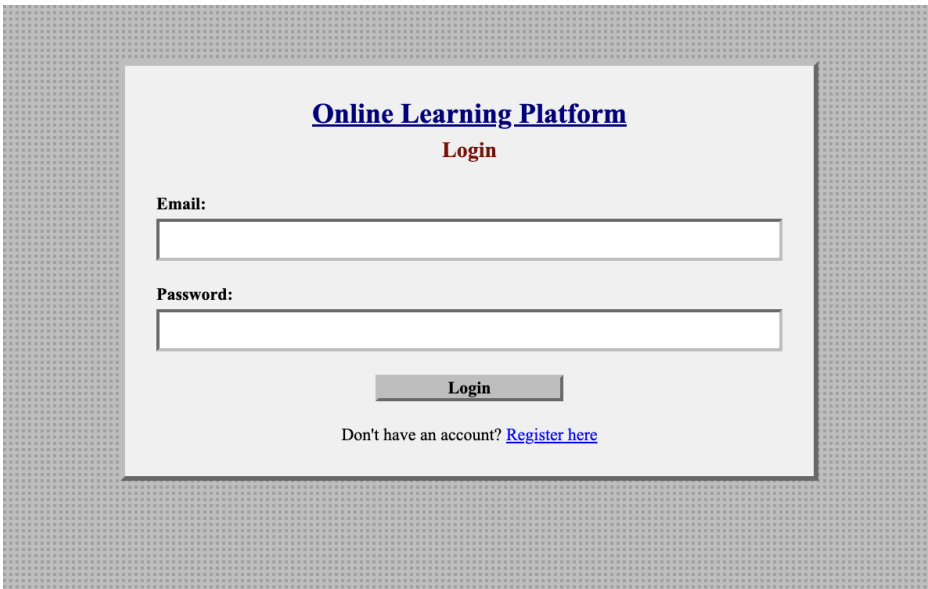# Task 8 - Interactive Dashboard Screenshot

Overview

This section provides a comprehensive guide for capturing screenshots of the Online Learning Platform dashboard across all user roles. The platform features role-based dashboards with distinct functionalities for Students, Instructors, and Administrators.

1. Login Process Interface

This is the Login Interface of the Online Learning Platform. It provides users with a simple and secure way to access the system by entering their email and password. For new users, a registration link is available at the bottom, directing them to create a new account. The clean layout ensures easy navigation for both students and instructors.

2. Student Dashboard Screenshots
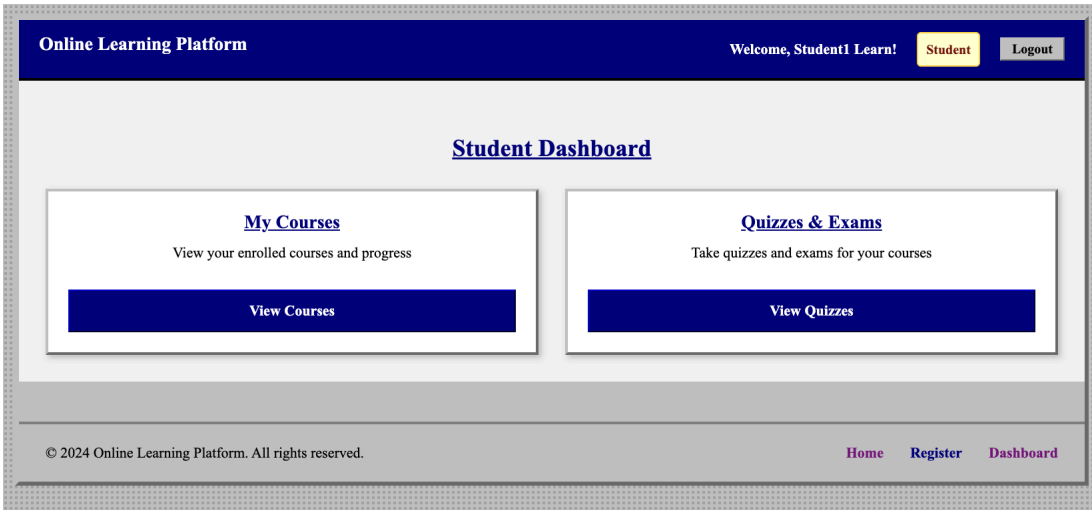
The Student Dashboard provides learners with a streamlined and user-friendly interface to navigate their academic activities. At the top, users are greeted by name with a clear role indicator and logout functionality. The main content area features two primary sections:

- My Courses: Allows students to view their enrolled courses and track their learning progress.
- Quizzes & Exams: Enables access to quizzes and assessments associated with their courses.

Each section is presented with a concise description and an action button for easy access. The footer includes navigation links to Home, Register, and Dashboard, ensuring intuitive site-wide navigation. The consistent color scheme and clean layout enhance usability and accessibility for all student users.

2.1 My Course Panel

The "My Enrolled Courses" page provides students with a detailed view of their current and completed courses. Each course card displays the course title, brief description, associated tags (such as category, difficulty level, and instructor), and a visual progress bar indicating completion percentage. Status badges (e.g., Learning, Completed) offer immediate insight into each course's progress stage.

2.1.1 View Quizzes Panel

Online Learning Platform

Welcome, Student1 Learn! Student Logout

Course Quizzes & Exams

← Back to Courses

Course 16

Description for course 16

AI/ML   Beginner   Instructor: Instructor1 Teach

QUIZ **test167**

Test quiz 167 for Course 16

Duration: 15 minutes   Questions: 1   Points: 5

Start: 7/28/2025, 5:00:00 PM   End: 8/28/2025, 5:00:00 PM

Take Quiz

QUIZ **test16**

Test quiz for Course 16

Duration: 30 minutes   Questions: 1   Points: 5

Start: 7/28/2025, 5:00:00 PM   End: 8/28/2025, 5:00:00 PM

Take Quiz

ASSIGNMENT Expired **Exam 16 for Course 16**

Description for exam 16 of course Course 161

Duration: 52 minutes   Questions: 4   Points: 8

Start: 7/22/2025, 5:36:45 PM   End: 7/30/2025, 5:36:45 PM

Quiz expired

The "Course Quizzes & Exams" page allows students to view and access all assessments associated with a specific course. Each assessment card provides the following details:

- Type: Clearly labeled as QUIZ or ASSIGNMENT
- Title and Description: Including quiz/exam name and purpose
- Logistics: Duration, number of questions, total points
- Availability: Start and end timeframes are prominently shown

- Status: A color-coded badge (e.g., Expired, Take Quiz) helps indicate availability and urgency
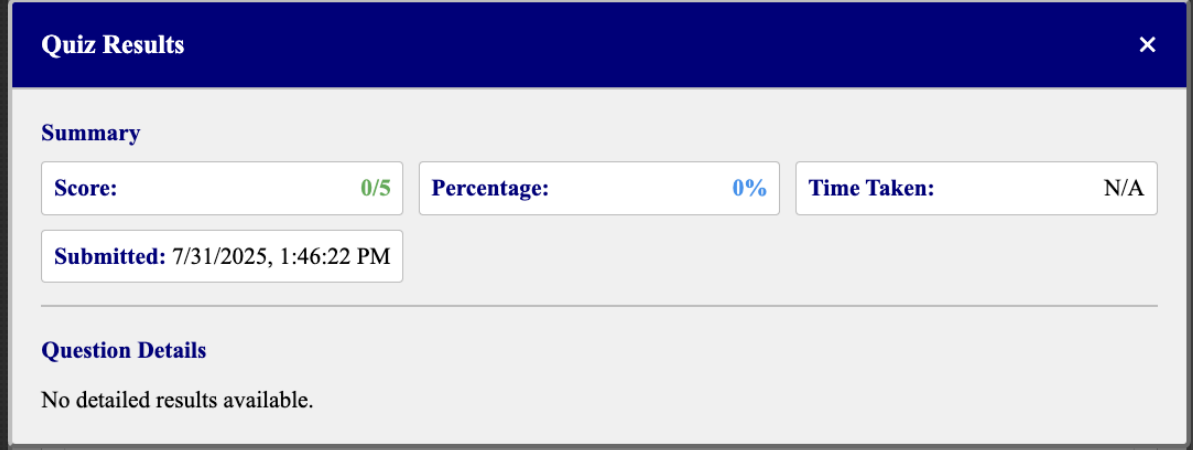
Students can click the "Take Quiz" button for eligible assessments or view expired quizzes that are no longer accessible. The layout ensures students can manage their exam schedules effectively and prioritize upcoming tasks.

This interface supports better time management and a structured approach to assessment tracking.

This page allows students to take quizzes with a clear layout. It includes:

- Quiz instructions and a countdown timer.
- Single multiple-choice question display.
- Options to Save Progress or Submit Quiz.

Quiz Results ✕

Summary

| Score: | 0/5 | Percentage: | 0% | Time Taken: | N/A |

Submitted: 7/31/2025, 1:46:22 PM
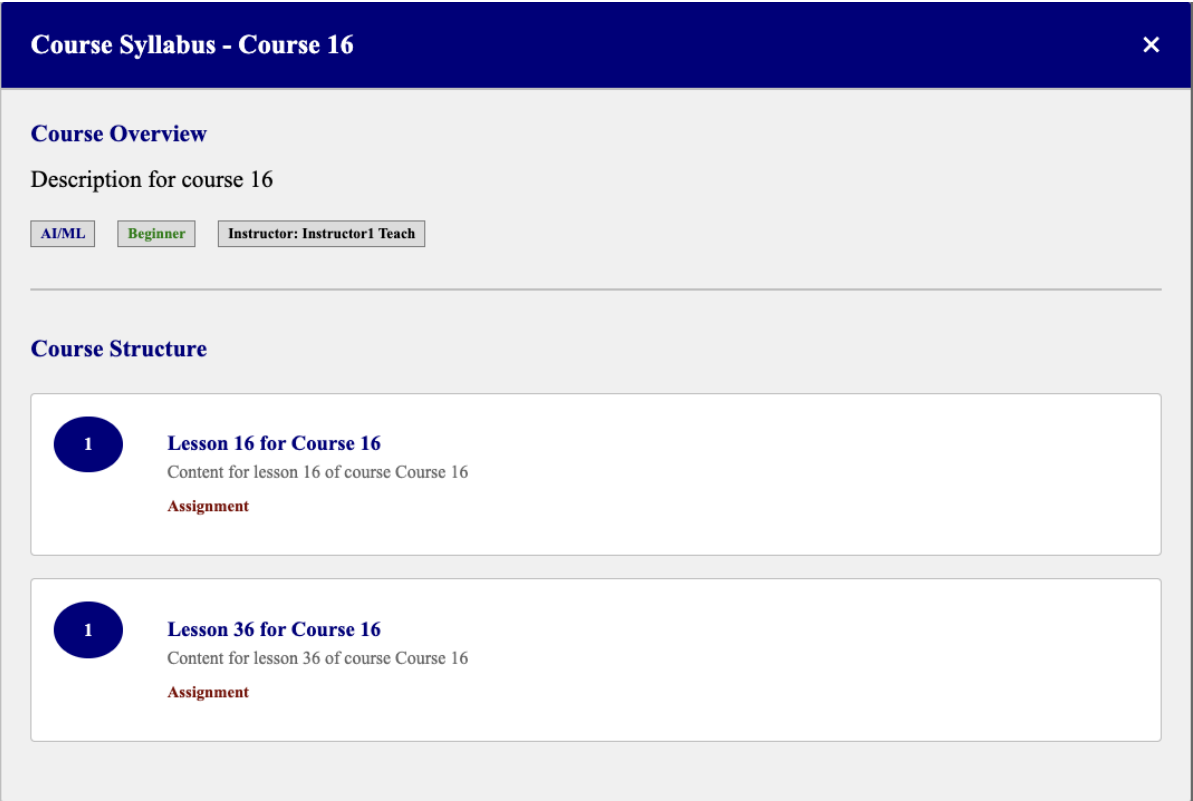
Question Details

No detailed results available.

After submission, students see:

- Their score, percentage, and submission time.
- A summary panel for performance.
- (If enabled) Detailed feedback per question.

2.1.2 Syllabus Panel

Course Syllabus - Course 16 ✕

Course Overview

Description for course 16

AI/ML   Beginner   Instructor: Instructor1 Teach

Course Structure

1 **Lesson 16 for Course 16**
   Content for lesson 16 of course Course 16
   Assignment

1 **Lesson 36 for Course 16**
   Content for lesson 36 of course Course 16
   Assignment

This page presents an overview of the selected course along with a structured list of lessons. Each lesson includes a title, brief description, and associated assignment label, helping students track their learning content and tasks clearly.

2.2 Quizzes & Exams Panel

Online Learning Platform

Welcome, Student1 Learn! | Student | Logout

All Quizzes & Exams

← Back to Dashboard

Course 6

Midterm
Exam 6 for Course 6
Description for exam 6 of course Course 6

Duration: 1h 19m | Questions: 4 | Points: 7

Take Quiz

Course 10

Midterm
Exam 10 for Course 10
Description for exam 10 of course Course 10

Duration: 39 minutes | Questions: 3 | Points: 8

Take Quiz

Course 15

Final Exam
Exam 15 for Course 15
Description for exam 15 of course Course 15

Duration: 1h 16m | Questions: 3 | Points: 8

Expired

Course 16

Assignment
Exam 16 for Course 16
Description for exam 16 of course Course 161

Duration: 52 minutes | Questions: 4 | Points: 8

Expired

This is the Quizzes & Exams Panel overview page, where students can view all quizzes and exams across their enrolled courses. Each section is organized by course and displays exam titles, descriptions, duration, number of questions, and point values. Available quizzes have a "Take Quiz" button, while expired ones are clearly labeled as "Expired." This centralized layout helps students efficiently track and manage their assessments.

2.2.1 Take Quiz Panel

Exam 6 for Course 6 `78:46` ✕

Instructions:

- Read each question carefully
- You have 1h 19m to complete this quiz
- You can review your answers before submitting
- Once submitted, you cannot change your answers

Question 1

Question 1 for exam 6

- ⦿ Option A for question 1
- ○ Option B for question 1
- ○ Option C for question 1
- ○ Option D for question 1

Question 2

Question 2 for exam 6

- ⦿ Option A for question 2
- ○ Option B for question 2
- ○ Option C for question 2

Course 10

This is the Take Quiz interface for Course 6. The page provides clear instructions at the top, including time limits and submission rules. Below, each question is displayed with multiple-choice options, allowing students to select their answers. A countdown timer is prominently shown to help students manage their remaining time effectively. This structured layout ensures a smooth and focused test-taking experience.

Quiz Results ✕

Summary

| Score: | 2/7 | Percentage: | 29% | Time Taken: | N/A |

Submitted: 7/31/2025, 1:56:41 PM

Question Details

No detailed results available.

This is the Quiz Results summary screen when you click the submit quiz button, which displays the student's performance immediately after submission. It shows the raw score (e.g., 2 out of 7), percentage achieved, submission timestamp, and time taken (if available). Detailed question results are currently not shown, keeping the summary concise and focused.

3. Instructor Dashboard Screenshots
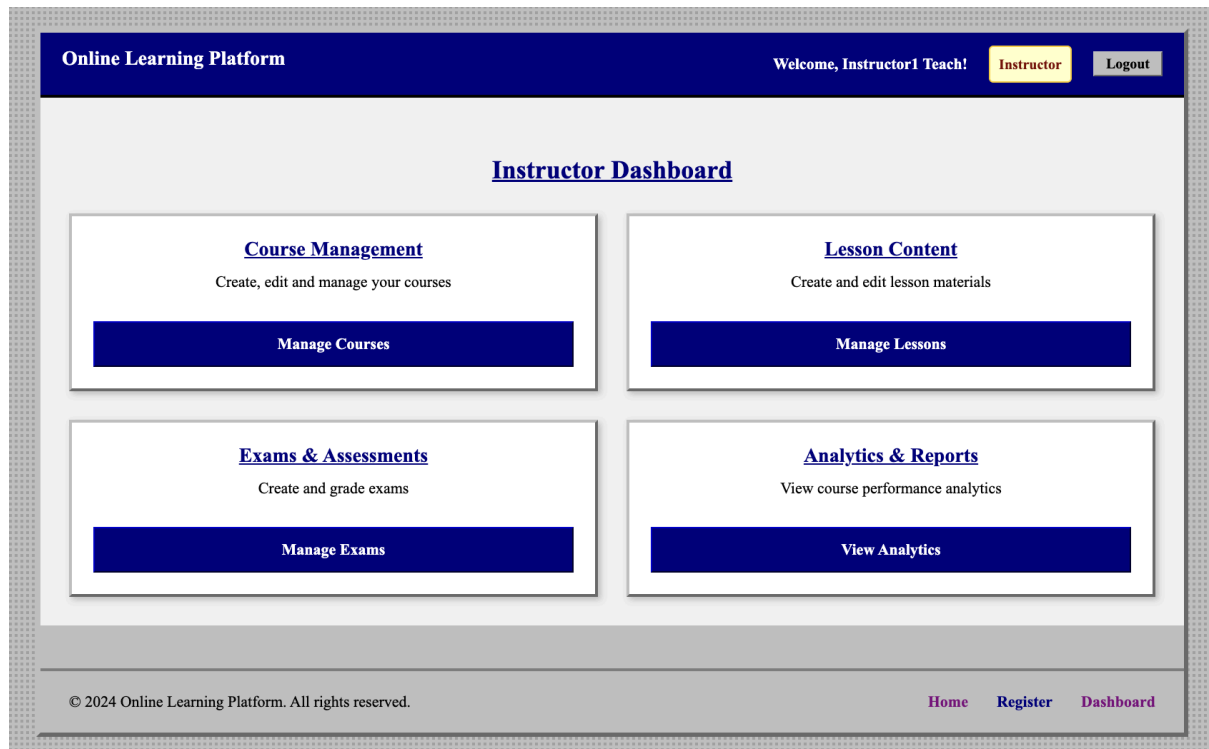
This is an instructor dashboard for an online learning platform that provides four main management areas: Course Management for creating and editing courses, Lesson Content for managing learning materials, Exams & Assessments for creating and grading tests, and Analytics & Reports for viewing course performance data.

The interface features a clean, professional design with a blue color scheme and clearly organized sections to help instructors efficiently manage their online courses.

3.1 Course Management Panel

Online Learning Platform

Welcome, Instructor1 Teach! | Instructor | Logout

Course Management

← Back | + Create New Course

Course 1 — Active

Description for course 1

Programming | Beginner | $267

Created: 7/28/2025

Edit | Deactivate | Delete

Course 6 — Active

Description for course 6

Other | Advanced | $71

Created: 7/28/2025

Edit | Deactivate | Delete

Course 11 — Active

Description for course 11

Database | Intermediate | $155

Created: 7/28/2025

Edit | Deactivate | Delete

Course 16 — Active

Description for course 16

AI/ML | Beginner | $279

Created: 7/28/2025

Edit | Deactivate | Delete

This is the Course Management page where instructors can view and manage all their courses in a list format. Each course entry displays key details like the course name, description, category tags (Programming, Database, AI/ML, etc.), difficulty level, price, creation date, and status, along with action buttons to Edit, Deactivate, or Delete each course.

3.1.1 Course Edit Panel

Edit Course

Course Title *

| Course EDIT |

Category *

| Database ⌄ |

Level *

| Intermediate ⌄ |

Price ($) *

| 500 |

Description *

| This is the course after edit |

☑ **Course is active and visible to students**

| Cancel | | **Save Course** |

Course EDIT [Active]

This is the course after edit

| Database | | Intermediate | | $500 |

Created: 7/28/2025   Updated: 7/28/2025

| Edit | | Deactivate | | Delete |

Course 6 [Active]

Description for course 6

| Other | | Advanced | | $71 |

Created: 7/28/2025

| Edit | | Deactivate | | Delete |

3.1.2 Course Deactivated Screenshot

Online Learning Platform   Welcome, Instructor1 Teach!   `Instructor`   `Logout`

Course Management   ← Back   + Create New Course

Course EDIT   Inactive

This is the course after edit

`Database`   `Intermediate`   `$500`

Created: 7/28/2025   Updated: 7/28/2025

Edit   Activate   Delete

Course 6   Active

Description for course 6

`Other`   `Advanced`   `$71`

Created: 7/28/2025

Edit   Deactivate   Delete

Course 11   Active

3.1.3 New Course Adding Screenshot

Course Management   ← Back   + Create New Course

Create New Course

Course Title *
NEW Course

Category *
Other

Level *
Beginner

Price ($) *
666

Description *
This is the new course to be added

☑ **Course is active and visible to students**

Cancel   Save Course

Course EDIT   Inactive

Course Management

← Back | + Create New Course

NEW Course

Active

This is the new course to be added

Other | Beginner | $666

Created: 7/28/2025

Edit | Deactivate | Delete

Course EDIT

Inactive

This is the course after edit

Database | Intermediate | $500

Created: 7/28/2025   Updated: 7/28/2025

Edit | Activate | Delete

Course 6

Active

3.2 Lesson Content Panel

Online Learning Platform

Welcome, Instructor1 Teach! | Instructor | Logout

Lesson Management

← Back | Select a course... ▾ | + Create New Lesson

Select a Course

Choose a course from the dropdown above to manage its lessons.

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Home   Register   Dashboard
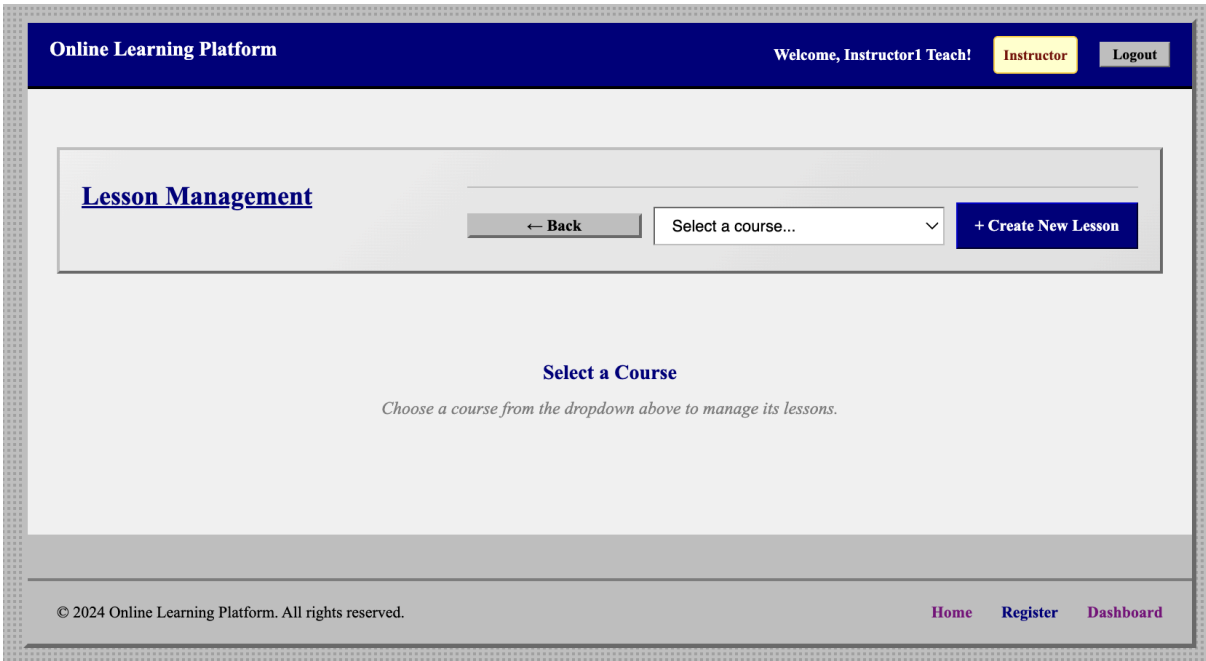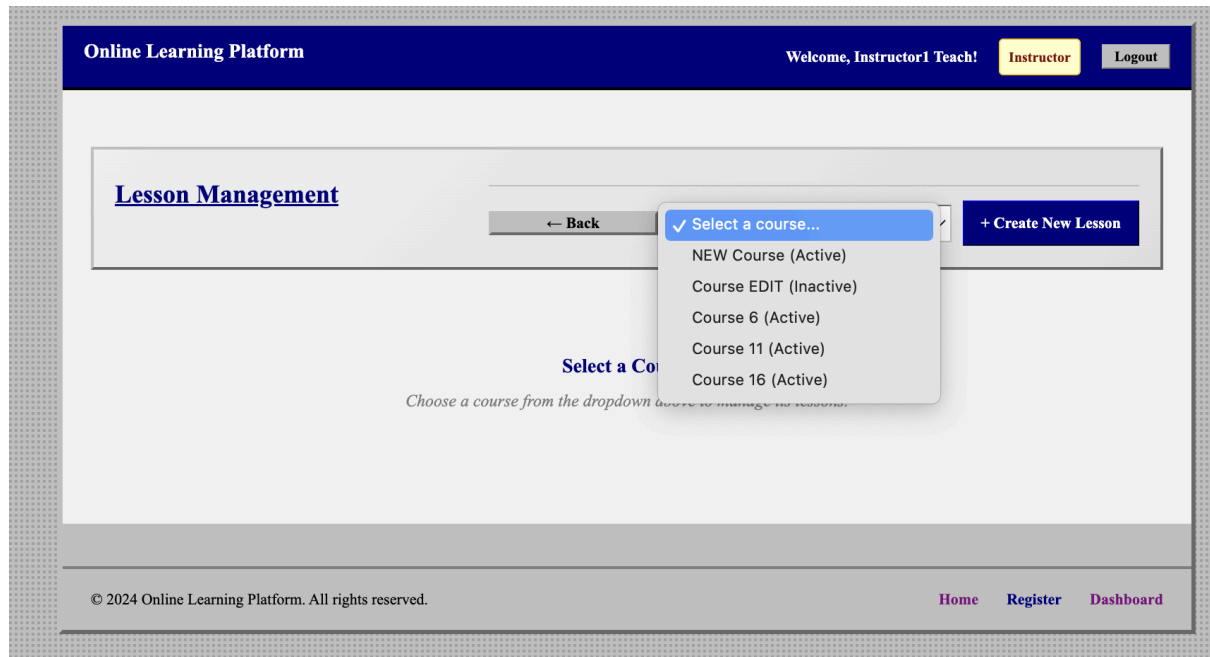
This is the Lesson Management page where instructors need to first select a course from the dropdown menu before they can view and manage the lessons within that course. The page provides a "Create New Lesson" button and prompts instructors to choose a course to begin managing its lesson content.

3.2.1 Delete Course

Online Learning Platform

Welcome, Instructor1 Teach! **Instructor** **Logout**

Lesson Management

← Back | Course 16 ◆ | **+ Add Lesson**

1 **Lesson 16 for Course 16**

Content for lesson 16 of course Course 16

Edit | Delete

1 **Lesson 36 for Course 16**

Content for lesson 36 of course Course 16

Edit | Delete

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Home **Register** **Dashboard**

Online Learning Platform

Welcome, Instructor1 Teach! **Instructor** **Logout**

Lesson Management

← Back | Course 16 ◆ | **+ Add Lesson**

Loading...

© 2024 Online Learning Platform. All rights reserved.

Home **Register** **Dashboard**

Lesson deleted!

Close
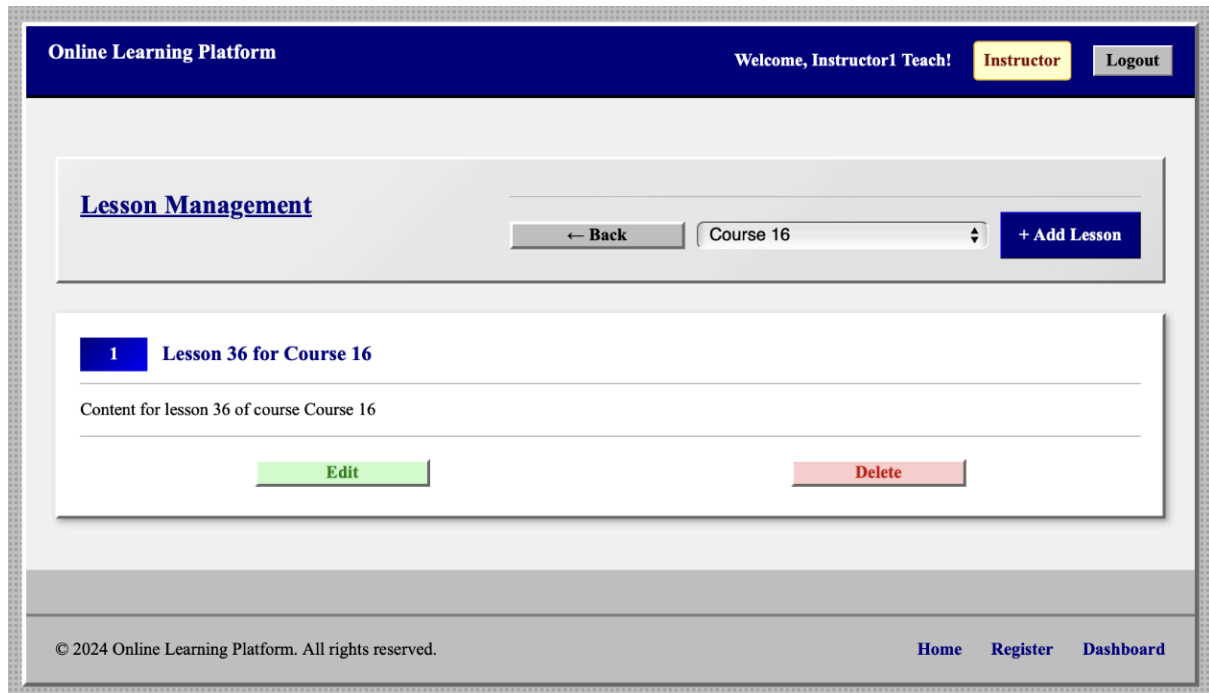
3.3 Lesson Content Panel
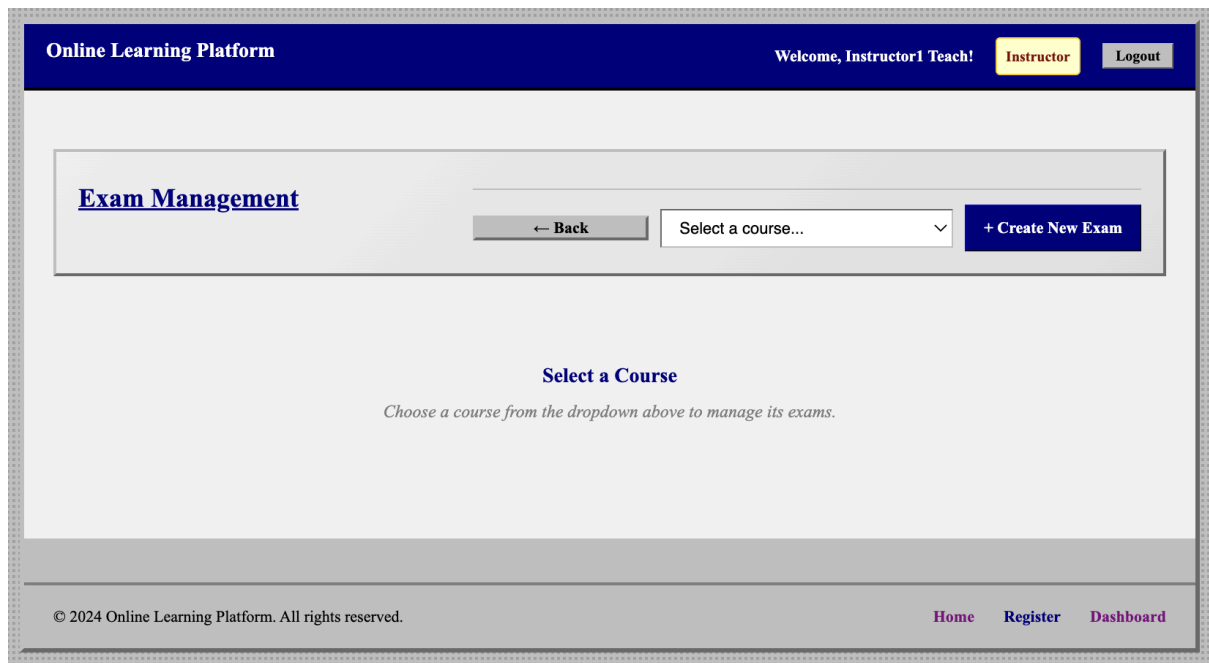
This is the initial Exam Management page where instructors must first select a course from the dropdown menu before they can view and manage exams for that specific course. The page prompts users to "Choose a course from the dropdown above to manage its exams" and includes a "Create New Exam" button that becomes functional once a course is selected.

3.3.1 Create New Exam

Online Learning Platform

Welcome, Instructor1 Teach! | Instructor | | Logout |

Exam Management

| ← Back | Course 11 (Active) ▾ | + Create New Exam |

Course 11

Description for course 11

Exam 11 for Course 11

| Active | FINAL EXAM |

Description:

Description for exam 11 of course Course 11

Created: 7/28/2025

| Edit | | Deactivate | | Delete |

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Home   **Register**   **Dashboard**

Online Learning Platform

Welcome, Instructor1 Teach! | Instructor | Logout

Exam Management

← Back | Course 11 (Active) ▾ | + Create New Exam

Course 11

Description for course 11

Exam 11 for Course 11   Active | FINAL EXAM

Description:

Description for exam 11 of course Course 11

Created: 7/28/2025

Edit | Deactivate | Delete

Course 11 New Exam   Active | FINAL EXAM

Description:

This is a the final exam for course 11. The exam contains 15 muti-choice and 2-3 short answers.

Created: 7/28/2025

Edit | Deactivate | Delete

© 2024 Online Learning Platform. All rights reserved.   Home   Register   Dashboard

3.3.2 Change Exam Type

Online Learning Platform

Welcome, Instructor1 Teach! | Instructor | Logout

Exam Management

← Back | Course 6 (Active) ▾ | **+ Create New Exam**

Course 6
Description for course 6

Exam 6 for Course 6

Active | MIDTERM

Description:
Description for exam 6 of course Course 6

Created: 7/28/2025

Edit | Deactivate | Delete

Online Learning Platform

Welcome, Instructor1 Teach! | Instructor | Logout

Exam Management

← Back | Course 6 (Active) ▾ | **+ Create New Exam**

Course 6
Description for course 6

Exam 6 for Course 6

Active | QUIZ

Description:
This is a quiz for course 6. The quiz is on Jul 28, 3pm. Optional: one sheet of cheat sheet.

Created: 7/28/2025   Updated: 7/28/2025

Edit | Deactivate | Delete
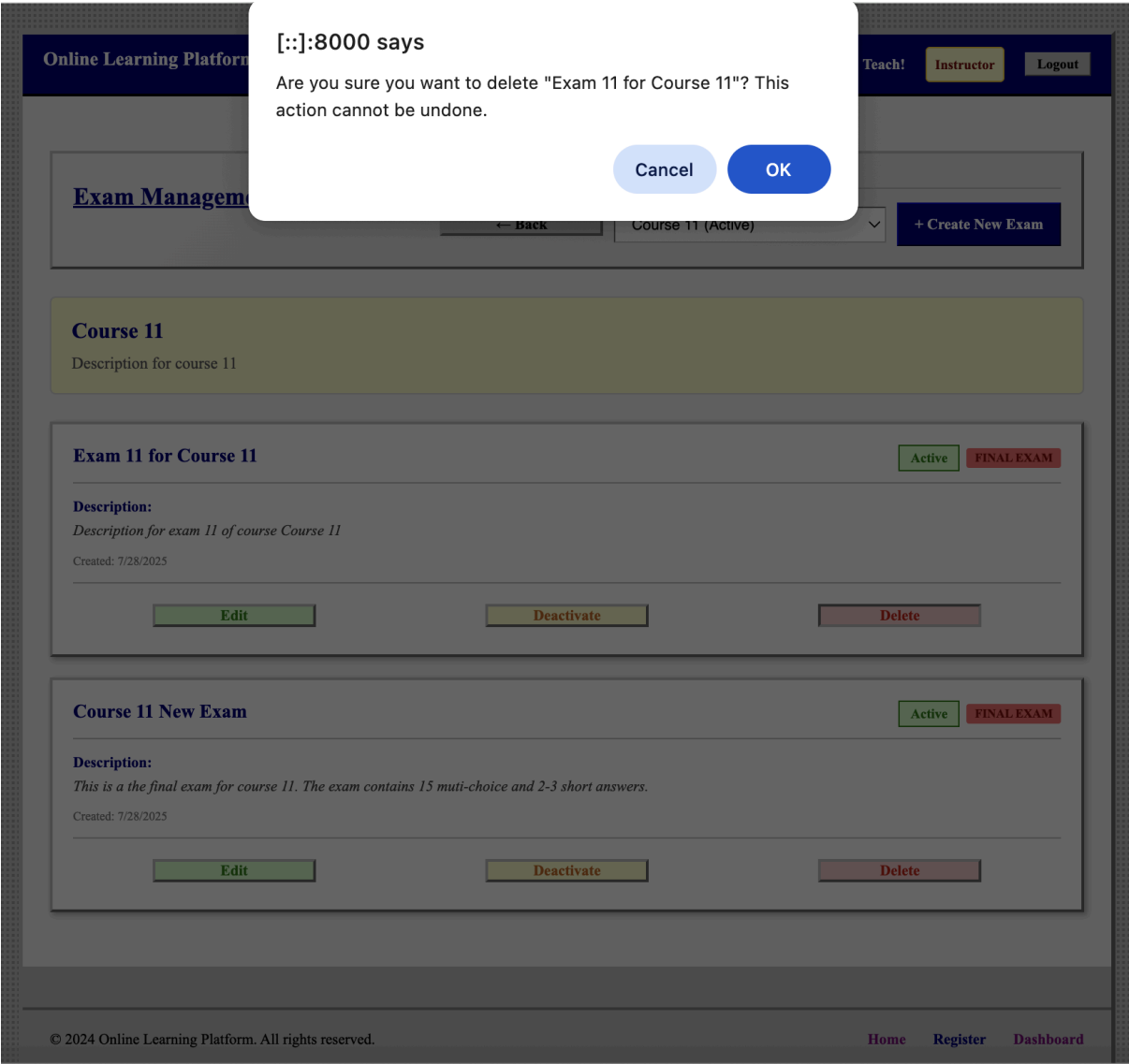
3.3.3 Delete Exam

[::]:8000 says

Are you sure you want to delete "Exam 11 for Course 11"? This action cannot be undone.

Cancel   OK

Online Learning Platform   Teach!   Instructor   Logout

Exam Management   ← Back   Course 11 (Active) ▼   + Create New Exam

Course 11
Description for course 11

Exam 11 for Course 11   Active   FINAL EXAM

Description:
Description for exam 11 of course Course 11

Created: 7/28/2025

Edit   Deactivate   Delete

Course 11 New Exam   Active   FINAL EXAM

Description:
This is a the final exam for course 11. The exam contains 15 muti-choice and 2-3 short answers.

Created: 7/28/2025

Edit   Deactivate   Delete

Home   Register   Dashboard

Online Learning Platform

Teach!   Instructor   Logout

[::]:8000 says

Exam deleted successfully!

OK

Exam Management

← Back   Course 11 (Active) ▼   + Create New Exam

Course 11
Description for course 11

Course 11 New Exam   Active   FINAL EXAM

Description:
This is a the final exam for course 11. The exam contains 15 muti-choice and 2-3 short answers.

Created: 7/28/2025

Edit   Deactivate   Delete

© 2024 Online Learning Platform. All rights reserved.   Home   Register   Dashboard
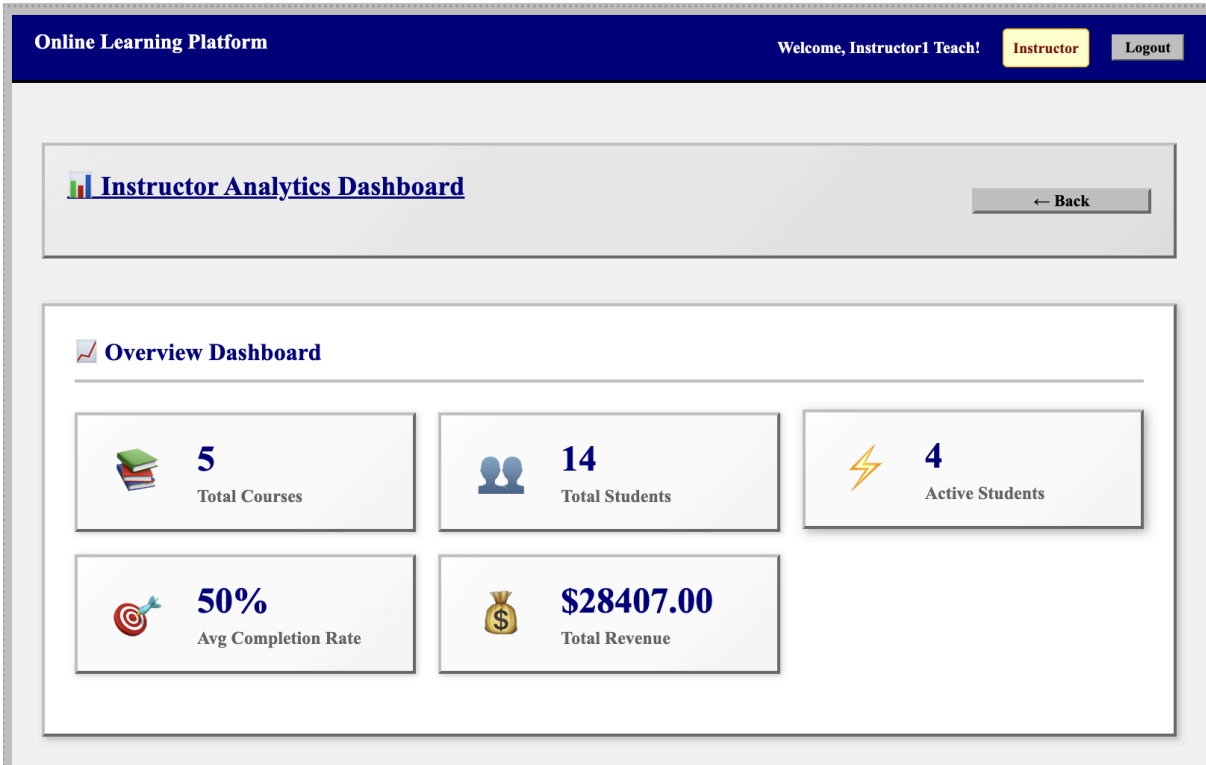
3.4 Analytic & Report Dashboard Overview

Online Learning Platform   Welcome, Instructor1 Teach!   Instructor   Logout

📊 Instructor Analytics Dashboard   ← Back

📈 Overview Dashboard

| 📚 **5** Total Courses | 👥 **14** Total Students | ⚡ **4** Active Students |

| 🎯 **50%** Avg Completion Rate | 💰 **$28407.00** Total Revenue | |

The Instructor Dashboard provides a centralized interface for instructors to monitor key teaching metrics. It summarizes course performance, student engagement, and revenue insights through interactive visualizations. This dashboard supports efficient teaching management and data-driven decisions across multiple dimensions.

3.4.1 Overview Dashboard
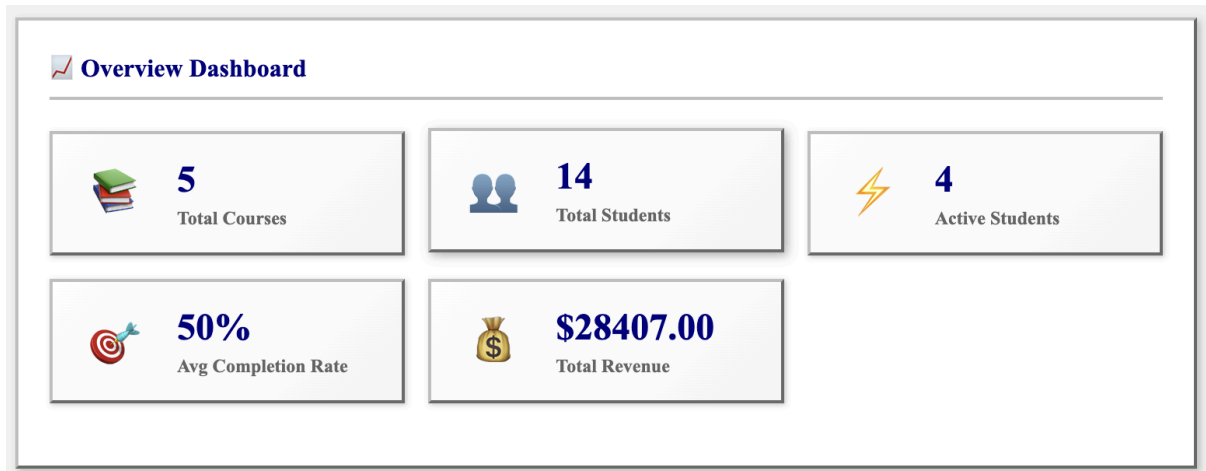
The Overview Dashboard provides instructors with a quick summary of key teaching metrics in a visually accessible format. It displays five core statistics:

- Total Courses: The number of courses created by the instructor (e.g., 5).
- Total Students: The cumulative number of students enrolled across all courses (e.g., 14).
- Active Students: The number of currently active students (e.g., 4), helping monitor engagement.
- Average Completion Rate: The percentage of course content completed on average by enrolled students (e.g., 50%).
- Total Revenue: The total revenue generated from course enrollments (e.g., $28,407.00).

This dashboard allows instructors to assess their teaching performance and revenue generation at a glance, supporting data-driven course management decisions.

3.4.2 Course Performance Analysis

📊 Course Performance Analysis

Course Enrollment Distribution

Course Completion Rates
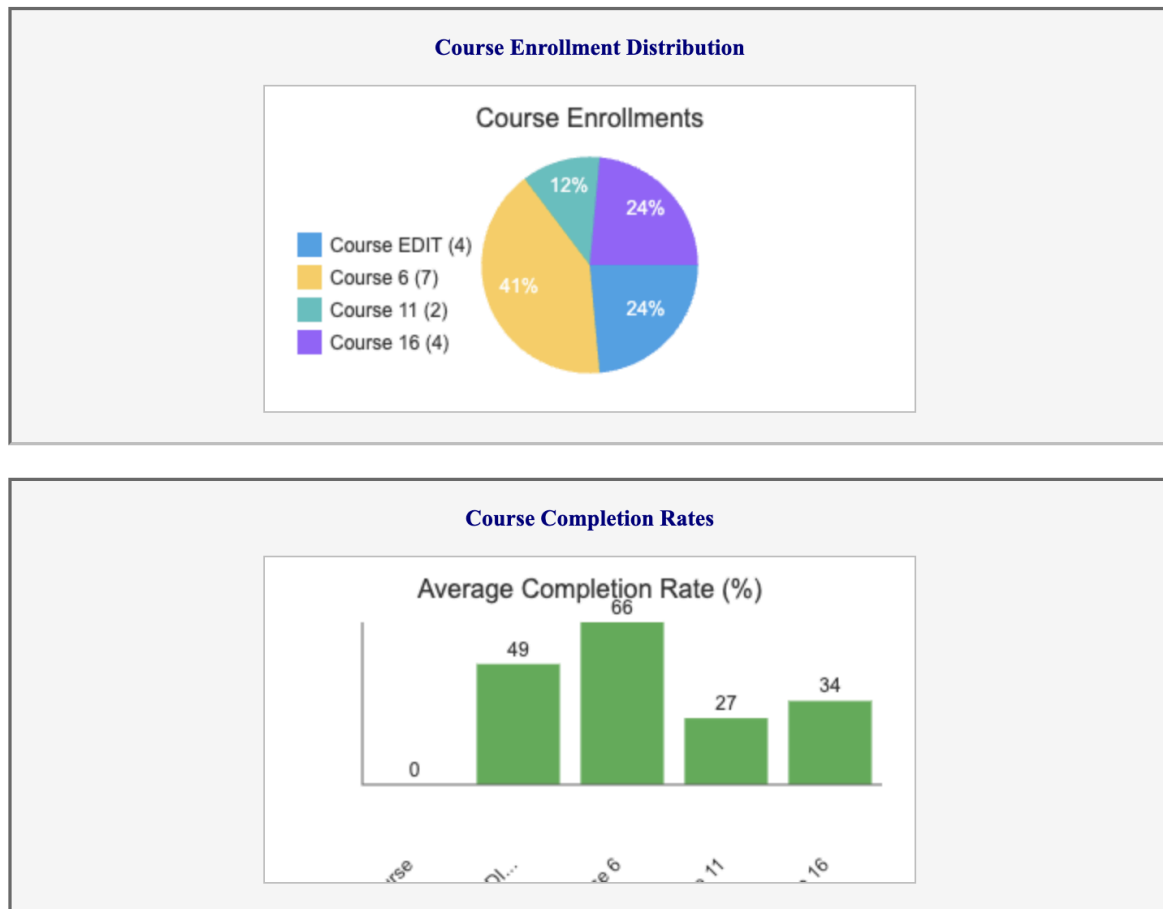
Course Performance Details

Course	Enrollments	Completion Rate	Avg Grade	Revenue	Status
NEW Course	0	0%	0%	$0.00	Active
Course EDIT	4	49%	18%	$2000.00	Inactive
Course 6	7	66%	28%	$497.00	Active
Course 11	2	27%	0%	$310.00	Active
Course 16	4	34%	11%	$1116.00	Active

The Course Performance Analysis module provides instructors with a detailed view of how each course is performing in terms of enrollment, completion, grades, and revenue.
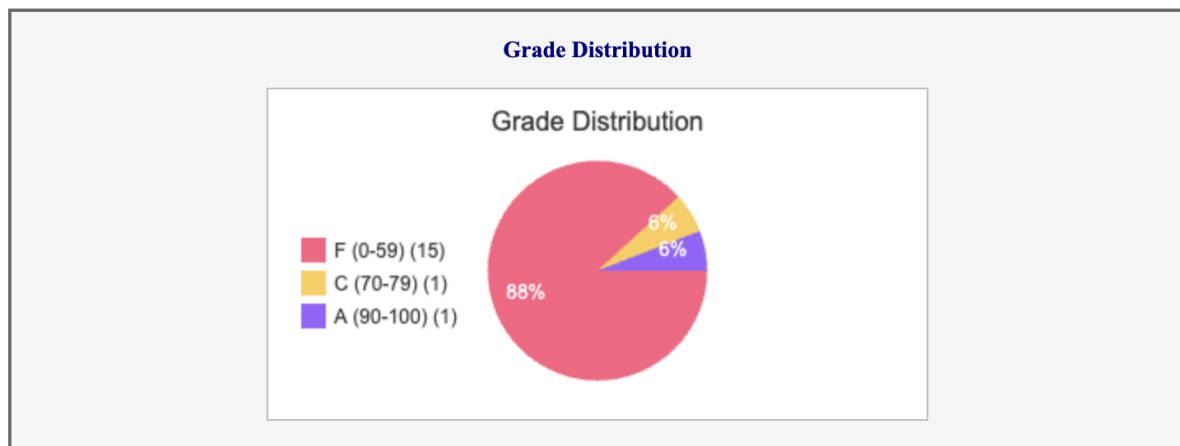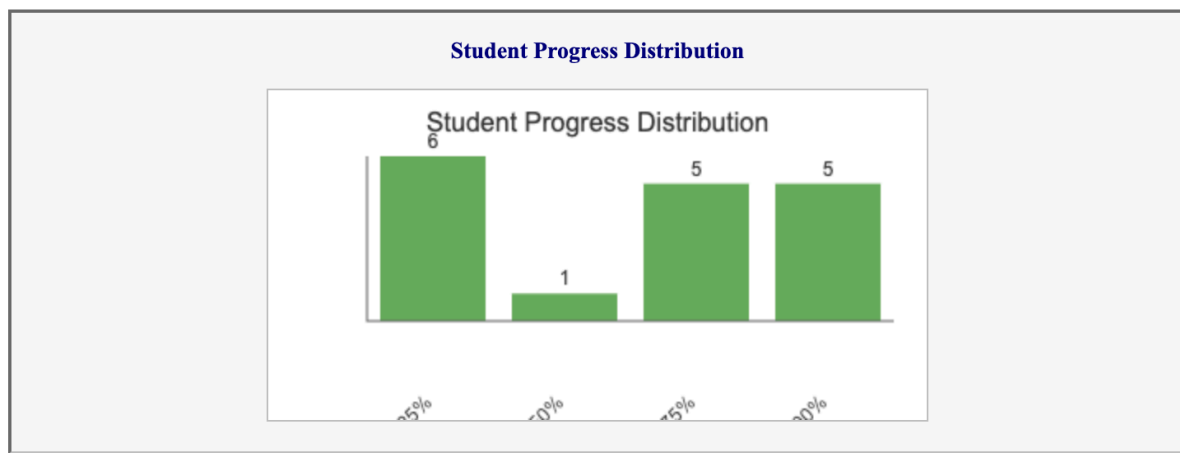
- At the top, a pie chart displays the distribution of enrollments across different courses, helping instructors quickly identify the most and least popular courses.
- Below it, a bar chart illustrates the average completion rate for each course, highlighting disparities in student engagement or course difficulty.
- The Course Performance Details table provides comprehensive statistics including:
  - Enrollment count
  - Completion rate

○ Average grade
○ Total revenue generated
○ Current course status (Active or Inactive)

This module enables data-driven decision-making by helping instructors pinpoint which courses need content improvements, which ones generate the most revenue, and which are underperforming.

3.4.3 Student Performance Analysis

🎓 **Student Performance Analysis**

Student Progress Distribution

Grade Distribution

The Student Performance Analysis module focuses on tracking and analyzing individual learner outcomes. It consists of:

- A Student Progress Distribution bar chart categorizing students based on their completion percentage;
- A Grade Distribution pie chart showing the spread of grades across all enrolled students;
- A Students Needing Attention panel that highlights learners with minimal progress, helping instructors prioritize outreach;
- A Top Performers panel showcasing students with outstanding progress.

Together, these components provide a comprehensive overview of student learning status, allowing instructors to identify at-risk students and recognize high achievers for targeted feedback and support.

4. Admin Dashboard Screenshots
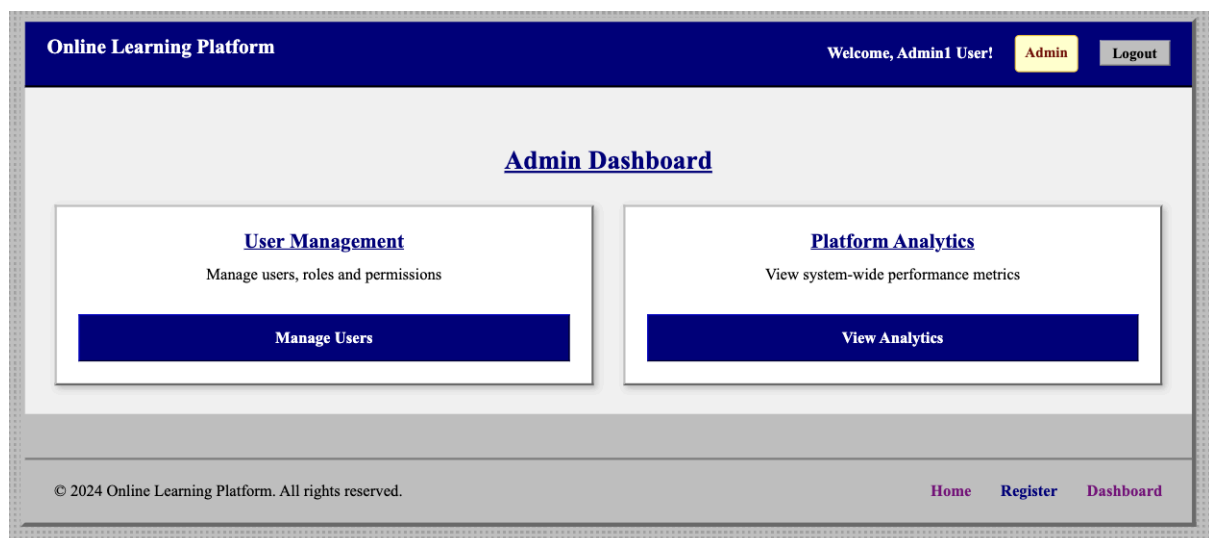
This is the Admin Dashboard of the Online Learning Platform. It provides two main management panels:

- User Management, where admins can manage user accounts, roles, and permissions.
- Platform Analytics, which allows viewing of system-wide performance metrics. The dashboard offers a clean and functional interface tailored for administrative control.

4.1 User Management Panel

This is the User Management Panel, accessed from the Admin Dashboard. It displays a list of all users with key information such as name, email, role, and status. Admins can filter by role, sort by name or date, and view users in ascending or descending order. Each user entry includes options to Edit or Delete, and admins can also add new users using the "+ Add User" button. This panel provides full control over user access and role assignment.

4.1.1 Edit User

Edit User

First Name *

Sunny

Last Name *

Li

Email *

sunny@test.com

Role *

Student ⌄

Password *

Leave blank to keep current password

Cancel   **Save**

Edit User

First Name *

Rainy

Last Name *

Li

Email *

sunny@test.com

Role *

Student ⌄

Password *
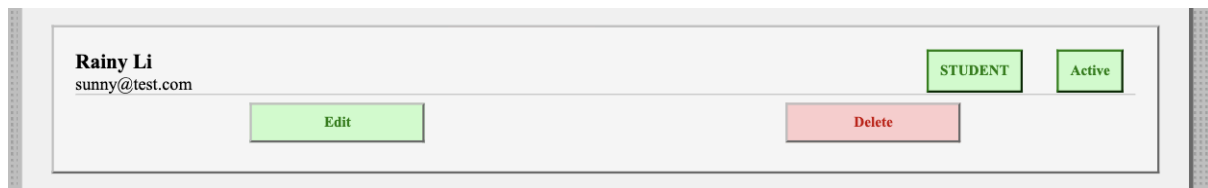
Leave blank to keep current password

Cancel   **Save**

localhost:8000 says

User updated successfully!

OK

This is the Edit User Interface within the User Management Panel. It allows admins to update a user's information, including first name, last name, email, role, and optionally reset the password. If the password field is left blank, the current password remains unchanged. Admins can choose to either save the changes or cancel to return without editing.

4.1.2 Delete User
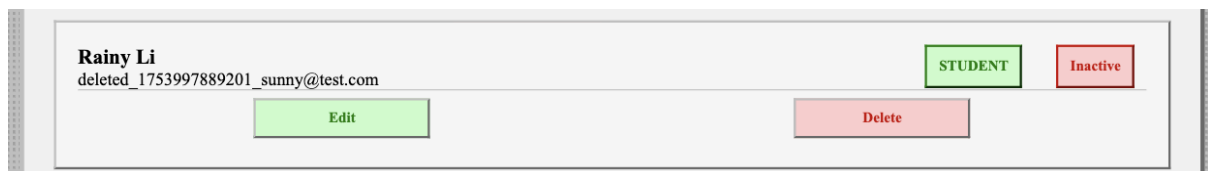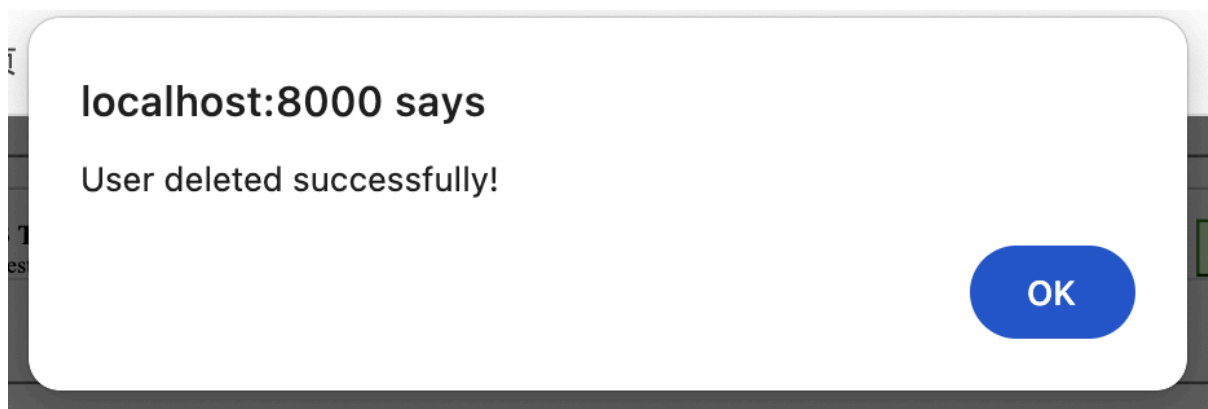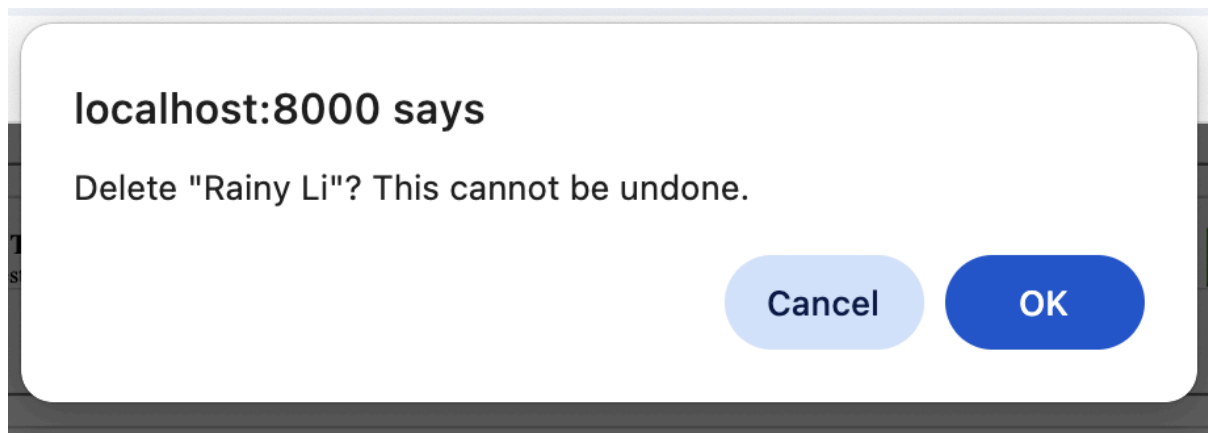
The user deletion process in the admin panel includes a confirmation step and a success message. When the admin clicks "Delete" next to a user (e.g., Rainy), a confirmation popup appears asking for final approval, warning that the action cannot be undone. Upon confirmation, a success dialog displays "User deleted successfully!" and the user's email is updated with a deletion tag, and their status changes to Inactive. This ensures both traceability and clarity in user lifecycle management.

4.1.3 Add User

The Admin dashboard enables administrators to easily add new users through a dedicated form. By clicking "+ Add User", the admin is presented with fields for first name, last name, email, role selection (e.g., Student, Instructor, Admin), and password input. Once the form is submitted, a confirmation dialog appears stating "User created successfully!", and the newly added user is immediately displayed in the user list with active status, complete with "Edit" and "Delete" options.

4.2 Platform Analytics Panel

4.2.1 System Overview
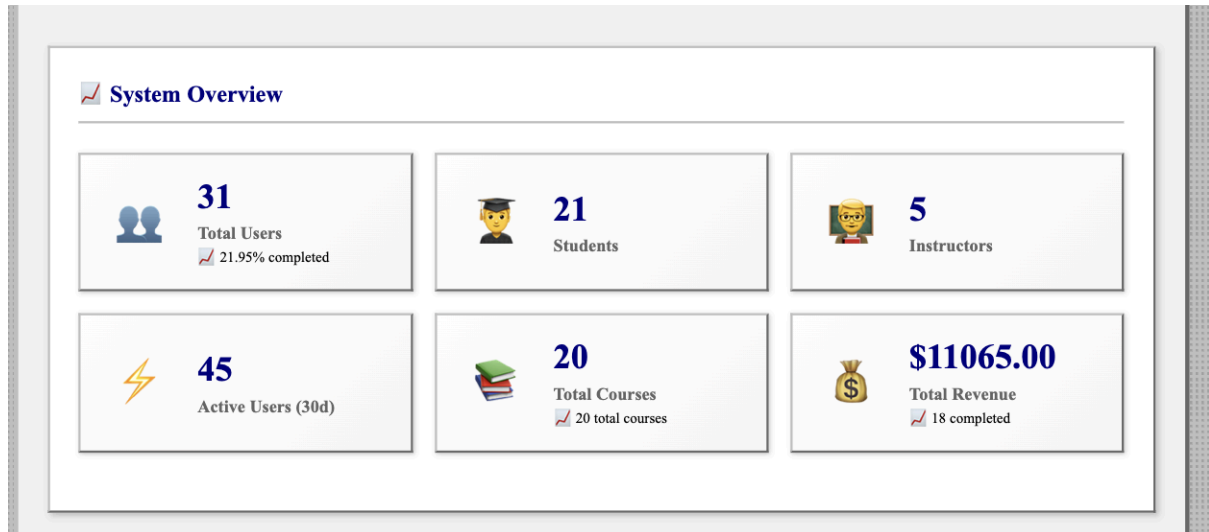
The System Overview panel provides administrators with a high-level summary of key platform metrics. It displays the total number of users (31), broken down into 21 students and 5 instructors, along with the 30-day count of active users (45). Additionally, it shows there are 20 total courses offered on the platform and a cumulative revenue of $11,065.00, with visual indicators highlighting completion statuses. This dashboard allows admins to quickly assess user engagement, course availability, and financial performance at a glance.

4.2.2 User Management Analytics
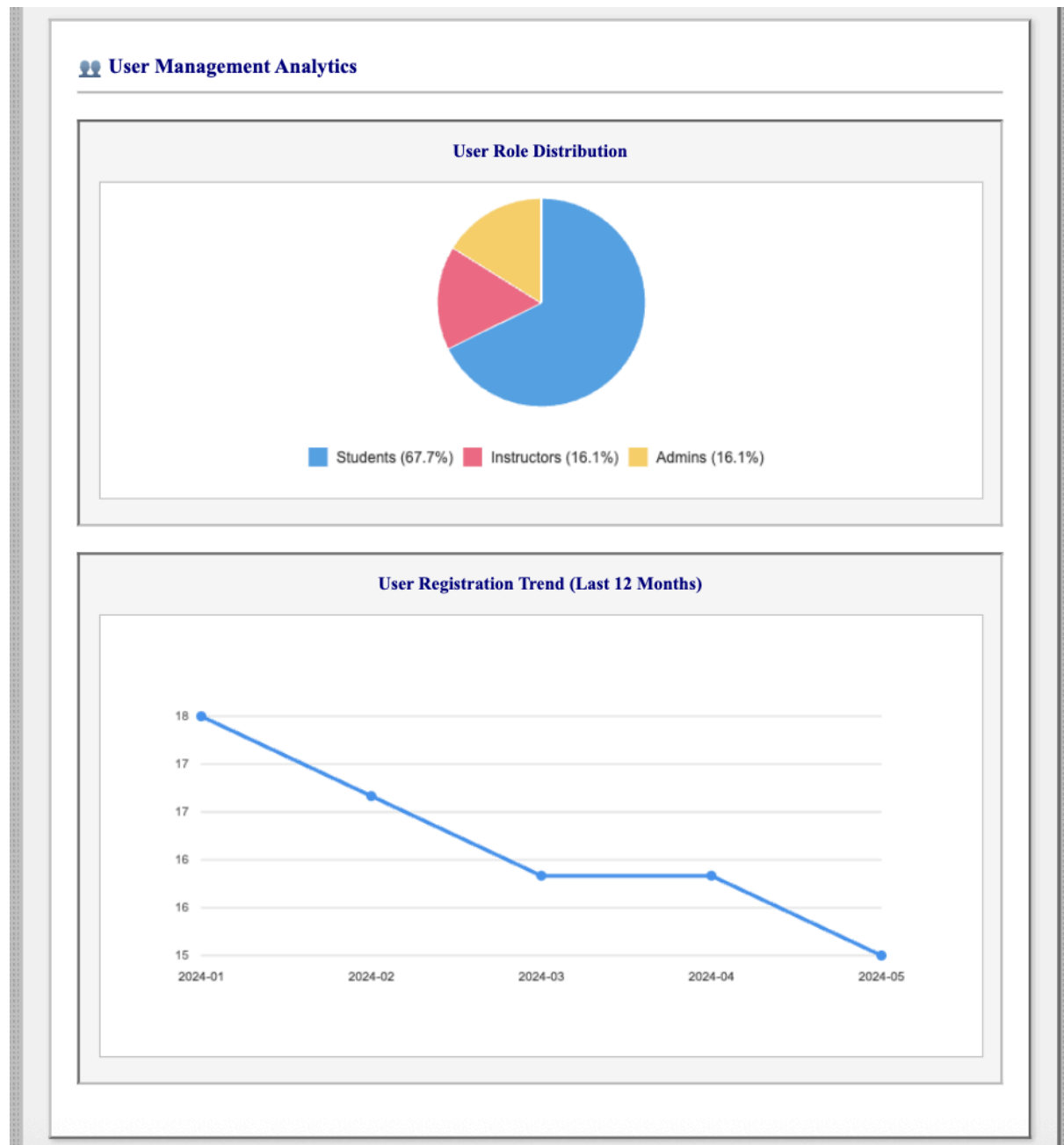
The User Management Analytics panel provides insights into platform user composition and registration trends. The User Role Distribution pie chart illustrates the breakdown of user types: students make up 67.7%, while instructors and admins each account for 16.1%. This distribution highlights a student-centric user base. Below, the User Registration Trend line chart shows a steady decline in new user registrations over the past five months, from 18 in January 2024 to 15 in May 2024, signaling a potential area for user acquisition improvement.

4.2.3 Course & Content Analytics

📚 **Course & Content Analytics**

Course Category Distribution

■ Data Science (27.5%) ■ Programming (23.5%) ■ AI/ML (21.6%) ■ Other (9.8%) ■ Database (9.8%)
■ Web Development (7.8%)

Course Completion Rates

40.0%									
	25.0%	20.0%	20.0%	16.7%	14.3%	0.0%	0.0%	0.0%	0.0%
Course 4...	Course 2...	Course 18...	Course 5...	Course 8...	Course 7...	Course 16...	Course 13...	Course 14...	Course 15...
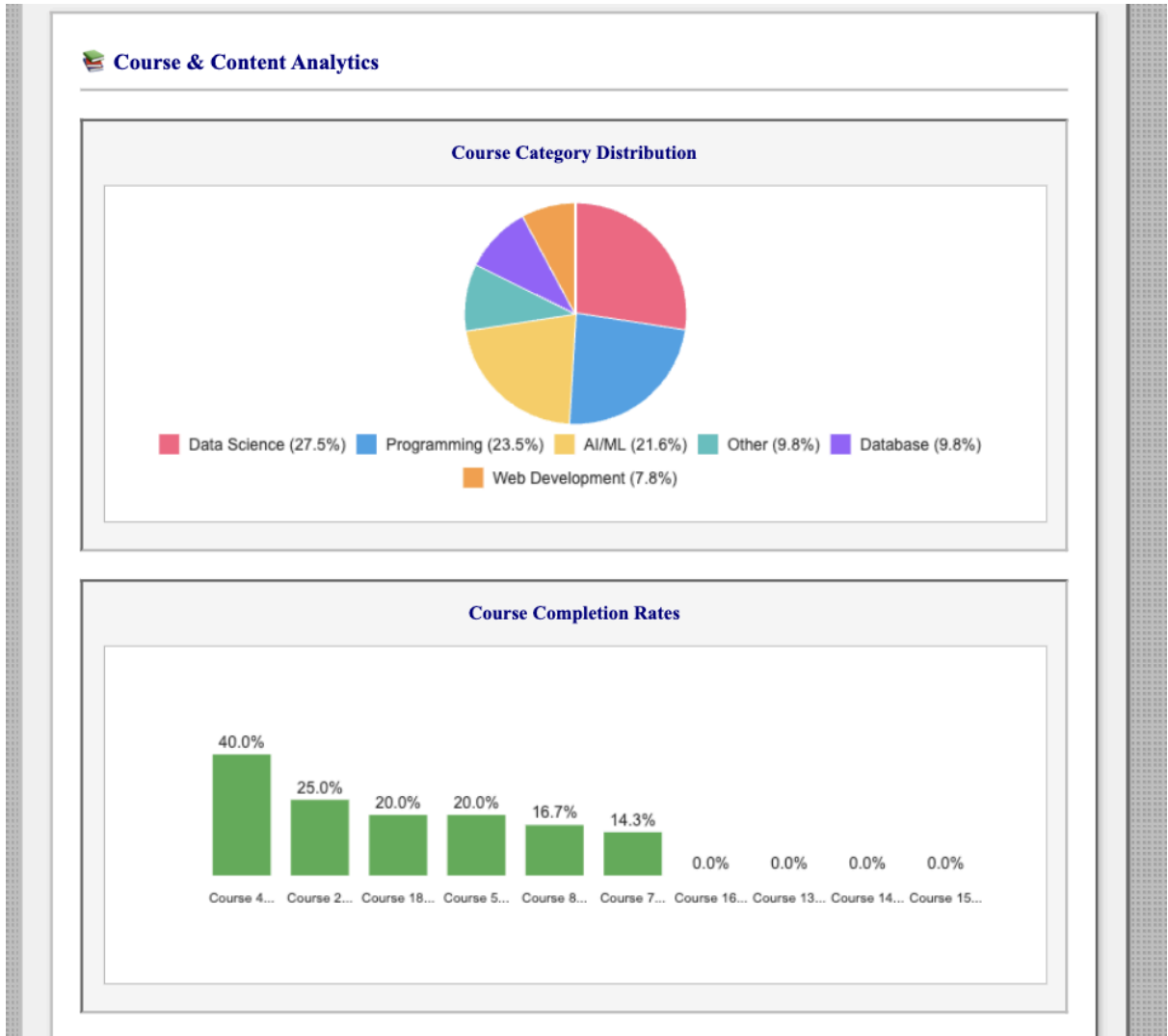
Most Popular Courses

Course	Instructor	Enrollments	Completion Rate	Revenue
Course 7	Instructor2 Teach	7	14.3%	$994.00
Course 8	Instructor3 Teach	6	16.7%	$1014.00
Course 16	Instructor1 Teach	6	N/A	$588.00
Course 4	Instructor4 Teach	5	40.0%	$2050.00
Course 13	Instructor3 Teach	5	N/A	$1570.00
Course 18	Instructor3 Teach	5	20.0%	$480.00
Course 5	Instructor5 Teach	5	20.0%	$505.00
Course 14	Instructor4 Teach	4	N/A	$1380.00
Course 2	Instructor2 Teach	4	25.0%	$1136.00
Course 15	Instructor5 Teach	4	N/A	$1348.00

Top Performing Instructors

Instructor	Courses	Total Students	Avg Completion Rate	Total Revenue
Instructor3 Teach	4	18	11.1%	$900.00
Instructor2 Teach	4	17	23.5%	$850.00
Instructor1 Teach	4	16	18.8%	$800.00
Instructor4 Teach	4	16	50.0%	$800.00
Instructor5 Teach	4	15	6.7%	$750.00

The Course & Content Analytics panel presents insights into course offerings and instructor performance.

- The Course Category Distribution pie chart shows that most courses fall under Data Science (27.5%), followed by Programming (23.5%) and AI/ML (21.6%), with smaller shares in Web Development, Database, and Other.
- The Course Completion Rates bar chart highlights disparities in course outcomes—Course 4 leads with a 40% completion rate, while several courses show 0% completion.
- The Most Popular Courses table lists top-enrolled courses, revealing that Course 4 also generates the highest revenue ($2,050) despite having fewer enrollments than Courses 7 and 8.
- The Top Performing Instructors table ranks instructors based on total students, revenue, and average course completion. Notably, Instructor4 Teach has the highest average completion rate (50%) despite lower revenue, while Instructor3 Teach leads in total students and revenue ($900).

4.2.3 Financial Analytics
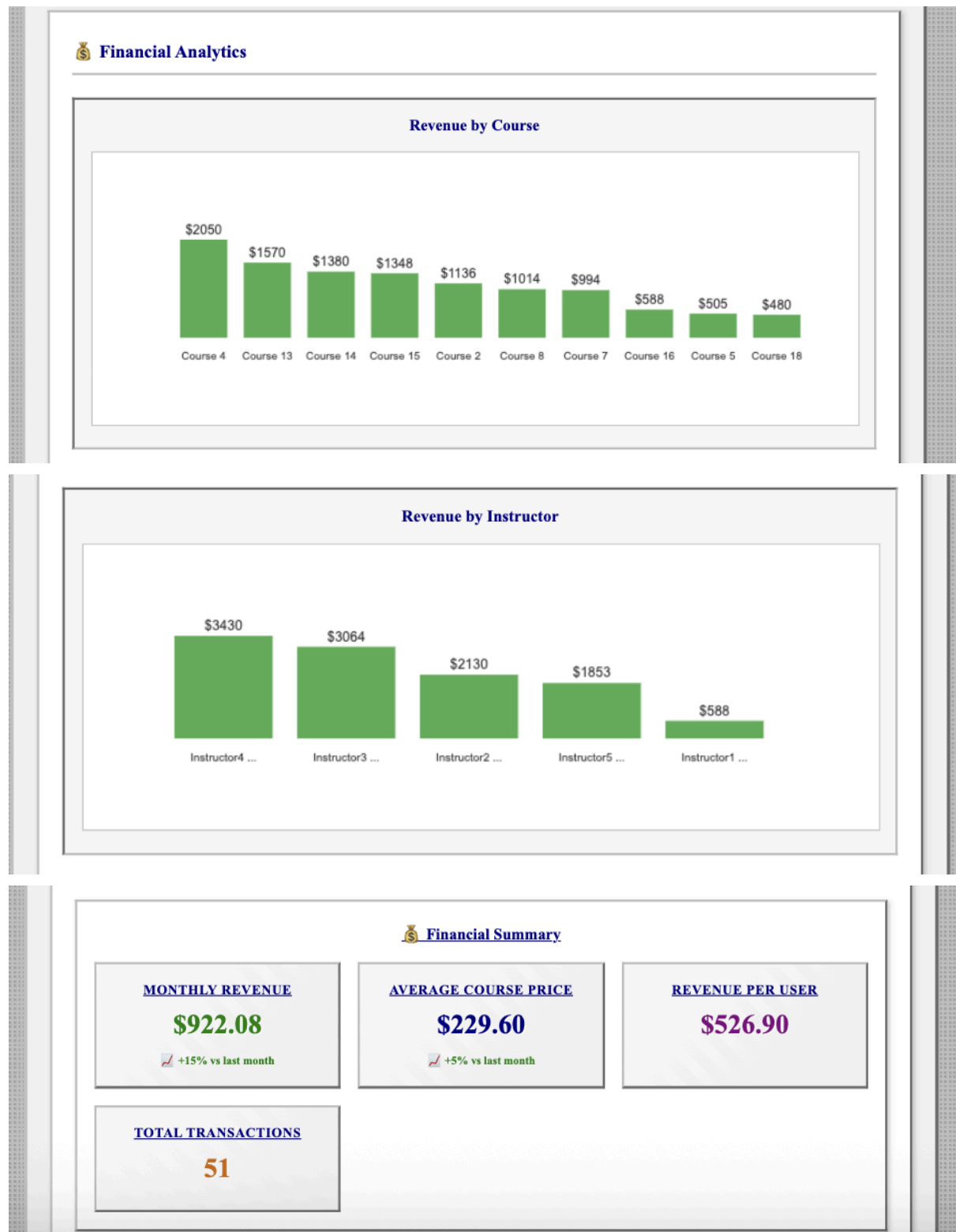
The Financial Analytics panel presents a comprehensive overview of revenue distribution and key financial metrics:

- Revenue by Course:
  Course 4 generated the highest revenue at $2050, followed by Course 13 ($1570),

Course 14 ($1380), and Course 15 ($1348). The top 10 courses show a noticeable range in financial contribution, with the lowest being Course 18 at $480.

- Revenue by Instructor:
  Instructor 4 leads in revenue generation with $3430, followed by Instructor 3 ($3064), Instructor 2 ($2130), and others. Instructor 1 shows the lowest revenue at $588, indicating possible improvement opportunities.
- Financial Summary:
  - Monthly Revenue: $922.08 (15% increase vs. last month)
  - Average Course Price: $229.60 (5% increase vs. last month)
  - Revenue per User: $526.90
  - Total Transactions: 51

This section helps track revenue trends and highlights the most financially impactful courses and instructors.

Task 8 - Dashboard Visualization Features and Database Queries

Overview

This document describes the purpose, features, and underlying MongoDB queries powering the interactive dashboard visualizations for the Online Learning Platform. It is structured by user role (Student, Instructor, Admin), covering each visualization's data source and logic.

1. Student Dashboard Visualizations

1.1 Course Progress Ring Charts

Purpose: Display individual course completion progress with interactive circular progress indicators.

Visual Features:

- Animated circular progress rings
- Percentage completion display
- Color-coded progress (red: 0-30%, yellow: 31-70%, green: 71-100%)
- Hover effects showing detailed statistics

MongoDB Query:

```
// Aggregation pipeline for student progress data
const getStudentProgress = async (studentId) => {
  return await Enrollment.aggregate([
    {
     $match: {
       student: new ObjectId(studentId),
       status: { $in: ['enrolled', 'in-progress', 'completed'] }
     }
    },
    {
     $lookup: {
       from: 'courses',
       localField: 'course',
       foreignField: '_id',
       as: 'courseDetails'
     }
    },
    {
     $unwind: '$courseDetails'
```

```
    },
    {
     $lookup: {
       from: 'lessons',
       localField: 'course',
       foreignField: 'course',
       as: 'totalLessons'
     }
    },
    {
     $project: {
       courseTitle: '$courseDetails.title',
       courseCategory: '$courseDetails.category',
       courseLevel: '$courseDetails.level',
       completionPercentage: 1,
       totalLessons: { $size: '$totalLessons' },
       enrollmentDate: 1,
       status: 1
     }
    }
  ]);
};
```

Database Collections Used:

- Enrollments: Progress tracking data
- Courses: Course metadata
- Lessons: Total lesson count for percentage calculations

1.2 Learning Activity Timeline

Purpose: Show student's learning journey over time with milestone markers and activity patterns.

Visual Features:

- Interactive timeline with scroll functionality
- Activity markers (enrollment, course completion)
- Status indicators for each course
- Progress tracking over time

MongoDB Query:

```
// Get student activity timeline
```

```javascript
const getStudentTimeline = async (studentId, dateRange = 30) => {
  const startDate = new Date();
  startDate.setDate(startDate.getDate() - dateRange);

  return await Enrollment.aggregate([
    {
      $match: {
        student: new ObjectId(studentId),
        enrollmentDate: { $gte: startDate }
      }
    },
    {
      $lookup: {
        from: 'courses',
        localField: 'course',
        foreignField: '_id',
        as: 'course'
      }
    },
    {
      $project: {
        courseTitle: { $arrayElemAt: ['$course.title', 0] },
        courseCategory: { $arrayElemAt: ['$course.category', 0] },
        enrollmentDate: 1,
        completionPercentage: 1,
        status: 1,
        finalGrade: 1,
        activityType: {
          $cond: {
            if: { $eq: ['$status', 'completed'] },
            then: 'course_completed',
            else: 'course_enrolled'
          }
        }
      }
    },
    {
      $sort: { enrollmentDate: 1 }
    }
  ]);
};
```

Database Collections Used:

- Enrollments: Activity dates and progress
- Courses: Course information

1.3 Performance Analytics Dashboard

Purpose: Compare student performance against class averages and identify strengths/weaknesses.

Visual Features:

- Grade comparison charts
- Subject-wise performance breakdown
- Course completion status overview
- Performance trend indicators

MongoDB Query:

```
// Get student performance analytics (simplified for actual model)
const getStudentAnalytics = async (studentId) => {
  return await Enrollment.aggregate([
    {
      $match: {
        student: new ObjectId(studentId)
      }
    },
    {
      $lookup: {
        from: 'courses',
        localField: 'course',
        foreignField: '_id',
        as: 'courseInfo'
      }
    },
    {
      $unwind: '$courseInfo'
    },
    {
      $group: {
        _id: '$courseInfo.category',
        courses: {
          $push: {
            courseTitle: '$courseInfo.title',
            level: '$courseInfo.level',
            completionPercentage: '$completionPercentage',
            finalGrade: '$finalGrade',
```

```
        status: '$status'
      }
    },
    avgCompletion: { $avg: '$completionPercentage' },
    avgGrade: { $avg: '$finalGrade' },
    courseCount: { $sum: 1 }
   }
  },
  {
   $sort: { avgCompletion: -1 }
  }
 ]);
};
```

Database Collections Used:

- Enrollments: Student performance data
- Courses: Course categorization for subject analysis

2. Instructor Dashboard Visualizations

2.1 Course Analytics Dashboard

Purpose: Provide instructors with insights into course performance, student engagement, and content effectiveness.

Visual Features:

- Multi-course performance comparison
- Enrollment statistics and trends
- Completion rate visualization
- Revenue tracking charts

MongoDB Query:

```
// Get instructor course analytics
const getInstructorAnalytics = async (instructorId) => {
  return await Course.aggregate([
    {
     $match: { instructor: new ObjectId(instructorId) }
    },
    {
     $lookup: {
       from: 'enrollments',
```

```
      localField: '_id',
      foreignField: 'course',
      as: 'enrollments'
    }
  },
  {
   $lookup: {
     from: 'lessons',
     localField: '_id',
     foreignField: 'course',
     as: 'lessons'
   }
  },
  {
   $lookup: {
     from: 'exams',
     localField: '_id',
     foreignField: 'course',
     as: 'exams'
   }
  },
  {
   $project: {
     title: 1,
     category: 1,
     level: 1,
     price: 1,
     isActive: 1,
     createdAt: 1,
     totalEnrollments: { $size: '$enrollments' },
     activeEnrollments: {
       $size: {
         $filter: {
           input: '$enrollments',
           cond: { $in: ['$$this.status', ['enrolled', 'in-progress']] }
         }
       }
     },
     completedEnrollments: {
       $size: {
         $filter: {
           input: '$enrollments',
           cond: { $eq: ['$$this.status', 'completed'] }
         }
```

```
          }
        },
        completionRate: {
          $cond: {
            if: { $gt: [{ $size: '$enrollments' }, 0] },
            then: {
              $multiply: [
                {
                  $divide: [
                    {
                      $size: {
                        $filter: {
                          input: '$enrollments',
                          cond: { $eq: ['$$this.status', 'completed'] }
                        }
                      }
                    },
                    { $size: '$enrollments' }
                  ]
                },
                100
              ]
            },
            else: 0
          }
        },
        averageProgress: {
          $cond: {
            if: { $gt: [{ $size: '$enrollments' }, 0] },
            then: { $avg: '$enrollments.completionPercentage' },
            else: 0
          }
        },
        totalRevenue: {
          $multiply: [{ $size: '$enrollments' }, '$price']
        },
        lessonCount: { $size: '$lessons' },
        examCount: { $size: '$exams' }
      }
    }
  ]);
};
```

Database Collections Used:

- Courses: Course metadata and pricing
- Enrollments: Student engagement and completion data
- Lessons: Content structure analysis
- Exams: Assessment data

2.2 Student Progress Heatmap

Purpose: Visualize student engagement patterns across course content to identify problematic areas.

Visual Features:

- Student-by-course progress matrix
- Color intensity representing completion levels
- Sortable by completion percentage or enrollment date
- Individual student performance details

MongoDB Query:

```
// Get student engagement heatmap data
const getStudentEngagementHeatmap = async (courseId) => {
  return await Enrollment.aggregate([
    {
      $match: {
        course: new ObjectId(courseId),
        status: { $in: ['enrolled', 'in-progress', 'completed'] }
      }
    },
    {
      $lookup: {
        from: 'users',
        localField: 'student',
        foreignField: '_id',
        as: 'studentInfo'
      }
    },
    {
      $lookup: {
        from: 'lessons',
        localField: 'course',
        foreignField: 'course',
        as: 'courseLessons'
      }
    }
```

```
    },
    {
     $unwind: '$studentInfo'
    },
    {
     $project: {
       studentId: '$student',
       studentName: {
         $concat: ['$studentInfo.firstName', ' ', '$studentInfo.lastName']
       },
       studentEmail: '$studentInfo.email',
       enrollmentDate: 1,
       completionPercentage: 1,
       finalGrade: 1,
       status: 1,
       totalLessons: { $size: '$courseLessons' },
       progressLevel: {
         $cond: {
           if: { $gte: ['$completionPercentage', 70] },
           then: 'high',
           else: {
             $cond: {
               if: { $gte: ['$completionPercentage', 30] },
               then: 'medium',
               else: 'low'
             }
           }
         }
       }
     }
    },
    {
     $sort: { completionPercentage: -1 }
    }
  ]);
};
```

Database Collections Used:

- Enrollments: Student progress data
- Users: Student identification information
- Lessons: Course content structure

3. Admin Dashboard Visualizations

3.1 Platform Analytics Overview

Purpose: Provide comprehensive platform statistics for administrative decision-making.

Visual Features:

- Real-time KPI cards (total users, courses, enrollments)
- User role distribution charts
- Course category breakdown
- Platform growth metrics

MongoDB Query:

```
// Get comprehensive platform analytics (from services/AnalyticsService.js)
const getPlatformAnalytics = async () => {
  const totalUsers = await User.countDocuments();
  const totalStudents = await User.countDocuments({ role: "student" });
  const totalInstructors = await User.countDocuments({ role: "instructor" });
  const totalCourses = await Course.countDocuments();
  const totalEnrollments = await Enrollment.countDocuments();
  const activeEnrollments = await Enrollment.countDocuments({
    status: { $in: ["enrolled", "in-progress"] }
  });
  const completedEnrollments = await Enrollment.countDocuments({ status: "completed" });
  const totalExams = await Exam.countDocuments();

  return {
    users: {
      total: totalUsers,
      students: totalStudents,
      instructors: totalInstructors,
      admins: totalUsers - totalStudents - totalInstructors,
    },
    courses: { total: totalCourses },
    enrollments: {
      total: totalEnrollments,
      active: activeEnrollments,
      completed: completedEnrollments,
      completionRate: totalEnrollments > 0 ?
        ((completedEnrollments / totalEnrollments) * 100).toFixed(2) : 0,
    },
    exams: { total: totalExams },
  };
```

```
};
```

Database Collections Used:

- Users: User demographics and growth
- Courses: Course catalog analysis
- Enrollments: Engagement and completion metrics
- Exams: Assessment data

3.2 Top Performing Courses

Purpose: Identify most successful courses by enrollment count and instructor performance.

Visual Features:

- Course ranking by enrollment numbers
- Instructor attribution
- Category-based performance analysis
- Revenue and engagement metrics

MongoDB Query:

```javascript
// Get top performing courses (from services/AnalyticsService.js)
const getTopPerformingCourses = async () => {
  return await Course.aggregate([
    {
      $lookup: {
        from: "enrollments",
        localField: "_id",
        foreignField: "course",
        as: "enrollments",
      },
    },
    {
      $lookup: {
        from: "users",
        localField: "instructor",
        foreignField: "_id",
        as: "instructorInfo",
      },
    },
    {
      $addFields: {
        enrollmentCount: { $size: "$enrollments" },
```

```
      instructorName: {
        $concat: [
          { $arrayElemAt: ["$instructorInfo.firstName", 0] },
          " ",
          { $arrayElemAt: ["$instructorInfo.lastName", 0] },
        ],
      },
    },
  },
  {
    $project: {
      title: 1,
      description: 1,
      category: 1,
      level: 1,
      price: 1,
      enrollmentCount: 1,
      instructorName: 1,
      createdAt: 1,
    },
  },
  { $sort: { enrollmentCount: -1 } },
  { $limit: 10 },
]);
};
```

Database Collections Used:

- Courses: Course data and metadata
- Enrollments: Performance metrics
- Users: Instructor information

4. Available API Endpoints

4.1 Student Analytics Endpoints

Referenced Implementation: See routes/enrollments.js

```
GET /api/enrollments              // Get student enrollments with course details
GET /api/enrollments/stats         // Get student progress statistics
GET /api/enrollments/:id          // Get specific enrollment details
PUT /api/enrollments/:id/progress      // Update progress
```

4.2 Instructor Analytics Endpoints

Referenced Implementation: See routes/courses.js and routes/analytics.js

```
GET /api/courses/instructor/my-courses  // Get instructor's courses with stats
GET /api/courses/:id/stats          // Get course-specific statistics
GET /api/analytics/instructor-analytics // Get instructor performance data
```

4.3 Admin Analytics Endpoints

Referenced Implementation: See routes/analytics.js

```
GET /api/analytics/platform-overview   // Platform-wide statistics
GET /api/analytics/top-courses       // Top performing courses
GET /api/analytics/student-progress    // All student progress data
GET /api/analytics/completion-trends   // Course completion trends
GET /api/analytics/exam-performance    // Exam performance analysis
GET /api/analytics/filtered         // Filtered analytics with query params
```

5. Dashboard Query Optimization

5.1 Database Indexes

Purpose: Optimize query performance for dashboard data retrieval.

Referenced Implementation: See scripts/createIndexes.js for the complete index creation script.

Key Indexes Used by Dashboard Queries:

```javascript
// Essential indexes for dashboard queries (implemented in scripts/createIndexes.js)
const createDashboardIndexes = async () => {
  await Promise.all([
    // User queries optimization
    db.collection('users').createIndex({ role: 1 }, { background: true }),
    db.collection('users').createIndex({ role: 1, isActive: 1 }, { background: true }),
    db.collection('users').createIndex({ email: 1 }, { unique: true, background: true }),

    // Course queries optimization
    db.collection('courses').createIndex({ instructor: 1 }, { background: true }),
    db.collection('courses').createIndex({ category: 1, level: 1 }, { background: true }),
    db.collection('courses').createIndex({ isActive: 1 }, { background: true }),
```

```
  // Enrollment queries optimization
  db.collection('enrollments').createIndex({ student: 1, course: 1 }, { unique: true,
background: true }),
  db.collection('enrollments').createIndex({ student: 1 }, { background: true }),
  db.collection('enrollments').createIndex({ course: 1 }, { background: true }),
  db.collection('enrollments').createIndex({ status: 1 }, { background: true }),
  db.collection('enrollments').createIndex({ enrollmentDate: -1 }, { background: true }),

  // Lesson queries optimization
  db.collection('lessons').createIndex({ course: 1, order: 1 }, { background: true }),
  db.collection('lessons').createIndex({ course: 1 }, { background: true }),

  // Exam queries optimization
  db.collection('exams').createIndex({ course: 1 }, { background: true })
 ]);
};
```

5.2 Analytics Service Implementation

Purpose: Centralized business logic for dashboard analytics.

Referenced Implementation: See services/AnalyticsService.js for the complete service implementation.

Available Analytics Methods:

```
// Analytics service methods (implemented in services/AnalyticsService.js)
class AnalyticsService {
  static async getTopPerformingCourses()
  static async getStudentProgressAnalytics()
  static async getInstructorAnalytics()
  static async getCourseCompletionTrends()
  static async getExamPerformanceAnalysis()
  static async getPlatformOverview()
  static async getFilteredAnalytics(filters)
}
```

5.3 Authentication and Authorization

Purpose: Role-based access control for dashboard features.

Referenced Implementation: See middleware/auth.js for authentication middleware.

Access Control Rules:

```
// Authentication middleware (implemented in middleware/auth.js)
const { protect, authorize } = require('../middleware/auth');

// Usage in routes:
router.get('/platform-overview', protect, authorize('admin'));
router.get('/student-progress', protect, authorize('admin', 'instructor'));
router.get('/enrollments', protect, authorize('student'));
```

Conclusion

The dashboard visualization system provides comprehensive insights into the learning platform through:

- Student-focused visualizations that motivate learning and track progress
- Instructor analytics that help optimize course content and engagement
- Administrative dashboards that enable data-driven platform management
- Optimized queries that ensure fast response times even with large datasets

Each visualization is backed by carefully designed MongoDB aggregation pipelines that efficiently process data from the five core collections (Users, Courses, Enrollments, Lessons, and Exams) to provide meaningful insights for different user roles.