



Classync - Virtual Classroom Platform

Sprint 5 Report

Group - 33

Course: Software Engineering

Professor: Prof. Saurabh Tiwari

Mentor: Shyam Patel

Team Members:

Role	Name (ID)
Team Leader	ATIK VOHRA - 202301447
Member	KANANI TANUJ - 202301474
Member	SANAGADHIYA RADHIKA - 202301184
Member	PATEL JAY - 202301430
Member	CHOVATIYA AYUSH - 202301461
Member	OM PATEL - 202301163
Member	BADRESIYA ANSH - 202301477
Member	PREM KUKADIYA - 202301452
Member	RAMOLIYA SHUBHAM - 202301442
Member	GAJERA MANTHAN - 202301488

Contents

1	Overview / Summary	1
2	User Stories Covered	2
2.1	User Stories - Whiteboard	2
2.2	Analytics	5
2.2.1	User Stories - Instructor Analytics	5
2.2.2	User Stories - Student Progress User Stories	9
2.2.3	User Stories - Common System	13
2.3	User Stories - Group	14
3	Proof of Concept (POC)	19
3.1	White board	19
3.2	Analysis Section	21
3.3	Group Specification	24
4	Sprint Review	28
4.1	What We Achieved	28
4.1.1	In Whiteboard & PDF Annotation	28
4.1.2	In Analytics Dashboard	28
4.1.3	In Group Management	28
4.2	Challenges	29
4.2.1	In Whiteboard & PDF Annotation	29
4.2.2	In Analytics Dashboard	29
4.2.3	In Group Management	30
5	Conclusion	32

1. Overview / Summary

Sprint 4 focused on delivering advanced data visualization and new instructional tools. A comprehensive analytics system was developed, featuring two distinct, role-based dashboards: one for instructors to track class performance, assignment engagement, and overall student progress, and another for students to view their personal grades and upcoming deadlines.

This sprint also introduced a key PDF annotation feature, providing instructors with a whiteboard-like tool to load and mark up documents.

Finally, the group management feature was implemented, allowing instructors to create and organize student groups and maintaining visibility for group specific posts and assignments.

Duration

5 Nov – 15 Nov

2. User Stories Covered

2.1 User Stories - Whiteboard

US-W01: Open PDF in Whiteboard

Front Card

As an instructor, I want to open a PDF file in the whiteboard editor so that I can annotate teaching materials.

Back Card

Success

- PDF displays in dialog with editing canvas overlay, all tools ready for use.

Failure

- Non-PDF file rejected with error message, corrupted PDF shows loading error.

US-W02: Initialize Whiteboard Components

Front Card

As the system, I want to load PDF.js and Fabric.js libraries so that whiteboard can render and accept annotations.

Back Card

Success

- Libraries load from CDN, PDF renders on background canvas, Fabric canvas overlays for drawing.

Failure

- CDN unavailable shows error, Fabric import fails disables drawing, canvas initialization retries up to 20 times.

US-W03: Whiteboard Annotation Tools

Front Card

As an instructor, I want to use annotation tools (Pen, Highlighter, Eraser) so that I can draw diagrams, emphasize text, and correct mistakes on the whiteboard.

Back Card

Success

- **Pen:** Smooth strokes appear in selected color.
- **Highlighter:** transparent marks (0.4 opacity) overlay text without obscuring it.
- **Eraser:** Removes specific objects via intersection detection (20px bounds).

Failure

- Canvas not initialized → Tools disabled.
- Opacity fails → Highlighter renders as solid color.
- Intersection fails → Eraser removes nothing.

US-W04: Add Text Notes

Front Card

As an instructor, I want to type notes in dedicated panel so that I can add written commentary and my learnings.

Back Card

Success

- Textarea in right panel auto-focused on tool selection, notes typed and stored in state.

Failure

- Notes panel not rendered shows warning, auto-focus fails requires manual click.

US-W05: Manage Annotations (Undo/Clear)**Front Card**

As an instructor, I want to undo my last action or clear the entire canvas so that I can quickly correct mistakes or start fresh without reloading the document.

Back Card**Success**

- **Undo:** Most recent canvas object is removed; canvas re-renders immediately.
- **Clear All:** All drawing objects removed instantly; PDF background and typed notes remain intact.

Failure

- Action on empty stack → No visual change/No crash.
- Clear All → Accidentally removes PDF background layer.

US-W06: Zoom Controls**Front Card**

As an instructor, I want to zoom in/out or fit to screen so that I can work at appropriate detail level.

Back Card**Success**

- Zoom in/out by 0.1 increments (0.5x-2.0x range), fit calculates optimal scale, both PDF and canvas layers scale together.

Failure

- Min zoom (0.5x) or max zoom (2.0x) reached disables respective button, container dimensions zero uses fallback.

US-W07: Navigate Between PDF Pages**Front Card**

As an instructor, I want to move to previous/next pages so that I can annotate multi-page documents.

Back Card**Success**

- Navigation buttons change pages, page indicator shows "Page X of Y", new page renders with cleared annotations.

Failure

- First page reached disables Previous button, last page reached disables Next button.

US-W08: Toggle Fullscreen Mode

Front Card

As an instructor, I want to enter/exit fullscreen so that I can return to normal view of the classroom.

Back Card

Success

- Fullscreen API activated, button text toggles state tracked.

Failure

- Browser denies fullscreen permission shows error, ESC key exits fullscreen updates state.

US-W09: Content Management (Copy, Clear, Download)

Front Card

As a user, I want to manage my notes by copying, clearing, or downloading them so that I can save my work offline or reset my workspace efficiently.

Back Card

Success

- **Copy:** Text copied to clipboard; toast confirms "Notes copied!".
- **Download:** Generates a PDF file containing the current whiteboard annotations and notes.
- **Clear:** Textarea empties instantly; character counters reset to 0.

Failure

- Empty content → "Nothing to export" validation error.
- Permissions → Browser denies clipboard/download access.

2.2 Analytics

2.2.1 User Stories - Instructor Analytics

US-IA-001: View Overall Analytics Summary**Front Card**

As an instructor, I want to see a clear summary of all my courses and students so I can quickly understand overall performance.

Back Card**Success**

- Summary cards show active courses, total students, average submission rate, and average grade.
- Non-instructors are redirected with a toast explaining the restriction.
- Refreshing the page re-runs analytics and updates values instantly.

Failure

- Metrics are missing, outdated, or incorrect.
- Students or unauthenticated users can access instructor analytics.

US-IA-002: Visualize Course Performance**Front Card**

As an instructor, I want a bar chart showing completion rates across all my courses so I can identify low-performing classes.

Back Card**Success**

- Bar chart shows each course with its 0–100% completion rate.
- Late submission counts appear via secondary values or tooltips.
- Empty state message appears if no courses exist.

Failure

- Chart renders incomplete, unreadable, or broken on mobile.
- Shows a blank area with no explanation when data is missing.

US-IA-003: Monitor Submission Health**Front Card**

As an instructor, I want a breakdown of submission status to understand student engagement.

Back Card**Success**

- Donut chart shows on-time, late, pending, and missing submission percentages and counts.
- Consistent color coding (green, yellow, blue, red).
- Percentages calculated using total expected submissions.

Failure

- Missing or incorrect segments or counts.
- Percentages do not add up logically.

US-IA-004: Deep-Dive Into Specific Course**Front Card**

As an instructor, I want to select a course and view detailed metrics.

Back Card**Success**

- Course selector lists only the instructor's courses.
- Metric tiles update when the selected course changes.
- Values persist after page refresh.

Failure

- Metrics show wrong data or fail to update.
- Empty selector appears without explanation.

US-IA-005: Analyze Individual Assignment Performance**Front Card**

As an instructor, I want to view submission details for a chosen assignment.

Back Card**Success**

- Assignment selector shows title, course, and deadline.
- Metrics show submitted, on-time, late, and missing counts.
- Empty state appears when no assignments exist.

Failure

- Stats do not refresh after selecting an assignment.
- Assignments outside the instructor's ownership appear.

US-IA-006: View Assignment Leaderboard**Front Card**

As an instructor, I want a table comparing all assignments.

Back Card**Success**

- Table shows assignment name, course, due date, submission count, completion %, late/on-time counts, and average grade.
- Horizontal scroll available on mobile.
- Empty state row shown when no assignments exist.

Failure

- Missing columns or misaligned data.
- Table becomes unusable on mobile.

US-IA-007: Identify Best and Challenging Courses**Front Card**

As an instructor, I want to automatically see my strongest and weakest courses.

Back Card**Success**

- Highlights highest and lowest completion rate courses (excluding empty ones).
- Shows course name and percentage.
- Neutral message for edge cases.

Failure

- Incorrect course identification.
- Placeholder shown even when data exists.

US-IA-008: Refresh Analytics Data**Front Card**

As an instructor, I want to refresh analytics instantly.

Back Card**Success**

- Visible refresh button re-fetches all analytics.
- Loading state + error toasts shown as needed.
- Role restrictions still enforced after refresh.

Failure

- Refresh does nothing or shows endless loading.
- Errors occur silently.

2.2.2 User Stories - Student Progress User Stories

US-SP-001: View Personal Progress Overview**Front Card**

As a student, I want a summary of all my enrolled courses.

Back Card**Success**

- Summary cards show course count, assignments, completion rate, average grade, and late submissions.
- Wrong-role users are redirected with a toast.
- Data matches backend calculations.

Failure

- Missing or inconsistent metrics.
- Instructors can view the student dashboard.

US-SP-002: Visualize Course Completion Progress**Front Card**

As a student, I want a bar chart showing completion % per course.

Back Card**Success**

- Shows each enrolled course with 0–100% completion.
- Long names handled with angled labels/tooltips.
- Empty state when no courses exist.

Failure

- Bars fail to render, overlap, or mismatch detailed data.
- Blank area shown when user has no courses.

US-SP-003: Track Submission Status Distribution**Front Card**

As a student, I want to see how many assignments are on-time, late, pending, or missing.

Back Card**Success**

- Donut chart with percentages + raw counts.
- Same color system as instructor analytics.
- Status breakdown repeated in text below.

Failure

- Totals do not match other dashboard data.
- Colors or labels swapped.

US-SP-004: Deep-Dive Into Specific Course Progress**Front Card**

As a student, I want to inspect progress for a specific course.

Back Card**Success**

- Course selector lists only enrolled courses.
- “Go to Course” routes to `/classroom/{courseId}`.
- Data updates instantly on selection change.

Failure

- Courses outside enrollment appear.
- Navigation breaks or resets analytics state.

US-SP-005: Track Assignment Status & History**Front Card**

As a student, I want to view a centralized dashboard of my pending, missing, and submitted assignments so that I can prioritize my current workload and track my submission performance.

Back Card**Success**

- Assignments are correctly categorized into "Pending" (future due date) and "Missing" (overdue & unsubmitted).
- Statistics display accurate counts for On-Time vs. Late submissions.
- Visual indicators (Color/Icons) clearly differentiate between open, overdue, and closed tasks.

Failure

- "Pending" list includes items that are actually overdue.
- Submission timestamps are miscalculated, marking on-time work as "Late".
- Dashboard fails to update status immediately after a student submits a file.

US-SP-006: View Average Grade Performance**Front Card**

As a student, I want to understand my average grade.

Back Card**Success**

- Calculates using graded submissions only.
- Rounded to 1 decimal; shows "—" if no grades exist.
- Same value across all dashboard sections.

Failure

- Ungraded items included or causing errors.
- Conflicting averages in different widgets.

US-SP-007: Refresh Progress Data**Front Card**

As a student, I want to refresh my analytics.

Back Card**Success**

- Refresh button fetches updated progress.
- Errors show toasts; selected course is preserved.
- All widgets update after completion.

Failure

- Refresh duplicates/loses data.
- Silent errors leave stale values.

US-SP-008: Navigate to Course from Analytics**Front Card**

As a student, I want to quickly jump from analytics to a course.

Back Card**Success**

- CTA enabled only when a course is selected.
- Navigates smoothly to /classroom/{courseId}.
- Returning keeps the same selected course.

Failure

- Button routes to wrong course or stays enabled with no selection.
- Navigation breaks login/session.

2.2.3 User Stories - Common System

US-SYS-001: Role-Based Access Control**Front Card**

As the system, I must ensure each user sees only their own analytics.

Back Card**Success**

- Auth and user role checks before rendering pages.
- Wrong-role users redirected with a toast.
- Role re-check after refresh.

Failure

- Users can open unauthorized dashboards.
- Sensitive data appears briefly before redirect.

US-SYS-002: Real-Time Data Accuracy**Front Card**

As a user, I want analytics to always show accurate, fresh information.

Back Card**Success**

- Fresh data fetched on load and on refresh.
- All calculations match backend values.
- Time zones handled consistently.

Failure

- Stale or mismatched numbers.
- Conflicting metrics across widgets.

2.3 User Stories - Group

US-GRP-01: Instructor Create Student Groups**Front Card**

As an instructor, I want to create named groups(unique) within my course so that I can organize students for projects or assignments.

Back Card**Success**

- A "Create Group" button is available on the "People" page inside Course Classroom Page as groups will be made based on specific classroom.
- Instructor can enter a group name (e.g., "Project Group A").
- The new, empty group appears in the list of groups for the course.

Failure

- Submitting a blank name shows a "Group name is required" error.
- Using a duplicate group name shows an error message.

US-GRP-02: Instructor Assign Students to Groups**Front Card**

As an instructor, I want to assign students to a group so that I can build the team rosters.

Back Card**Success**

- Instructor can see a list of "unassigned" students.
- Students can be selected via checkbox to add to a group.
- The student's name disappears from the "unassigned" list and appears under the group.

Failure

- Attempting to add a student to two groups shows an error "Student is already in a group."
- If the database fails to save, an error toast is shown and the UI reverts.

US-GRP-03: Student Views Their Group**Front Card**

As a student, I want to see which group I am in and who my group members are, so that I can collaborate with them.

Back Card**Success**

- A "My Group" section is visible on the "People" page.
- The section displays the student's group name (e.g., "Project Group A").
- A list of all other members in that group is clearly shown.

Failure

- If the group list fails to load, an error is displayed.

US-GRP-04: Designate Group Representative**Front Card**

As an instructor, I want to designate one student as the "Group Rep" so that I have a single point of contact for the team.

Back Card**Success**

- When viewing a group's member list, the instructor sees a "Make Rep" button next to each student's name.
- Clicking the button designates that student as the representative.
- The student's name is now highlighted with a "Rep" badge.
- The previous rep (if any) is automatically un-designated.

Failure

- If the database update fails, an error is shown and the change is reverted.
- The "Make Rep" button is disabled for the current representative.

US-GRP-05: View Group Dashboard (Instructor)**Front Card**

As an instructor, I want to see a list of all groups with their full details so that I can manage my course and see all rosters at a glance.

Back Card**Success**

- The "Groups" page displays a row for every group in the course.
- Each group card clearly lists all members by name.
- The designated "Group Rep" is prominently marked.
- The total number of students in each group is shown.

Failure

- If groups fail to load, an error message is shown.
- If no groups have been created, a "No groups created yet" message is displayed.

US-GRP-06: Create Group-Specific Assignment**Front Card**

As an instructor, I want to post an assignment that is only visible to specific groups so that I can give different work to different teams.

Back Card**Success**

- The "Create Assignment" form has a dropdown to select recipients.
- The default is "All Students," but the instructor can select one or more groups.
- Students only see the assignment if they are in a selected group.
- Students not in the selected groups do not see the assignment in their list.

Failure

- If saving fails, an error toast is shown.

US-GRP-07: Create Group-Specific Stream Post**Front Card**

As an instructor, I want to post an announcement in the stream that is only visible to one or more specific groups.

Back Card**Success**

- The "Create Post" form includes a recipient dropdown (default "All Students").
- Instructor can select one or more groups from the list.
- The post, when published, is only visible in the stream for members of the selected groups.
- The post is marked with a "Group Post" tag for clarity.

Failure

- Students not in the target groups do not see the post.
- If the post fails to save, an error is shown to the instructor.

US-GRP-08: Manage Student Groups**Front Card**

As an instructor, I want to edit/remove groups so that I can manage student groups efficiently.

Back Card**Success**

- Group name/Group member/Group Rep updates in the list immediately after saving changes.
- Group is permanently removed from the dashboard after confirming deletion.
- Student associations are cleared when a group is deleted.
- Updates are reflected in class stream also.

Failure

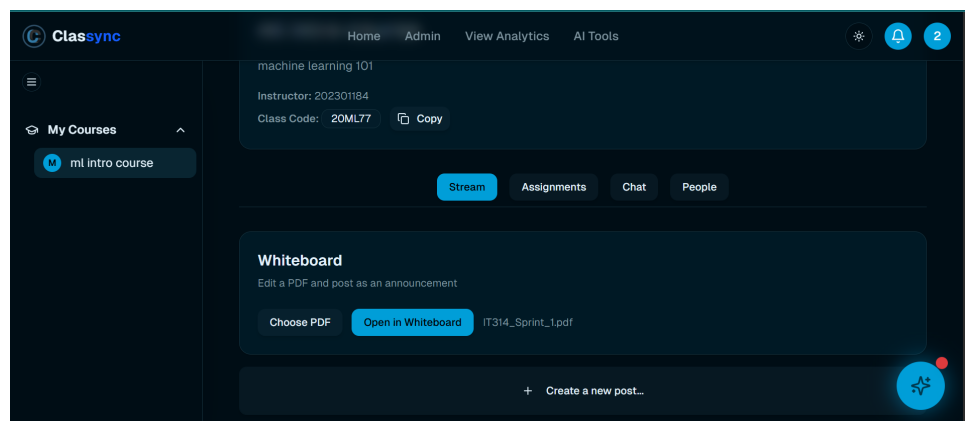
- Error message displayed if the new group name is left empty/blank.
- Action is aborted and group remains if user clicks "Cancel" on delete prompt.
- Error shown if network fails during the update request.

3. Proof of Concept (POC)

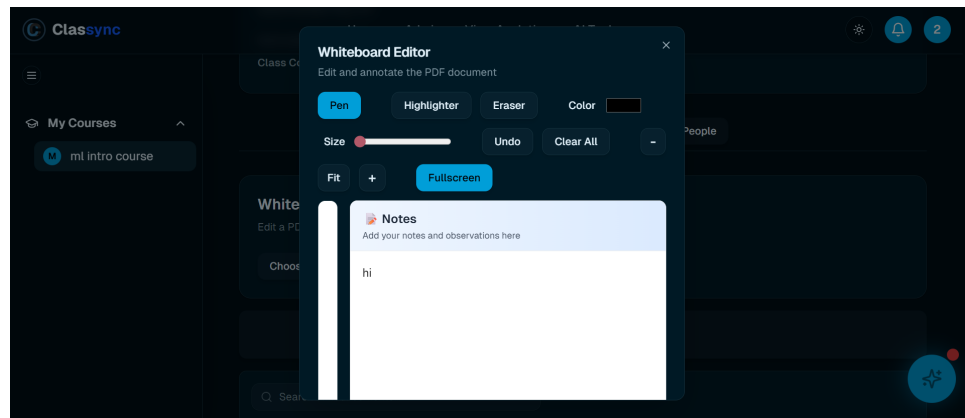
3.1 White board

This section provides a visual overview of How Whiteboard works and looks like.

- 1. Upload any PDF doc and open it in whiteboard



- 2. opens window for whiteboard



- 3. opens full screen view of whiteboard Different features like pen size, color, highlighter, eraser, undo, redo and clear all etc.

Pen Highlighter Eraser Color Size Undo Clear All - Fit + Exit Fullscreen

Virtual Classroom System

Contents

- 1 Overview / Summary
 - 1.1 Authentication System(Auth)
 - 1.2 AI-Bubble Assistant (AI-Bubble)
- 2 Duration
- 3 User Stories Covered
 - 3.1 User Stories - Auth
 - 3.2 User Stories - AI Bubble
- 4 Proof of Concept (POC)
 - 4.1 Auth Flow

Previous Next Page 2 of 17

Notes
Add your notes and observations here
Click here to start typing your notes...

0 characters • 1 lines Copy Download Clear

Pen Highlighter Eraser Color Size Undo Clear All - Fit + Exit Fullscreen

Virtual Classroom System

Contents

- 1 Overview / Summary
 - 1.1 Authentication System(Auth)
 - 1.2 AI-Bubble Assistant (AI-Bubble)
- 2 Duration
- 3 User Stories Covered
 - 3.1 User Stories - Auth
 - 3.2 User Stories - AI Bubble
- 4 Proof of Concept (POC)
 - 4.1 Auth Flow

Previous Next Page 2 of 17

Notes
Add your notes and observations here
Click here to start typing your notes...

0 characters • 1 lines Copy Download Clear

Pen Highlighter Eraser Color Size Undo Clear All - Fit + Exit Fullscreen

Virtual Classroom System

Contents

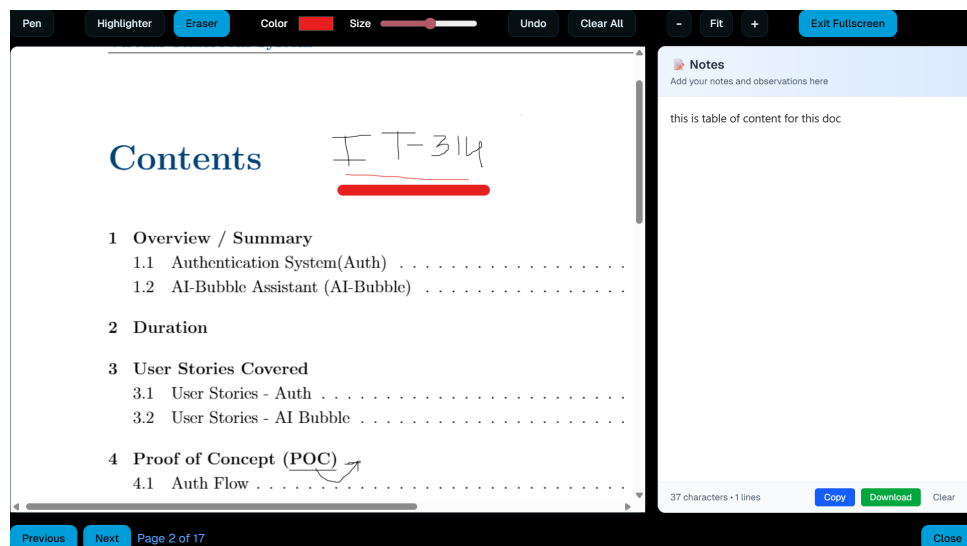
- 1 Overview / Summary
 - 1.1 Authentication System(Auth)
 - 1.2 AI-Bubble Assistant (AI-Bubble)
- 2 Duration
- 3 User Stories Covered
 - 3.1 User Stories - Auth
 - 3.2 User Stories - AI Bubble
- 4 Proof of Concept (POC)
 - 4.1 Auth Flow

Previous Next Page 2 of 17

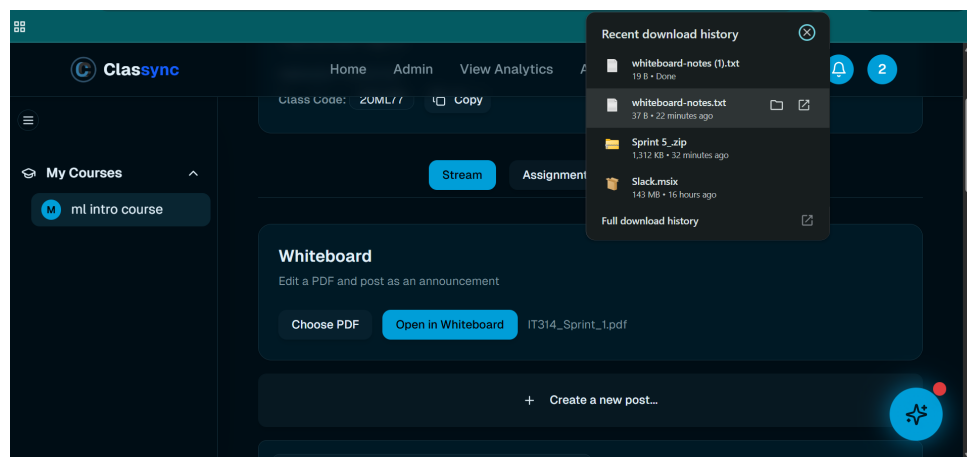
Notes
Add your notes and observations here
Click here to start typing your notes...

0 characters • 1 lines Copy Download Clear

- 4. write text notes



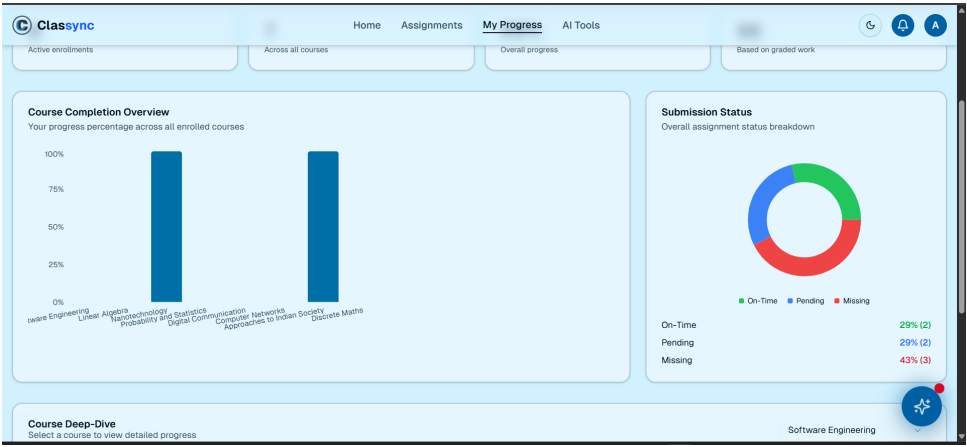
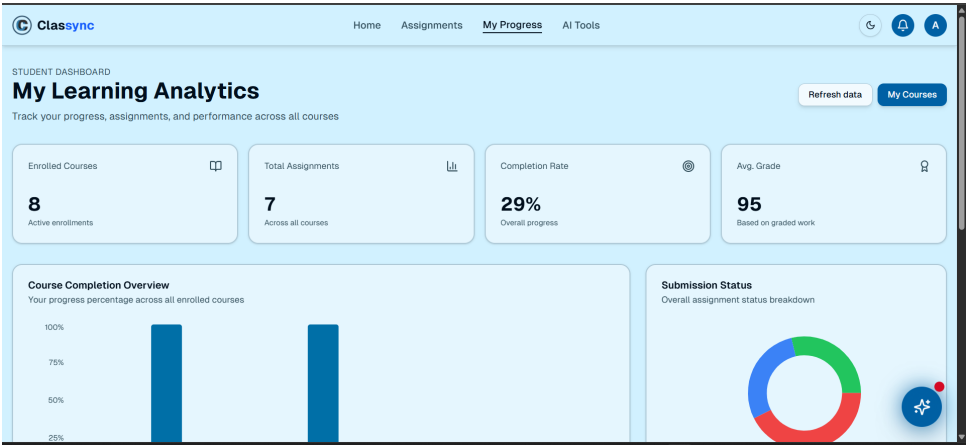
- 5. download notes file to local device



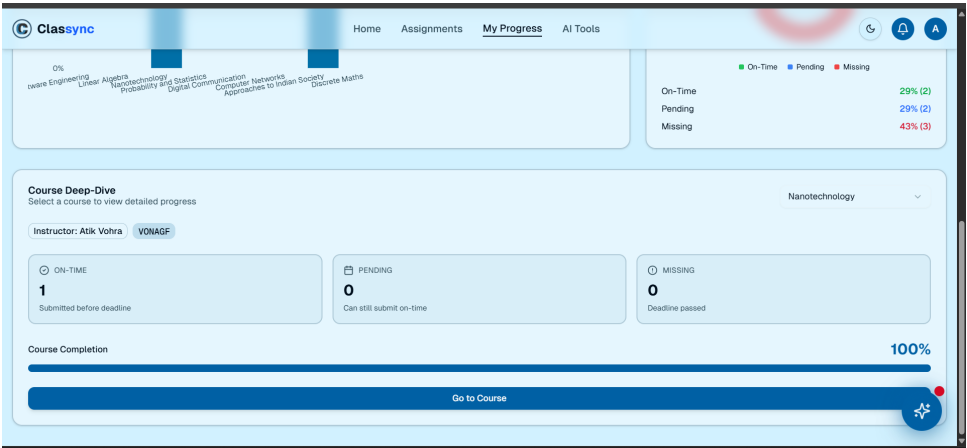
3.2 Analysis Section

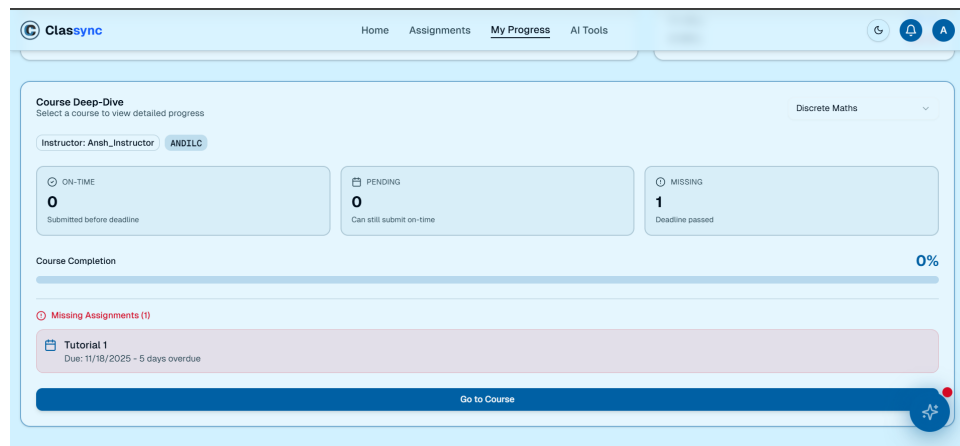
This section provides a visual overview of Analysis part for both instructor and student.

- 1. Analysis Page for students:

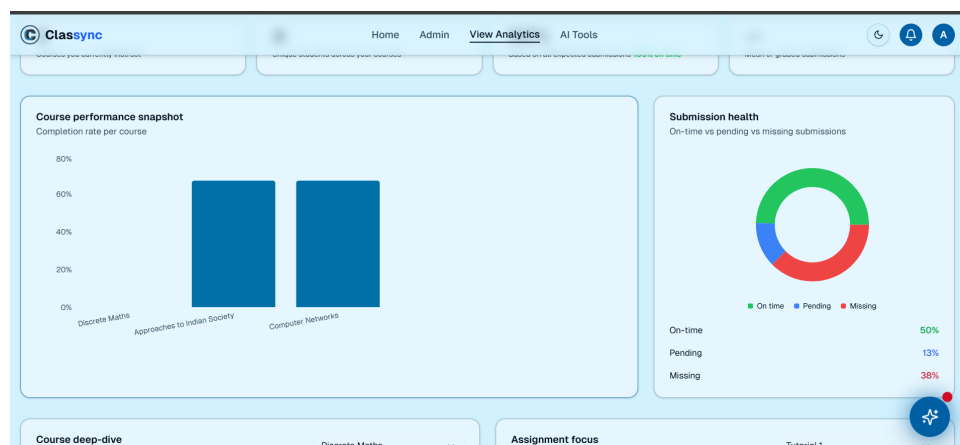
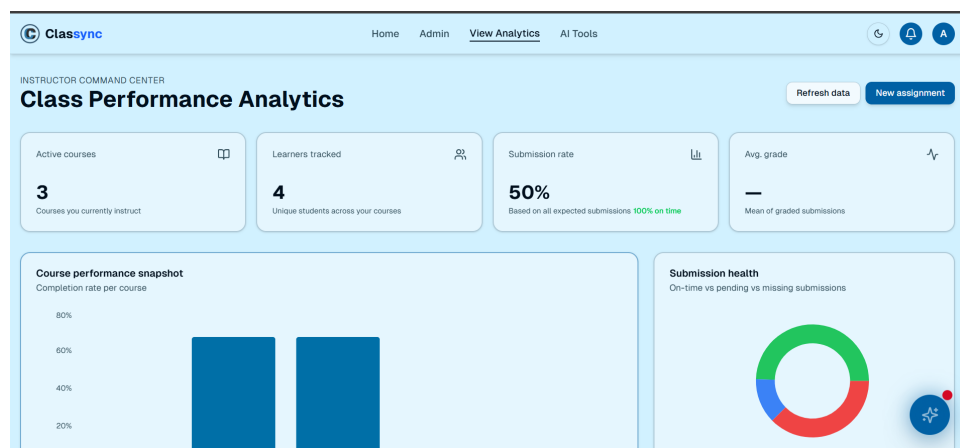


2. Course Wise Analysis for students

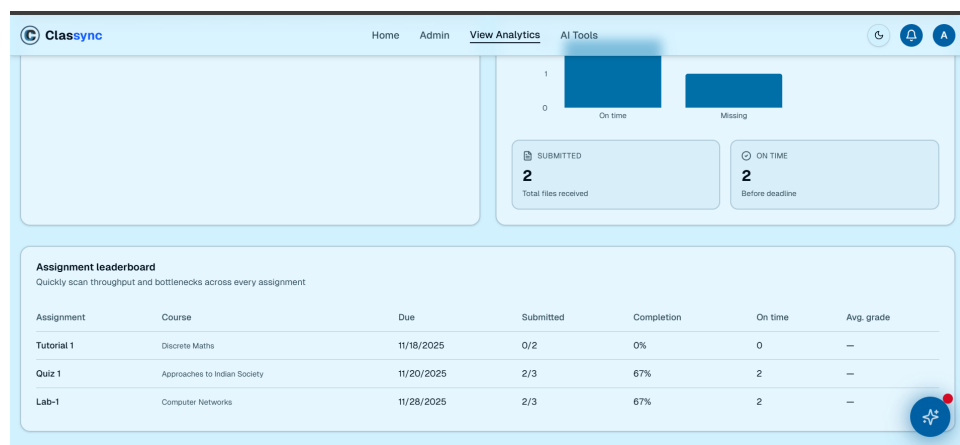
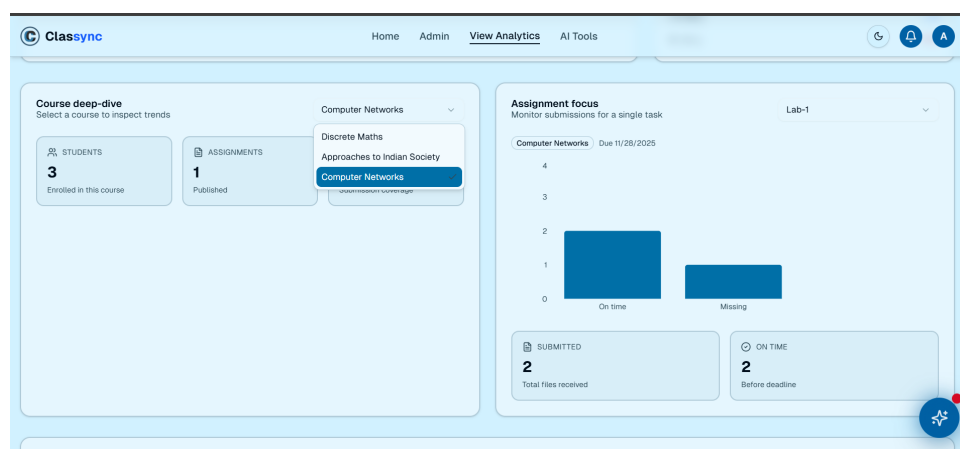
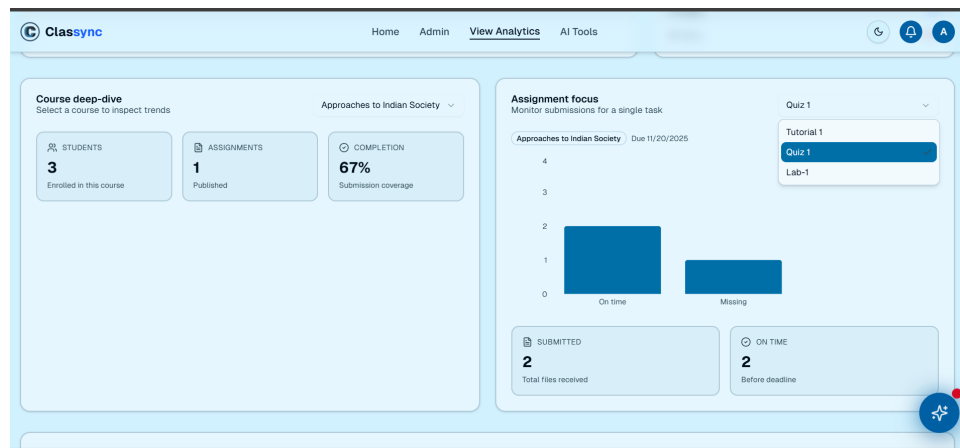




- 3. Analysis Page for instructor:



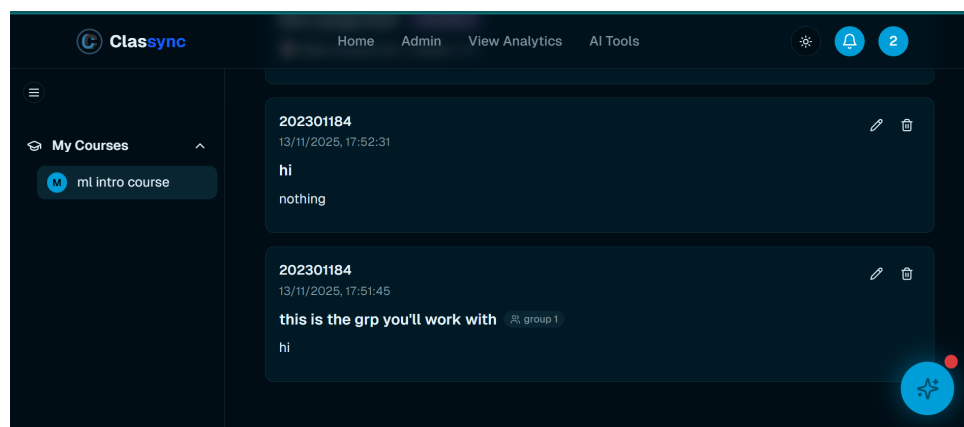
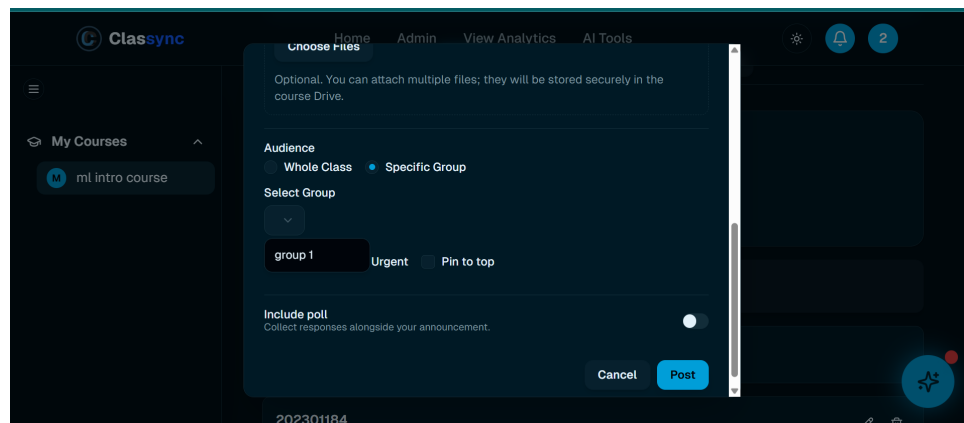
- 4. Analysis Page for instructor for each course:



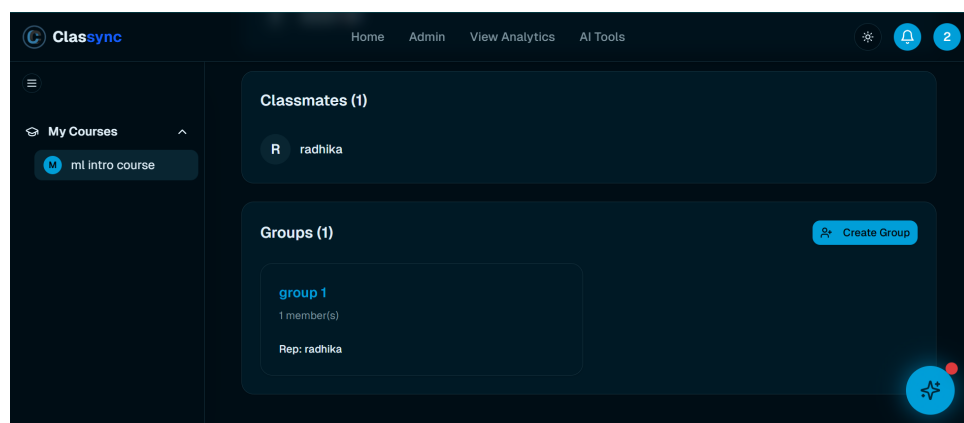
3.3 Group Specification

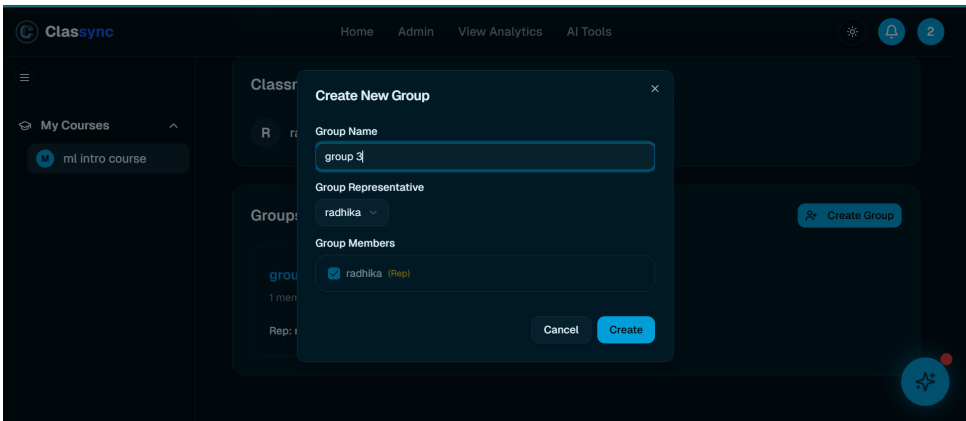
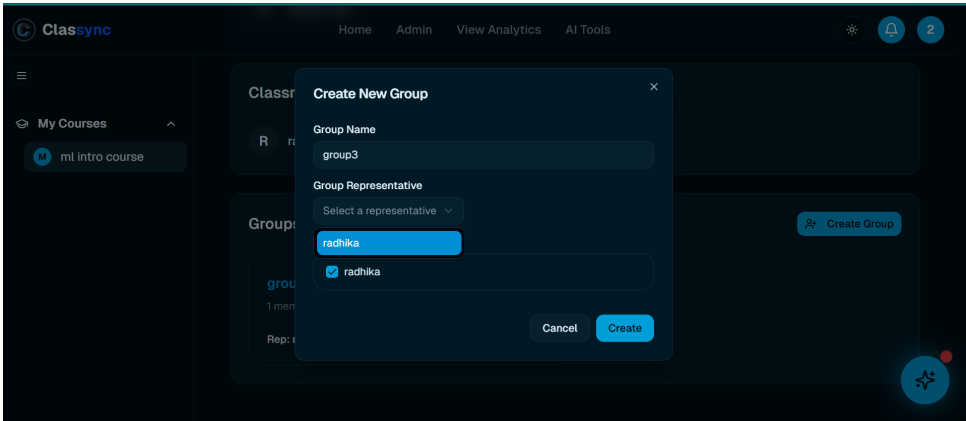
This section provides a visual overview of How Group specification works.

- **1. Group Specifications in Classroom stream:** Instructor can add post specific to a group which will be visible to that group only.

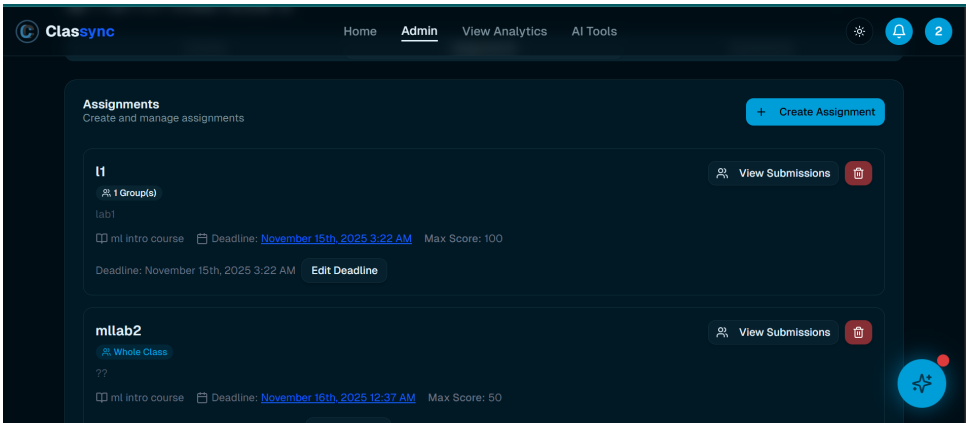


- **2. Create new group:** For user logged in as instructor can see button of create group in people tab in classroom which can be clicked to create new groups in classroom.





- **3. Assignment for specific groups:** Instructor can create assignments for specific groups.



Create New Assignment
Add a new assignment for students

Course/Subject *
Select a course ▾

Audience
☒ Whole Class

Assignment Title *
Assignment title

Description *
Assignment description...

Deadline *
mm/dd/yyyy --:-- --

Max Score (Optional)

Background Interface:
+ Create Assignment
View Submissions (trash icon)
View Submissions (trash icon)

Create New Assignment
Add a new assignment for students

Course/Subject *
ml Intro course (20ML77) ▾

Audience
☐ Whole Class ☒ Specific Group(s)

Select Group(s)
Select groups... ▾

Assignment Title *
Assignment title

Description *
Assignment description...

Deadline *

Background Interface:
Classsync
Assignments
Create and manage assignments
t1
1 Group(s)
lab1
ml Intro course Deadline: Novem
Deadline: November 15th, 2025 3:22 AM
mtlab2
Whole Class
ml Intro course Deadline: Novem
+ Create Assignment
View Submissions (trash icon)
View Submissions (trash icon)

4. Sprint Review

4.1 What We Achieved

4.1.1 In Whiteboard & PDF Annotation

- **PDF Annotation Core:** Successfully implemented a whiteboard tool that allows instructors to open, load, and display multi-page PDF files within the application.
- **Drawing Tools:** Enabled a full suite of annotation tools, including a freehand pen with customizable color/size, a semi-transparent highlighter, and an object-based eraser.
- **Canvas Controls:** Deployed essential controls for a smooth user experience, including undo last action, clear all annotations, zoom in/out, and fit-to-screen.
- **Navigation & Notes:** Implemented multi-page navigation for large documents and a dedicated side panel for instructors to type, copy, and clear persistent notes related to the document.

4.1.2 In Analytics Dashboard

- **Role-Based Dashboards:** Deployed two distinct analytics pages with role-based access control: one for instructors (course performance) and one for students (personal progress).
- **Instructor Analytics:** Provided instructors with a high-level summary of class engagement, submission health (on-time, late, missing), and per-course/per-assignment performance charts.
- **Student Progress:** Gave students a personal dashboard to track their own completion rates, average grades, and a clear list of upcoming or missing assignments.
- **Data Visualization:** Implemented various charts (bar charts, donut charts) to make complex data easy to understand at a glance for both roles.

4.1.3 In Group Management

- **Instructor Controls:** Built a full dashboard for instructors to create, view, and manage student groups, including assigning students and designating a "Group Rep."

- **Student Visibility:** Created a "My Group" view for students to see their group members and collaborate effectively.
- **Group-Specific Content:** Successfully implemented the core logic to target stream announcements and new assignments to specific groups, rather than just the entire class.
- **Group Submissions:** Enabled a single student (the "Group Rep") to submit an assignment on behalf of their entire group.

4.2 Challenges

4.2.1 In Whiteboard & PDF Annotation

Challenge 1: Layering PDF and Drawing Canvases Issue: How to render a high-fidelity PDF page and simultaneously allow smooth, real-time drawing on *top* of it without the two systems interfering or causing performance issues.

Solution: Used a layered canvas approach. Loaded 'pdf.js' to render the PDF page onto a static background 'jcanvas'. Then, placed a second, transparent 'jcanvas' managed by 'fabric.js' directly on top to handle all user-drawn annotations.

Learning: Learned to layer and manage multiple canvases. This separation of concerns (static PDF rendering vs. dynamic user drawing) was the key to making the feature both functional and performant.

Challenge 2: Managing Annotations During Page Navigation Issue: When an instructor turned the page in a multi-page PDF, the annotations from the previous page would incorrectly remain visible on the new page.

Solution: Tied the 'fabric.js' canvas state to the 'pdf.js' page navigation. When the "Next" or "Previous" button was clicked, a function was triggered to first 'clear()' all objects from the 'fabric.js' canvas before rendering the new PDF page to the background canvas.

Learning: Learned the importance of managing application state during "transition" events (like page changes) to prevent data from one view (Page 1) incorrectly persisting on another (Page 2).

4.2.2 In Analytics Dashboard

Challenge 1: Role-Based Access Control (RBAC) Issue: The instructor dashboard contains sensitive student data, and the student dashboard contains personal data. We needed to ensure instructors *only* see instructor analytics and students *only* see their own.

Solution: Implemented a strict role-check at the page/route level. The user's role was fetched from the auth state. If a user with a "student" role tried to access the '/analytics/instructor' route, they were immediately redirected to their own dashboard (and vice-versa).

Learning: Reinforced that security cannot just be hiding a button (client-side). Access control must be enforced at the route level to prevent unauthorized access.

Challenge 2: Aggregating Complex Data for Charts Issue: Calculating metrics like "average completion rate" or "on-time vs. late" required fetching data from multiple database tables (e.g., 'users', 'assignments', 'submissions') and performing complex calculations.

Solution: Created dedicated helper functions (or simulated backend endpoints) to aggregate this data. For example, a function would fetch all assignments, then for each one, count its submissions, check timestamps against due dates, and *then* return the simple numbers ('on_{time} : 10, late : 3')*required by the charts*.

Learning: Learned that raw data from the database is rarely in the correct format for a UI. Writing dedicated "aggregator" or "selector" functions is essential to transform complex data into simple, view-ready values.

4.2.3 In Group Management

Challenge 1: Group-Specific Content Visibility Issue: How to show a post or assignment to 'only' the members of "Group A" and "Group B," but hide it from everyone else in the class.

Solution: Added an "allowed_groups" array field to the 'assignments' and 'posts' tables. When a student loaded their stream, the database query would check: "Show all posts where 'allowed_groups' is empty OR where my 'group_id' is in the 'allowed_groups' array."

Learning: Learned to use array-based database queries (like 'array-contains-any') to efficiently filter content for a list of valid recipients, which is more scalable and flexible than checking permissions one by one.

Challenge 2: Designing the Group Management UI Issue: Determining the optimal placement for the 'Create Group' feature to ensure it is easily accessible without adding clutter or cognitive load to the main dashboard.

Solution: Integrated the feature directly into the "People" section, logically grouping it with student roster management rather than creating a separate navigation tab.

Learning: Gained insight into **Contextual UI Design**. We learned that placing features where users naturally expect them (i.e., managing groups

within the student list) significantly improves usability and reduces the learning curve.

5. Conclusion

This sprint delivered a massive leap in data-driven insights and advanced instructor tooling. The implementation of two distinct, role-based analytics dashboards provides clear, actionable data on performance and engagement for both instructors and students. Simultaneously, the new group management system gives instructors fine-grained control over team-based work, from creating rosters to assigning group-specific content. Finally, the launch of the interactive PDF whiteboard and annotation tool provides a powerful new way for instructors to teach and collaborate on documents directly within the platform. Collectively, these features have successfully evolved the platform into a more mature, interactive, and data-rich educational environment.