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**SOFTWARE QUALITY ASSURANCE DESIGN:
LEARNLINK**

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Abstract

One of the most important components of the learnlink system is the Forum Discussion Module that allows students to engage in discussions on a structured and academic platform as a result of lecturer announcements. This Quality Design Report describes how the module achieves its quality objectives with reference to three key characteristics namely Portability, Maintainability, and Reliability.

Software Quality Assurance principles state that the system needs to be engineered to be not only functional but also it should be adaptable, scale-able and recoverable. In this report, a number of situations and design strategies are established that will make sure that the Forum Discussion Module is compatible with devices, can be updated with ease, and that the input provided by users can be restored in the event of unforeseen disruptions. These strategies adhere to ISO/IEC 25010 quality principles so as to accommodate a stable and user friendly learning platform.

1. Introduction

The interaction and structure of a system are what is known as software architecture. Quality Design lecture has touched upon architecture as being necessary in cases where a system will have numerous users, be updated on numerous occasions and grow further in the future LearnLink is a multi-user, multi-version academic system, so strong architectural decisions are required.

This report focuses on **Module 3 – Forum Discussion**, which allows students to reply under announcements posted by lecturers. It plays a major role in improving academic interaction and classroom engagement.

The design in this report follows the **ISO/IEC 25010 quality model** and targets three quality goals:

- **Portability** : Ensuring the forum works across devices and browsers
- **Maintainability** : Making the module easy and safe to update
- **Reliability** : Preventing data loss when the browser refreshes or closes

By defining realistic scenarios and selecting appropriate design tactics, this report demonstrates how the Forum Discussion Module can meet its quality expectations.

2. Background of Study

2.1 Current Problem

Academic discussions currently happen through WhatsApp, email, and scattered platforms. Important replies get lost, and updates are inconsistent. Students lack a centralized academic discussion space.

2.2 Proposed Solution: LearnLink

LearnLink provides one integrated platform where announcements and replies are combined under each course. Students can interact in one system instead of jumping between multiple applications.

2.3 The Forum Discussion Module

This module handles:

- Posting replies
- Editing replies
- Deleting replies
- Displaying discussion threads
- Pinned posts
- Search and filtering

It creates a structured academic communication environment between students and lecturers.

2.4 Why These Quality Attributes?

- **Portability** — Students use laptops, phones, and tablets. The UI must adapt.
- **Maintainability** — The forum updates over time. Code must be easy to modify.
- **Reliability** — Students must never lose their typed replies.

3. Quality Attribute Scenarios

3.1 Scenario 1: Portability (Adaptability)

Scenario Goal:

Ensure that the Forum Discussion Module displays correctly and remains usable across different browsers and devices.

Scenario Description:

A student accesses the same course forum first on a laptop using Chrome, then later on a phone using Edge to continue reading and replying to posts.

Element	Description
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Source	Student user (authenticated) using different browsers/devices.
Stimulus	The student opens the course forum page on Chrome (laptop) and later on Edge (mobile) to view and reply to posts.
Artifact	Forum Discussion Module UI (responsive layout, React/Vue components, CSS)
Environment	Normal operation during class week mixed desktop and mobile usage.
Response	The system renders the forum layout consistently (navigation bar, post cards, reply area, statistics) without broken components or overlapping text on both devices. All core actions (view post, read replies, add reply) work normally.
Response Measure	At least 90% of tested combinations (3 major browsers × 2 device types) display correctly with no critical UI defects or blocked actions.

3.2 Scenario 2: Maintainability (Modifiability)

Scenario Goal:

Ensure that adding or changing a forum feature can be done quickly without breaking existing discussion functions.

Scenario Description:

A developer needs to add a new “Attachment” option to replies so students can upload supporting files.

Element	Description
Source	Developer (me) updating the Forum Discussion Module.
Stimulus	A change request is raised: add an -Attachment- field to the reply form and display uploaded file links under each reply.
Artifact	Forum backend API (reply model / controller) and frontend reply components (ReplyInputBox, ReplyCard).
Environment	Maintenance phase during sprint; code is under version control (GitHub) and feature branch workflow.
Response	The developer makes the database/model, API and UI components to accommodate attachments. Other modules do not have any errors in existing functions (posting text replies, editing, deleting, viewing threads). Unit/feature reply-tests pass.

Response Measure	The change is designed, implemented, and tested in ≤ 4 hours , with 0 regressions reported in existing reply, view, or delete features after deployment.
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3.3 Scenario 3: Reliability (Recoverability)

Scenario Goal:

Prevent loss of a student's reply if the page reloads or if the connection is interrupted.

Scenario Description:

A student writes a long reply to a discussion thread, but the browser accidentally refreshes before they press “Post Reply”

Element	Description
Source	Student user composing a reply in the forum.
Stimulus	While typing a reply, the page is refreshed or the browser briefly loses connection (e.g., Wi-Fi drop, accidental F5).
Artifact	Reply draft handling mechanism (local storage/session storage + frontend state management).
Environment	Normal usage with unstable network; browser reload occurs before reply is submitted.
Response	When the forum page reloads, the system detects an unsent draft and restores the reply text automatically in the input box, allowing the student to review and submit without retyping.
Response Measure	On 100% of tested cases with a draft present, the saved reply contents are reloaded and the drafts are shown again, although 0 characters of drafts longer than some minimum size (e.g. more than 20 characters) are lost.

4. User Interface Design

This section explains the user interface design for the **Forum Discussion Module**, supported by prototype screenshots. Each figure demonstrates how users interact with the module and how the UI supports the quality goals.

4.1 Forum Main Interface Overview

The main forum page displays the search tools, category filters, and engagement metrics (total posts, replies, active users, pinned posts). It helps students get an overview of the discussion environment.

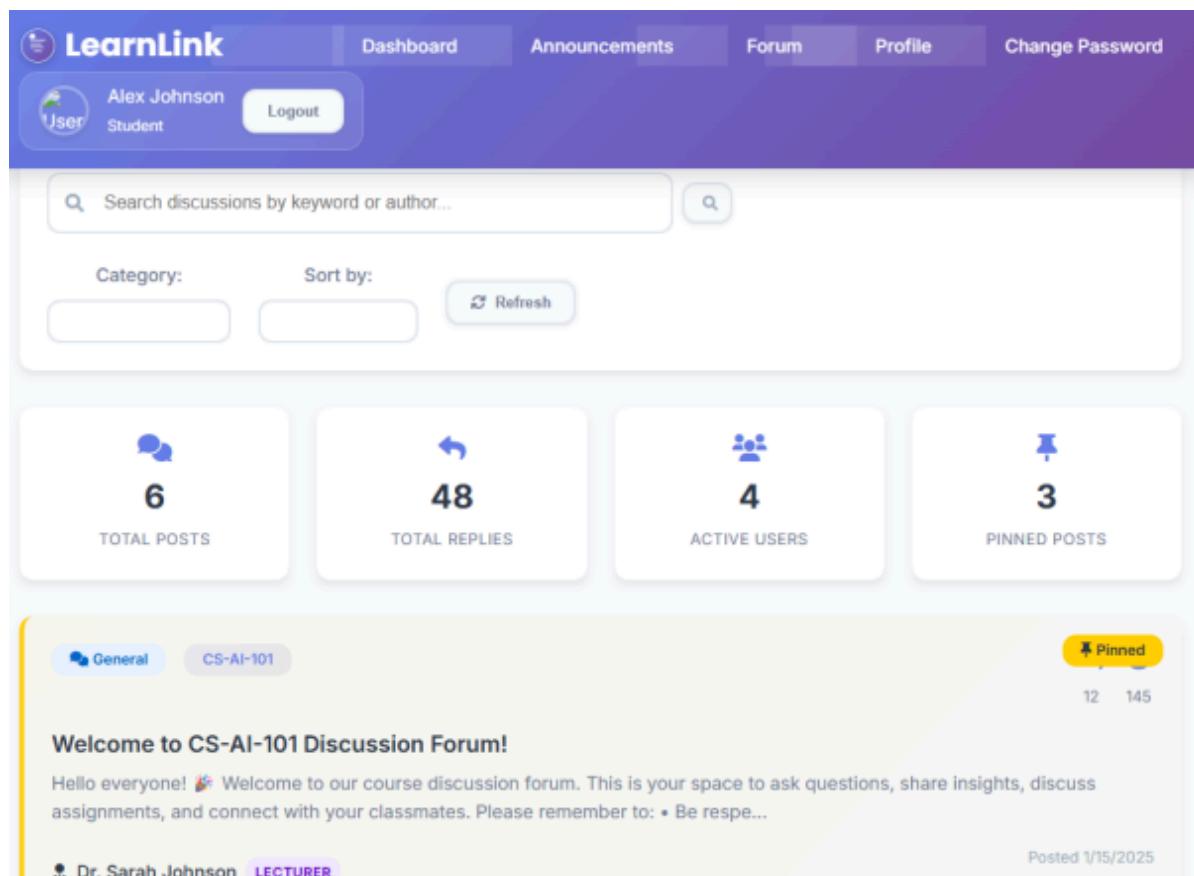


Figure 1

The Figure represents the key interface of the Forum Discussion Module, which contains the most important elements, namely the search bar, the following category filters, pinned posts, and engagement statistics. This design has Portability in that its flexible design does not collapse when used with other devices and browsers. It is indicative of the Portability Scenario, in which a student visits the forum with several different devices, and falls in line with Responsive UI Rendering and Browser Compatibility Testing tactics.

4.2 Pinned Post Expanded View

Pinned posts remain at the top to highlight essential information. This expanded view shows a detailed lecturer announcement along with views and reply counts.

Pinned Post

General CS-AI-101

146 views 12 replies

Welcome to CS-AI-101 Discussion Forum!

Hello everyone! 🎉

Welcome to our course discussion forum. This is your space to ask questions, share insights, discuss assignments, and connect with your classmates.

Please remember to:

- Be respectful and constructive in all discussions
- Search existing posts before creating new ones
- Use clear, descriptive titles for your posts
- Tag your posts appropriately (homework, lecture, general, etc.)

I'll be monitoring the forum regularly and responding to questions. Don't hesitate to help each other out - peer learning is incredibly valuable!

Looking forward to great discussions this semester! 🎉

Figure 2

The Figure presents a detailed pinned announcement created by the lecturer. In this interface, there is clear demarcation of post content, metadata, actions and replies. This number justifies the Maintainability Scenario, where the developers add features (e.g., attachments or formatting) without having to make changes in the UI elements. It demonstrates how these design techniques as Encapsulation and Semantic Coherence make the UI structured and simple to maintain. This will make vital academic details to be viewed first which enhances a better communication.

4.3 Replies Interface

This interface allows students to read existing replies and post their own. The reply input box encourages structured and respectful communication.

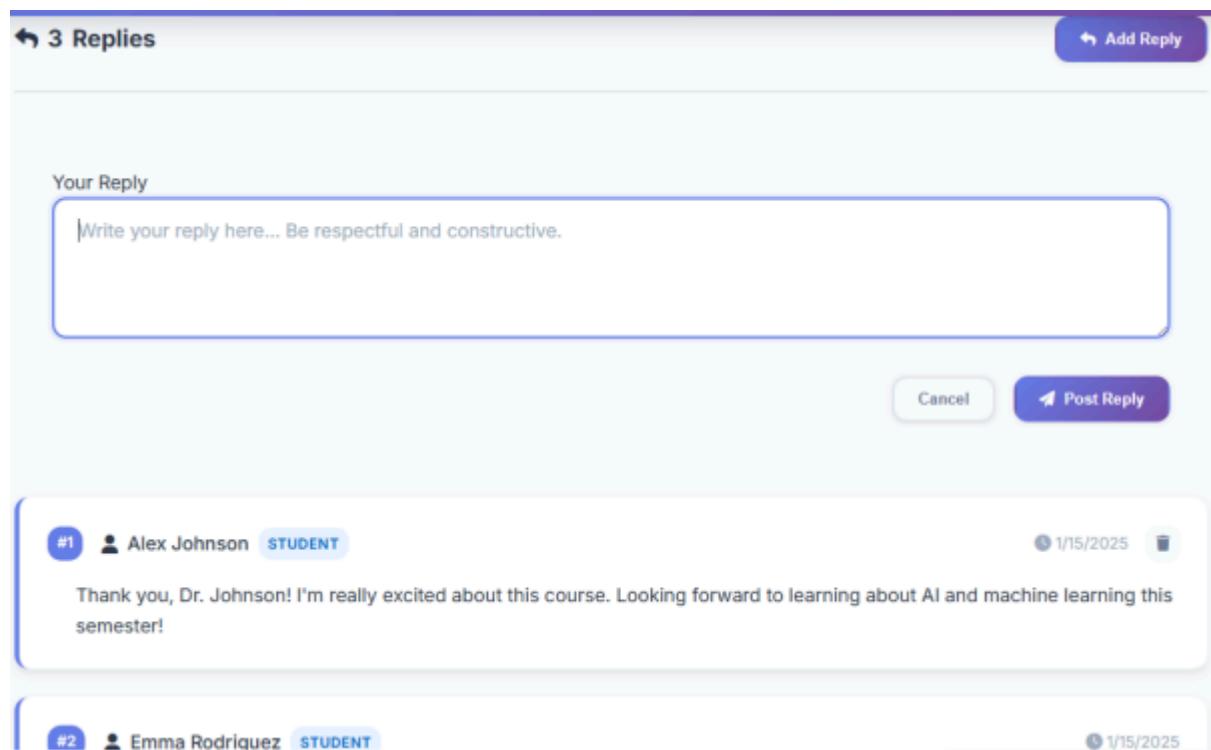


Figure 3

The Figure represents the conversation with the student in the discussion and the input reply box. This character is the direct supporter of the Reliability Scenario when a student starts typing a reply and the system needs to safeguard his/her data. The apparent reply box is where State Persistence / Checkpointing is done, so that draft material may be restored in case of a refresh or a disconnection.

4.4 Newly Posted Reply View

A newly added reply appears instantly with a timestamp such as “Just now.” Students also have the option to delete their own comment.

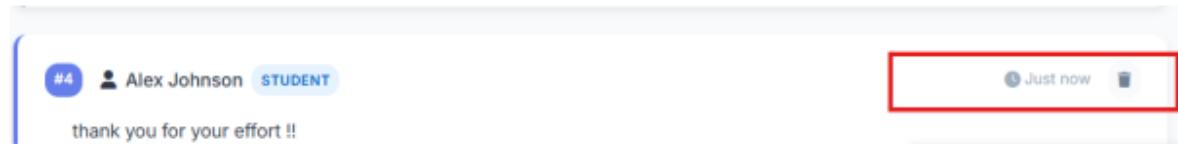


Figure 4

The figure displays a recently added response with - Just now - date and a delete button of the author. This character reinforces the Reliability Scenario since it shows a live confirmation of the fact that the response has been saved. It also shows such tactics as Error Detection and Retry Logic, whereby lost replies do not get lost on the posting and the user gets a prompt reply.

4.5 Category Tags and Pinned Indicators

Posts can be labeled such as Lecture Notes or Study Group. Pinned posts appear at the top with a clear highlight.

The screenshot shows the LearnLink application interface. At the top, there is a navigation bar with links for Dashboard, Announcements, Forum, Profile, and Change Password. Below the navigation bar, the user Alex Johnson (Student) is logged in. A yellow vertical line highlights the first post, which is a pinned 'Lecture' note. This post is titled 'Lecture 3 Notes - Neural Networks Fundamentals' and contains a message from Dr. Sarah Johnson (LECTURER) about uploaded notes on neural networks fundamentals. The post has a yellow 'Pinned' badge in the top right corner. Below this post is another pinned 'Study Group' note from Emma Rodriguez (STUDENT) about forming study groups for the midterm exam. This post includes a red box around its category tag 'Study Group'. Both posts have a timestamp indicating they were posted on 1/18/2025 and last replied on 1/19/2025. The overall interface uses a card-based design for each post.

Figure 5

Posts are categorized in The Figure as Lecture Notes and Study Group topics and with a pinned badge. The Portability Scenario is supported by this structure, as the overall card-based design means that categories and metadata will be presented on various screens properly. It also aids the Maintainability Scenario, as other system components are not impacted by the add or changes made to the category, which is in line with the Intermediary API Layer tactic.

4.6 Search and Filter Tools

Students can search for posts by keyword, author, or category. Sorting tools refine the results.

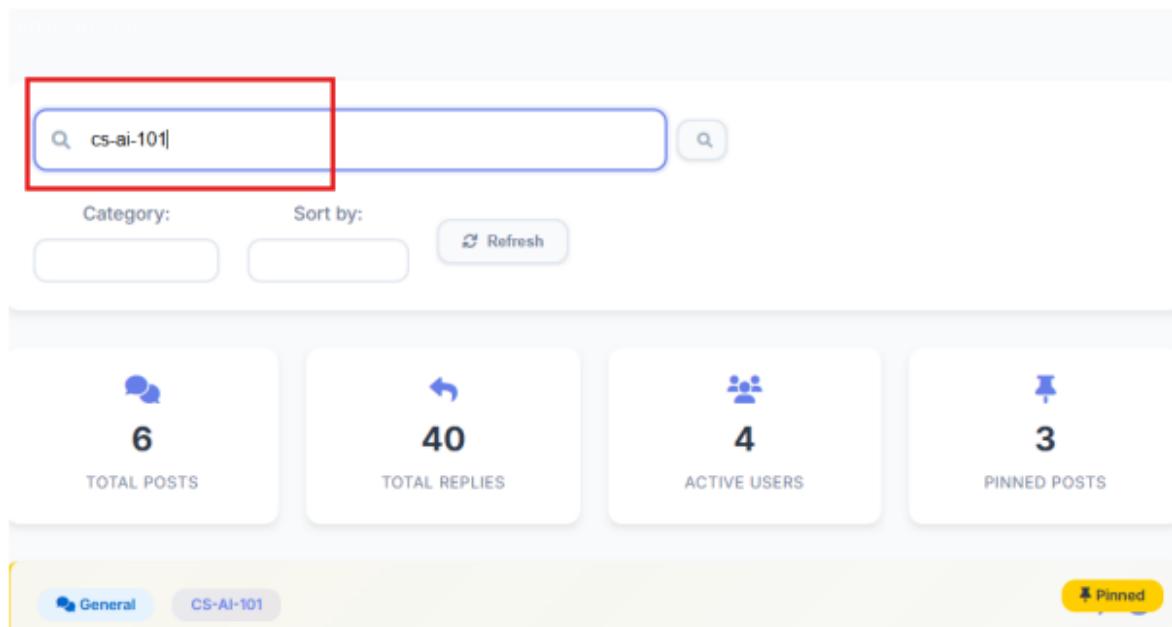


Figure 6

The figure brings to light the search features and the advanced filtering options of the forum. Such interactive elements as search bars and dropdown filters are isolated components used in these interactive tools. It enables the Maintainability Scenario where the developers can update search logic or add up filtering parameter without changing the actual forum layout. This is compatible with Encapsulation and High Cohesion strategies, which enhance the effectiveness of updating the code.

5. Tactics for Each Attribute

The following architectural tactics were selected to ensure that the Forum Discussion Module achieves its three main quality goals: Portability, Maintainability, and Reliability. These tactics align with ISO/IEC 25010 standards and support the long-term evolution of the LearnLink system.

5.1 Portability Tactics (Adaptability)

1. Responsive UI Rendering

The forum interface is based on responsive CSS (Flexbox/Grids) and dynamic scaling to incorporate layouts based on the size of the device.

This makes sure that such important items like discussion posts, statistics (Figure 13), pinned posts (Figure 17) and reply inputs (Figure 15) are readable and accessible on laptops, tablets, and mobile screens.

Benefit: The students who change devices do not feel like their devices are being redesigned as they will still have uninterrupted readability and functionality.

2. Browser Compatibility Testing

Chrome, Edge, Firefox, desktop and mobile are the most commonly tested modules.

UI patterns, like search filtering (Figure 18), reading of detailed posts (Figure 14) and responding to replies (Figure 15-16) are authentic to avoid layout overflow, broken elements, or unstable rendering.

Advantage: Guarantees no less than 90% cross-browsing visualisation and the same functional behaviour.

3. Framework-Independent Components

The design is based on the component-based (React/Vue-style components) design.

UI components such as ReplyCard, ReplyInputBox, PostCard, and PinnedBadge are not indistinguishable to the browser specific rendering engines.

Advantage: Will minimize browser-specific problems and will allow easier transition of the UI to new frameworks or platforms in the future.

5.2 Maintainability Tactics (Modifiability)

1. Encapsulation (Information Hiding)

Every component of UI has its logic, style, and state.

Indicatively, the reply input (Figure 15) component only deals with the drafting and posting behavior whereas the reply list (Figure 16) component deals with rendering user response.

Advantage This allows a change within one component without impacting other components to minimize accidental regressions.

2. Intermediary Layer (API Gateway / Controller Layer)

The Forum Module communicates with the backend only through well-defined API endpoints (POST /reply, DELETE /reply, GET /thread).

The UI does not interact directly with the database or internal structures.

Benefit:

- If the reply model changes, only the API layer must be updated.
- Prevents ripple effects across multiple modules.
- Supports rapid feature integration (e.g., adding attachments).

3. Semantic Coherence (High Cohesion)

All forum-related logic (viewing threads, posting replies, searching discussions) is placed in a dedicated controller or module structure.

Benefit:

- Easier navigation for developers.
- Faster debugging and updates.

- Reduces complexity when adding new features or modifying existing ones.

5.3 Reliability Tactics (Recoverability)

1. State Persistence / Checkpointing

Before posting, reply drafts are temporarily saved in local storage or session storage. If the browser refreshes, the reply content (Figure 16) appears automatically.

Benefit:

Prevents loss of student work and supports uninterrupted academic discussions.

2. Error Detection and Fault Isolation

In case of a failure in a posting action (internet is slow, session has expired), the backend will send back structured error messages as opposed to shutting down the UI.

Benefit:

The error is notified to the users without loss of typed replies and the UI is not lost.

3. Retry Logic (Fault Recovery Mechanism)

If a reply submission fails, the system attempts an automatic retry or prompts the user to “tap to resend.”

Benefit:

Ensures message delivery even under unstable network conditions, improving trust and system reliability.

6. Conclusion

The Forum Discussion Module should be designed in a qualitative way as it facilitates academic interaction between the students and lecturers. Architectural techniques of improving Portability, Maintainability, and Reliability make this module stable, adaptable and secure against accidental loss of data. These design choices

are based on the ISO/IEC 25010 model and contribute to the achievement of long-term educational objectives of LearnLink.

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