
SDU University
Faculty of Engineering and Natural Sciences

# DIPLOMA PROJECT

CrossEval: Smart Evaluations, Smarter Learning

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Zhanbolat Mukan
6B06101 - “Information Systems”

Kaskelen, 2025

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## Abstract

Peer assessment promises richer engagement and fairer grading, yet real-world adoption is hampered by orchestration complexity, inconsistent feedback, and high instructor workload. CrossEval answers these challenges with a themed peer-review ecosystem that translates collaborative-learning theory into practice. A role-adaptive Next.js interface, protected by Zod validation, guides students through structured submission and rubric-based review, while a Laravel microservice API and Docker-composed services (Nginx, MySQL, Redis, MailHog) deliver fault-tolerant, low-latency operation.

In a survey with forty undergraduates, it raised self-reported engagement from 3.0 to 4.6 and reduced weekly grading time for ten instructors from 6 h to 1.5 h — a 75 % decrease. Usability and performance scores were 4.7 and 4.6, respectively. These results show that the hope of turning the concept of peer learning into real educational and operational benefits can be achieved by a carefully scaffolded, rubric-driven workflow. CrossEval's modular design further invites new work that involves adaptive analytics, sketching a sustainable path toward student-centered, data-informed assessment at scale.

# Аннотация

Кросс-бағалау неғұрлым белсенді қатысуға және әділ бағалауға кепіл етеді, бірақ нақты өмірде енгізуге ұйымның күрделілігі, бағалаудың сәйкес келмеуі және мұғалімге жоғары жүктеме кедергі келтіреді. CrossEval бұл мәселелерді бірлескен оқыту теориясын тәжірибеге енгізетін тақырыптық кросс-бағалау экожүйесі арқылы шешеді. NextJS, Zod валидациясымен қорғалған JS интерфейсі студенттерге құрылымдық көрініске және рубрикаларға негізделген тексеруге көмектеседі, ал Laravel микросервистік API және Docker (Nginx, MySQL, Redis, MailHog) негізіндегі қызметтер төмен кідіріспен ақауларға төзімді жұмысты қамтамасыз етеді.

Қырық жоғары курс студенттері қатысқан сауалнама кросс-тексеру әдісі қатысуды 3,0-ден 4,6 баллға дейін арттырғанын және он оқытушының апта сайынғы тексеру уақытын 6-дан 1,5 сағатқа дейін қысқартқанын анықтады, бұл дәстүрлі тексеру әдісіне қарағанда 75 % - ға аз. Пайдалану және өнімділік ұпайлары сәйкесінше 4,7 және 4,6 балл болды. Бұл нәтижелер кросс-тексеруге негізделген күрделі жұмыс процесі өзара оқыту тұжырымдамасын нақты білім беру және операциялық артықшылықтарға айналдыруға қабілетті екенін көрсетеді. Crosseval модульдік дизайны сонымен қатар кері байланыс, адаптивті аналитика және пайдаланушыға ыңғайлы интерфейс үшін перспективалар ашады, оқушыға бағытталған және деректерге негізделген бағалаудың тұрақты жолын белгілейді.

peer assessment, collaborative learning, educational technology, containerization, web applications, student engagement

# Аннотация

Перекрестное оценивание обещает более активное участие и более справедливые оценки, однако внедрению в реальной жизни препятствуют сложность организации, несогласованность оценивания и высокая нагрузка на преподавателя. CrossEval решает эти задачи с помощью тематической экосистемы перекрестного оценивания, которая воплощает теорию совместного обучения на практике. Адаптивный к ролям Next.js интерфейс, защищенный валидацией Zod, помогает учащимся в структурированном представлении и проверке на основе рубрик, в то время как микросервисный API Laravel и сервисы, созданные на основе Docker (Nginx, MySQL, Redis, MailHog), обеспечивают отказоустойчивую работу с низкой задержкой.

В ходе опроса, в котором приняли участие сорок студентов старшекурсников, выяснилось, что метод перекрестной проверки повысило оценку вовлеченности с 3,0 до 4,6 баллов и сократило время еженедельной проверки десяти преподавателей с 6 до 1,5 часов, что на 75 % меньше чем у традиционного способа проверки. Оценки за удобство использования и производительность составили 4,7 и 4,6 балла соответственно. Эти результаты показывают, что тщательно продуманный рабочий процесс, основанный на перекрестной проверке, способен преобразовать концепцию взаимного обучения в реальные образовательные и операционные преимущества. Модульный дизайн CrossEval также открывает перспективы для обратной связи, адаптивной аналитики и удобного интерфейса, намечая устойчивый путь к оценке, ориентированной на учащихся и основанной на данных.

peer assessment, collaborative learning, educational technology, containerization, web applications, student engagement

# Acknowledgements

The CrossEval platform has been developed with the visionary guidance of our diploma supervisor **Khaled Mohamad,** who first initiated the idea of this project and guided design. His directions were such that they formed the basis for the conceptual as well as the technical trajectory of the platform. We owe him a word of gratitude for sharing with us his continuous support and timely feedback, which proved to be invaluable to us in the entire development process.

We also acknowledge the contributions of the development team:

**Zhanbolat** worked as the Front-End Developer and UI/UX Designer and created the whole client interface using Next.js 14, TypeScript, Tailwind CSS, and shadcn components. This work made sure we had a responsive, accessible, and user-friendly interface that worked well with the backend architecture.

**Yedyge** was in charge of the Back-End development and database design as well as DevOps operations and security. He created the unique CrossEval's algorithm, set up the project using the MVC pattern with PHP-Laravel, developed the relational database schema, helped with the technical feasibility and deployment strategy of the product.

Apart from providing feedback on the project concept, members committed themselves to quick skill attainment by embracing any new tools and methodologies that would enhance both development speed and quality.

Our thanks go to the academic advisors, reviewers, and students for pilot testing and user evaluations. Their feedback has shaped the platform into its many iterations.

# Contents

# Chapter 1

# Introduction

Over the past five years, there has not been much enhancement in the effectiveness of education assessment. The teachers and students face several challenges such as too much work in assessment, student projects take a long time, and there is not enough time to address all student problems. In a result, it may lead to ineffective learning process which may make students miss out on the most improtant knowledge they could gain by reviewing others works. All the problems also further reduce the number of experts in different fields.

To solve this problem, our team created a newer platform that will help students evaluate them and access learning materials more efficiently and help teachers check work faster and easier.
Our aim is to develop a new method which will allow students to improve their study or learning experiences and make their academic performance better. And our cross-evaluation method improves it, because simultaneously checking and reviewing other students work allows them to gain deeper and better knowledge of the subject. It will help students recognize the topics and areas that need time to learn and improve. This kind of assignments not only help teachers to save a bunch of time, but also help students to stay connected and motivate them to learn together by checking each others works, giving advices for future improvements and sharing their ideas

Our new assessment method also helps teachers, supervisors, and lecturers by reducing amount of time teachers spend on checking students work. Now they can spend their free time on helping students. Help them with their study problems, organize additional office hours or make interactive games.

To achieve this, we designed CrossEval, an intelligent assessment platform designed for both students and teachers. CrossEval platform has a user-friendly interface which provides well planned user experience. The usage of smart tools in its development allows us to implement better assessment and reviewing techniques, which makes it easy to use for teachers and students. CrossEval aims to simplify the grading process, promote collaborative learning, and provide students with a complete all-in-one platform to support their academic growth.

# Chapter 2

# Literature Review

## 2.1 Introduction

Recently, teachers have increasingly incorporated peer review into their teaching methods as a means of encouraging students to learn demonstrate the process of learning, promote collaboration, and provide useful criticism in real time. However, numerous studies have demonstrated that things aren't going as expected issues like bias, inconsistent behavior, and the immediate need for more effective tools have traditionally been significant barriers. This is the entrance to "CrossEval: Smart Evaluations, Smarter Education." By combining our personal learning. The system of administration, the purpose of the program is to create a more organized and equal distribution of power, the process of reviewing peers. Through this, it addresses some of the prominent issues discussed in previous investigations. This review surveys previous studies, and discusses the methods used employed, and exposes imperfections, all of which are intended to improve the way we endorse and evaluated students learning.

## 2.2 Bias in Peer Assessment

Bias is still a significant problem in the peer review process. In their research, Stonewall et al. (2018)[7] discussed possible sources of bias in peer reviews that include the dynamics of friendship, cultural differences, and tolerance. The investigation's findings suggested that biases have a significant effect on the reliability of peer review, therefore, algorithm intervention is necessary to ensure that the rating processes are standardized. This perpetuates the subjectivity concern discussed by Clark (2019)[2] who observed that the subjective perspective often had an effect on the results that led to inconsistent measurement results.

## 2.3 Effectiveness and Benefits of Peer Assessment

Because of its numerous benefits for both students and teachers, peer assessment, or PA, has become more popular in modern educational traditions. The capacity of peer assessment to promote reflection and active learning is one of its primary attributes. The formative peer assessment, which is particularly prevalent in academic writing, allows students to assess their own work in conjunction with the contributions of their peers, as reported by Topping et al.(2000)[10]. Other than improving students' academic writing, this method facilitates them in evaluating and considering the quality of their own as well as other people's writing. Similarly, Topping (1998)[8] observed that the evaluation of peers creates a climate in which students are more responsible for their education, which leads to increased performance.

Peer evaluation fosters vital social and communication skills in addition to improving critical thinking and accountability. Boud, Cohen, and Sampson (1999)[1] underlined that peer learning, aided by peer assessment, helps students to communicate with their peers, discuss assessment criteria, and engage in constructive criticism. In addition to encouraging teamwork, this interaction helps students learn how to provide and accept constructive criticism in a professional way. Dolezal et al. (2018)[3] observed that implementing peer review techniques in student-centered classrooms improved peer connections and fostered a more dynamic learning environment, further supporting these collaborative components of peer assessment. Additionally, because they feel more accountable to their peers, students who participate in peer assessment can greatly increase their motivation (Reinholz, 2016)[6].

## 2.4 Methodologies in Peer Assessment Research

Numerous methodologies are used in PA research, depending on the goals of the study, the environment, and the kind of peer evaluation procedure. Both qualitative and quantitative approaches are frequently used to assess PA's effectiveness in educational contexts. For example, Topping et al.(2000)[10] used a quantitative approach and, in the postgraduate group, to study the influence of formative peer assessment on academic writing. In this study, a controlled experiment design provided rating exercises on academic writing by the peers of the students. The reliability and validity of the accuracy of their assessments were then tested. This kind of methodology undertaken in the study can give the authors' power to infer some specific inferences on the effects of such inferences on students' writing.

Besides, to assess the subjective nature of the course, which involves aspects of student experience and perception, qualitative methods other than quantitative

methods are used. In this case, it was necessary to use qualitative interviews to determine more about the students' attitudes toward the course, its equity, validity, and reliability in Clarke (2019)[2]. Qualitative methodologies help explore the details of the peer review process, which are not common within numerical statistics. One common example of this research type is the case study. For instance, it was through a case study that Dolezal et al.(2018)[3] explored the incorporation of peer review techniques within student-centered learning environments by studying students' interactions. This creates the possibility to meet pedagogic desires for collaborative learning through peer assessment.

## 2.5 Software Solutions for Peer Assessment

Turnitin, Peerwise and Google Forms are some of the most commonly used software programs for conducting peer assessments. Each has diversified components directed toward specific learning outcomes. For example, while it also lets students check work for plagiarism, more accurate peer review is provided through Turnitin. The detection of plagiarism in the program can add more reliability to the feedback, and so making sure, that the peer reviews are effective and objective (Topping,2009)[9]. A similar example is Peerwise, which enables students to create multiple choice questions and also has an evaluation component that allows students to assess each other's questions and offer comments. Actively engaging with questions created by peers encourages the learners to use higher-order skills and, therefore, fosters active learning (Topping, 2000)[10]. On the other hand, Google Forms is a more flexible and adjustable tool that helps teachers create their own peer assessment forms, which students can then fill out online to give feedback quickly and anonymously.

Software solutions have their fair share of drawbacks in as far as ensuring the fairness and trustworthiness of the peer review process. According to Stonewall et al.(2018)[7], the algorithms used to assess feedback can never always reflect the true nature of the quite complex peer reviews, and online platforms may introduce some forms of bias, due to anonymity. Also, Kishwar et al.(2015)[5] noted that technical issues, including platform complexity and software accessibility, may lessen the effectiveness of the PA systems.

## 2.6 Research Gaps and Limitations

An additional research gap is the dispute over which is the best model of the PA. Peer assessments have been conducted in several different ways, from relatively ad hoc feedback sessions to very prescriptive, rubric-based evaluations (Reinholz, 2016)[6]. It is not known whether the best model for a vast variety of educational contexts with different student populations, class sizes, and disciplinary canons has been introduced. Indeed, to some best knowledge reports by Hovardas et

al. (2014)[4] and Dolezal et al. (2018)[3], several studies have, for instance, established the benefits of using peer review adaptations within student-centered classrooms; the adaptation for different learners or content areas remains somewhat unclear. Moreover, the diversity and complexity of peer-assessment practices make it nearly impossible to develop standardized criteria, thus impeding result generalization in investigations.

Bias and equity are two primary concerns of the Peer Assessment (PA) research that has not been overcome even in numerous studies conducted on peer assessment. According to the viewpoint shared by Stonewall et al.(2018)[7] and Kishwar et al.(2015)[5], amongst many others, bias in feedback amongst peers can violate the validity of peer assessments due to factors like anonymity, interpersonal relationships, or even the lack of proper training. Very few studies have empirically tested ways to minimize bias and ensure the validity of peer assessments on multiple platforms and evaluation settings even when such concerns exist. Strategies to reduce bias, such as teaching students how to give positive feedback, making the assessment in multiple cycles, or using technology to ensure the uniformity of rating, need further research(Topping, 2009)[9]. All such measures would enhance the validity and equity of peer assessments and thus make the findings more reliable!

# Chapter 3

# Design and Methodology

## 3.1 BackEnd

### 3.1.1 Authentication and User Management

The CrossEval platform ensures safe and efficient management of user access by implementing a strong authentication system. Based on the Laravel authentication architecture, the system is meant to allow for transparent login and registration by users while maintaining stringent security measures. Making good use of Laravel's built-in authentication system, middleware protection plus encryption tools ensures that every other means of authentication applied will also follow industry standards. You can see the code of Backend by this link on github: https://github.com/B1ssultanov/CrossEval

#### User registration mechanism

Most of the means by which the authentication system works are carried out by the registration procedure, letting the Users register an account and log in. This process ensures data integri- ty and security to the highest standards through disciplined back-office workflows. The Laravel request processing system checks all required fields as a user fills a registration form. The system sets predefined limits including making sure passwords follow security formatting rules and that email ad- dresses are disallowed. Once the entered data has been confirmed, it will be cleaned to lower the SQL injection and other security flaws related risks. For added security, passwords are not stored in plain text; instead, Laravel's built-in hashing algorithm is applied before the credentials are stored in the database. Then, the verified and sterilized user data is inserted into the database via Laravel Eloquent ORM, which extracts the complexity of direct interaction with the organization name database and safe data processing. Once registration has been successful, the newly registered user shall be automatically authenticated by the system, creating a ready-to-use session on the platform, hence eliminating any additional login steps post-registration by the user.

**User Login Process**

It is the process that detects a user and provides access to the functions of the plat- form according to his or her role and right. A user submits their credentials, usually an email and password, in the login form; then, Laravel's authentication process checks and matches these against the saved users' records.

For password verification, the authentication system of Laravel compares the entered password with the already securely hashed version stored in the database. If these credentials are valid, then the system initiates session management. An authentication token is created which will act as the base for all subsequent user activities within the platform. This, in turn, enables security to be reestablished because the user is authenticated once again and provided that authentication validity is maintained throughout the session. Upon session expiration, the reauthentication has to be done again.

Proper access control is enforced by the use of Laravel middleware which checks for the right user permissions before granting access to the relevant sections on the platform. The roles predefine the sections to which access is to be limited. For example, different levels of access are set for students and teachers, and the user will only be able to see and interact with the features that are directly related to their roles.

In case there is a failure in the logins, the system would then be able to implement more security measures so as to ensure that there is no unauthorized user entry. The Laravel rate-limiter does stop the brute-forcing against the login requests; on receiving multiple failed login attempts from any account, authentication is temporarily locked for that account and no more attempts can be made from it, thus making the overall security of the platform better.

Security Considerations: To keep up with a good standard of security and shield user credentials from possible attacks, the following measures of security are integrated into the authentication system.

Password Hashing: Passwords are hashed with the use of Laravel's secure algorithm function, thereby making sure that even if there is a data breach, there will be no possibility of gaining access to plaintext passwords.

Cross-Site Request Forgery (CSRF) Protection: By validating a token for each request made, Laravel's CSRF protection mechanism helps prevent unauthorized use of the forms-which would otherwise lead to an attack by a malicious source.

Rate Limiting: The system applies login throttling to limit the number of failed login attempts. Therefore, it effectively prevents brute-force attacks.

Encryption of Sensitive Data: Critical user information is encoded with Laravel's encryption services, providing complete security of all data against any malicious activity, at rest or in transit. By putting the above authentication and security measures in place, the CrossEval platform will operate in a secured environment where easy access is balanced with stringent policies for protecting data. The described backend mechanisms will be working in a collective manner,

enhance user experience while upholding security best practices to ensure that authorized users alone can interact with the system's functionalities.

### 3.1.2 User Profile Management

The user profile system in CrossEval platform helps in easy handling of personal information with providing role-based access to grading data. With the help of Laravels authentication and authorization, mechanisms are fully ensured that users can only access information that is related to their roles, maintaining data integrity and privacy.

#### Role-Based Access to Grade Information

The platform enforces very strict role in use Role-Based Access Control (RBAC) in determining how grades are accessed and displayed. There are different data retrieval policies that depend on the user type to make sure that students and teachers interact only with the information they are authorized to view.

The system shall fetch academic records by filtering grades based on the unique identifier of the authenticated student. This would make sure that the students have a comprehensive, yet privacy-sensitive overview of their performance, without exposing data belonging to his peers. Also, grade visibility should be restricted for the students to only the courses in which they are actively enrolled.

On the other hand, teachers have a wider access level because of their role in instruction. The system allows the teacher to see the grades of all the students who are registered in the courses under his or her charge. This is through structured database queries which establish relationships between the records of a teacher and the courses he or she is in charge of. With dynamic retrieval of relevant data on student performance, the platform allows the teacher to assess progress and look for students who may need help and are ready to accept interventions.

Stringent security measures will be enforced by the platform to keep data safe and prevent unauthorized access. Users will not be able to access or manipulate data beyond their allocated permissions through the mechanism of role-based access control. Moreover, API responses will be formed in such a way that doesn't return sensitive information, reducing possible data exposure. These would collectively enhance the security and confidentiality of the user profile to be able to access academic records seamlessly.

### 3.1.3 Course Management

The CrossEval platform includes a structured course management system meant to help easily create, enroll, and run courses. This allows the teacher to set up and keep track of courses and students to join them using special codes. It uses Laravel's Eloquent ORM along with middleware for access control and secure

API endpoints for quick course handling with strong data integrity and security measures.

### Course Creation and Administration

The feature that enables instructors to create courses with a combined syllabus and assignment management system is of at least fundamental repute. There has to be a structured workflow in the functioning process of this feature so that there can be ensured accuracy and consistency in data handling.

An instructor has to fill and submit a form that carries essential details about the course: title, description, syllabus, and other relevant metadata. The Request validation method of Laravel checks for all required fields to be correctly filled; hence, no incomplete or inconsistent data will be entered. If the validation is successful, then a new course record will be created securely stored using the Eloquent ORM of Laravel that establishes a clear relationship between the course and its creator.

An all-unique alphanumeric course code is automatically generated for every new course created; doubling as a credential to access and, without direct admin involved, swiftly enroll students into the courses. In compliance with the need for data security and integrity, access rights of Laravel authorization policies shall ensure that only the creator of the course may be given access to modify or delete the course.

### Course Enrollment via Invitation Codes

The enrollment mechanism in the platform is made to make it easier for the students to take part in the courses. Instead of adding students manually, instructors give out unique course codes, allowing self-enrollment while keeping secure authentication protocols.

Enter the course code to which the student is enrolling, and the system shall check whether or not the record of that course already exists. If the code relates to an active course, then a student is successfully enrolled - in this many-to-many relationship between students and courses set up by Laravel's pivot tables. Also, built-in safeguards will check and stop duplicate enrollments - so students cannot register multiple times for the same course. On successfully enrolling, students are returned a responsive confirmation, thus building transparency and user involvement within the system.

### Management of Course Participants

The platform helps in efficient administration of the course by providing the feature for the instructors to look after the students who have enrolled. The teachers can get a complete list of all the participants linked with their courses to be able to keep a check on the engagement and progress of the students.

The system dynamically queries and retrieves enrolled student data using Laravel's Eloquent relationships. To uphold privacy and security, RBAC mechanisms for that particular course should apply to viewing the details of a participant. This dataset brings important details like student names, email addresses, and university identification numbers — which will help an instructor properly control the course record. In addition, where else there is a need for student unenrollment, it allows the instructor to unenroll a student from a course to maintain the data consistency as well.

- **Security and Access Control Measures** A number of security mechanisms are implemented by the platform to ensure the reliability and security of course-related operations.
- **Role-Based Access Control:** Permissions are enforced here so that unauthorized users are not able to change data about courses.
- **Data Validation Rules:** No incomplete or invalid course information can be stored; this ensures the consistency of the database.
- **Query Optimization Strategies:** Among several eager loading techniques which help minimize the queries to the database as well as help the system to run faster.

This scaled and flexible course of action does much to help not only the teachers but also the students have what they need to learn in a good environment. This is done by setting up the CrossEval platform with easy and safe ways to check and run things.

### 3.1.4 Assignment Management

The platform comes with a well-structured and full-on system of assignment management in academic courses with which teachers and students can interact smoothly. This includes front for assignment creation, students tracking their assigned tasks, and automated mechanisms for monitoring and updating the status of assignments. The backend architecture uses Laravel's Eloquent ORM for database interactions, middleware for access control policies, and API endpoints for optimized data retrieval and communication between the different components of the system.

#### Creation and Management of Assignments

The process of assignment creation has been designed to be efficient and strong, giving an instructor what is needed to generate and manage coursework well.

When the initiation of new assignment is done by instructor, then first system does perform validation to check all required fields like assignment title, description, due date, and associated course are provided and meet predefined validation criteria. This validation step is important to maintain data integrity and stop incomplete or wrong piece of information to be stored.

Upon successful validation, the assignment is persisted in the database through the Assignment model to ensure proper links to both the designated course and the instructor who is responsible for its administration. This structured data storage approach enables assignments to be retrieved and managed seamlessly over the duration of the course. If an assignment is created successfully, it is systematically assigned to all students who are enrolled in the respective course, so it must be immediately available and visible to the learners.

### Automated Identification of Missed Assignments

For academic accountability, the platform has in place an automated system for tracking the submission deadlines to identify which assignments are overdue. If an assignment is not submitted by a student before the specified deadline, then the system marks it as "Missed" automatically. This is done by a background job scheduled within Laravel which runs at specified intervals, mostly once every day, to scan the database and identify the assignments for which the submission deadline has passed.

If an assignment is past due and appears to be unsubmitted, then the system triggers an update on the relevant database records. It updates the status of the assignment in the pivot table that manages the relationship between students and assignments. The "Missed" status has to reflect properly here. This would be an automated check and would serve to significantly reduce the administrative burden for instructors as well as ensure a fair evaluation process is taking place.

### Student Access to Scheduled Assignments

A feature does this- shows students all their upcoming assignments in an orderly list. The system pulls up assignments with future due dates so that students can plan their work in advance. For ease of use, assignments show up in an orderly list, usually sorted by time as their due dates come up.

Also, for more use and user view, the system helps mix with a calendar show. Work can be seen in a calendar look, using Laravel's API replies to give a more easy way to schedule links. This lets students fast check their school work and give time where it is needed, thus helping better time use and school plans.

Through systematically designed features, the platform ensures an automated and user-friendly approach to assignment management that is well-organized. It will first of all initiate real-time validation, automated tracking of missed assignments, and intuitive student scheduling tools for coursework administration being

fair and transparent on assessment processes.

### Peer-Assessment System

The platform includes a structured peer-assessment mechanism that allows students to critically evaluate the work of others within pre-defined groups. It is set up to maintain fairness and accountability to ensure that all the participants complete their assessments before final grades are computed and displayed. Instructors retain oversight and intervention interfaces so that they can ensure the integrity of the assessment process.

### Peer-Assessment Workflow

The peer-assessment process starts with the orderly forming of students. When a task is set for peer appraisal, the system automatically puts students into groups of four, with every person in charge of checking the work of three peers. This set giving out helps a fair assessment process, making sure each student gets many evaluations.

Students provide qualitative feedback and assign a provisional score after reviewing the assigned submissions. Data integrity and prevention of bias are maintained by validation rules before storing the reviews in the database. This means that the assessments are to be recorded accurately according to some predefined criteria.

A review tracking is incorporated to ensure that the grading process remains fair. It monitors dynamically the status of completion of all assigned Peer Reviews within a Group. If their evaluations are not submitted by any student within the defined time, then final grading for that student is not submitted automatically; instead, the student receives a notification to complete the process.

### Final Grading and Teacher Oversight

Once all students in a group have completed their assigned peer evaluations, the system consolidates the assigned scores and calculates the final grade. These computed results are then stored within the database and made available for both students and instructors to review.

Teachers play not a less part in keeping up the trust of the peer-assessment way. They get all access to submitted reviews, so they can check on eval quality and step in if needed. If an eval is seen as not right, not accurate, or not the same, the teacher has the power to take over the given score and give a changed grade.

A part of the platform that is meant for keeping records among institutions and for easy management reporting is the grade extraction function. Teachers can easily export their final grades to an Excel file using the Excel package for Laravel. The exported file will have detailed information like student names, assignment

details, the scores their peers gave them, and the final grades computed; so it fits well with how the university grading systems work.

## 3.2 FrontEnd

CrossEval's frontend architecture uses a select mix of modern web techs that come stamped with success to ensure a reliable, scalable, and incredibly easy-to-use experience for the user. To ensure that the end-user interaction is as smooth and fast as possible, CrossEval is based on Next.js, a strong React framework known for its server-side rendering (SSR), along with automatic code splitting and throwing optimized performance to the mix. You can see the code of FrontEnd by this link:https://github.com/B1ssultanov/CrossEval/tree/main/frontend

For responsive design that looks good on all devices and screen sizes, we use TailwindCSS. It's a utility-first CSS framework that helps us prototype our user interfaces quickly and develop them even faster while also writing styles that are clear and easy to maintain. Shadcn parts, which give reusable, composable, and configurable React components, great improve component making and UI sameness. This way makes sure a sameness look and feel all over the app while also speeding up how fast it grows. The intense use of TypeScript makes the runtime errors less, improving the developer experience and making the type safety. Since it helps developers spot mistakes early on in the coding process, the static typing of TypeScript leads to better quality of code, easier debugging, and more effective teamwork.

CrossEval leverages Zod, a schema validation toolkit that is famous for its easy-to-use API and proper error handling to validate its data and enforce the schema on the client-side thoroughly. This interface ensures that the consistency of the data is maintained rigorously so as to avert certain issues that may be brought on by inaccurate or distorted submissions of data. Easily handle the state with the help of Redux Toolkit that comes with middleware for async logic out of the box and enforces best practices and store updates with much less code. Redux Toolkit provides an efficient way of dealing with complex application states, managing data flow and ensuring state transitions on the UI level. Communication with the backend API is seamlessly handled using Axios. a promise-based HTTP client that offers advanced features like request and response interceptors-automatic JSON parsing, and robust error handling. It, therefore, makes even easier the management of asynchronous data fetching data and in the process makes the frontend-back end integration even more reliable.

Together, these modern technologies help make CrossEval's front end into a web application that is fast, safe, and easy for the user. It does not just meet the needs for function now but also sets a strong base for the future when it comes to being able to scale, easy to keep up, and add features.

### 3.2.1 Authentication and User Management

CrossEval puts its major design considerations in usability, data integrity, and security over the mechanism for authenticating and managing users. The frontend is able to work seamlessly with a highly secure back-end system for authenticating users to make very easy and intuitional registrations as well as logins.

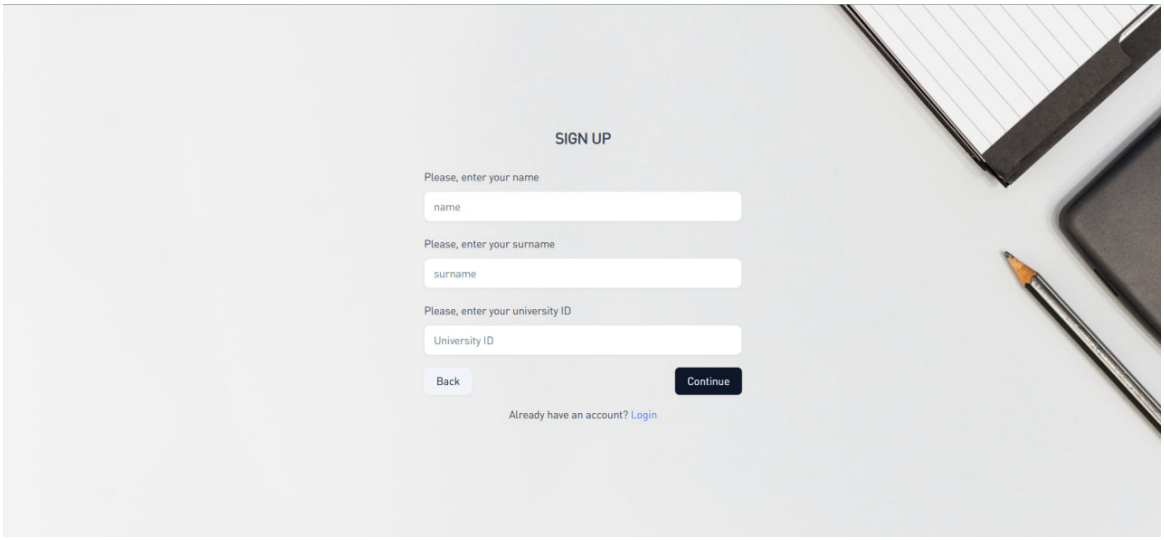


Figure 3.1: User Authentication Page in CrossEval Platform

**User Registration Interface**

- Form Submission and Validation: Creation of the registration form using Shadcn UI components for modern responsive design makes it work seamlessly. Validating logic is enforced through Zod schemas to check the structural and semantic meaning of input by the user before submission.
- Data Transmission: We used Axios to securely transmit validated data to the backend API endpoints over HTTPS, so the error messages from the backend would be gracefully intercepted and communicated to the user in a very friendly manner.
- Post-Registration Handling: Upon successful registration, users are able to be automatically redirected to their profile dashboard. This shall be a process that has keenly prioritized the aspect of user flow continuity as well as accuracy of data.

**User Login Interface**

- The login interface is made using shadcn and TailwindCSS to make sure it looks good and works well, and to make it easy to use, on any kind of device.

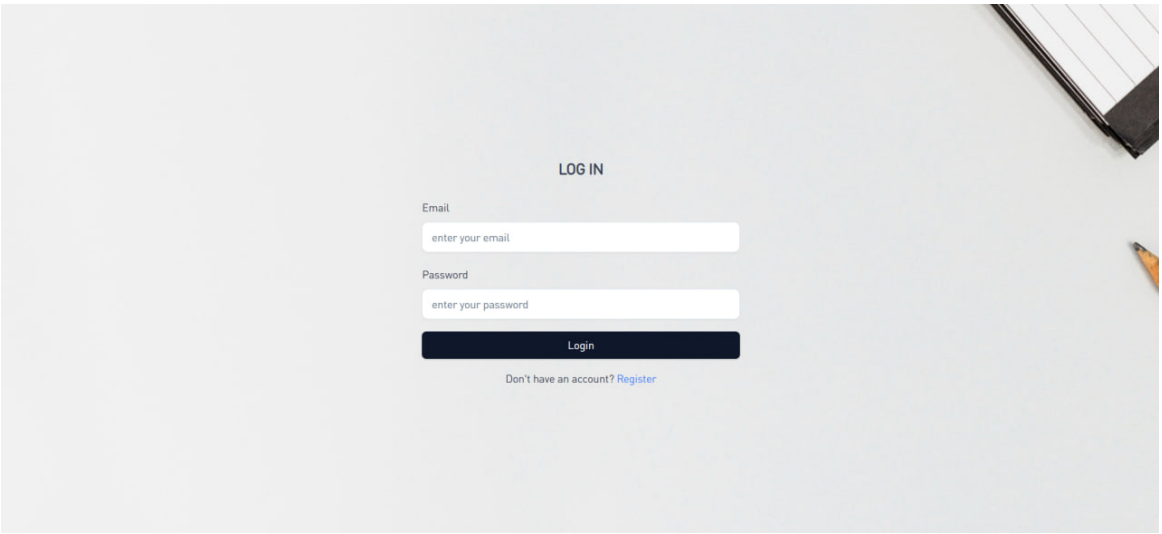


Figure 3.2: Login Page in CrossEval Platform

- Schemas from Zod validate login credentials on the client side, so we can know right away if it looks good or not, stopping invalid requests from reaching the backend.

  Session and State Management: User sessions are managed using Axios interceptors and Redux Toolkit for token storage and propagation across authenticated routes, which works best with Next.js applications since it integrates well with its context API to let session data survive between components and pages.

  Robust Error Handling: Clear contextual error messages manage incorrect login attempts. This is transparent to the user and in turn improves the security of the platform.

### 3.2.2 User Profile Management

The user profile management system in CrossEval supports personalized experiences aimed at two primary user roles and is student and instructor. It allows presenting data pertaining to the role and the features available by rendering dynamically and also securely integrating with backend services.

Once authenticated, the frontend uses Redux Toolkit and React's context API to determine the user's role and dynamically render the appropriate interface. The teacher should get tools for tracking student progress, managing coursework, and feedbacking. What the student should get is personal dashboards that show learning milestones, grades, and instructor evaluations.

All data fetching is done securely through Axios to role-specific back-end endpoints. Data structures are strongly typed by TypeScript interfaces, reducing runtime errors and ensuring consistency in the component's logic.

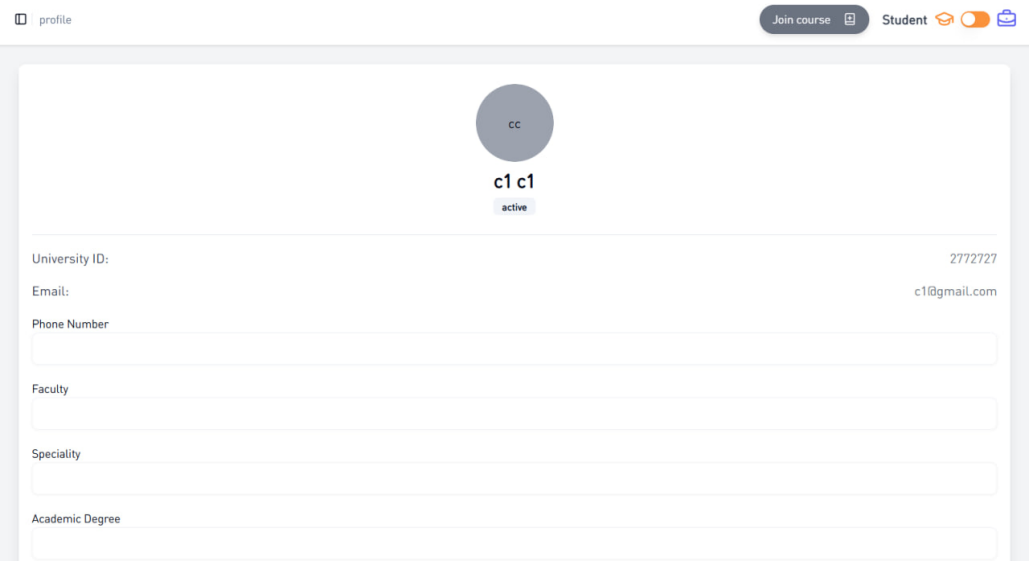


Figure 3.3: Profile Page in CrossEval Platform

Grade and feedback displays are made using a mix of shadcn UI components — tables, modals, tabbed views, etc., styled with TailwindCSS. This gives a pretty simple and clean interface that makes things much more usable and engaging.

This function-conscious design method allows a united and clear platform experience, making sure that users engage only with details and tasks linked to their part, leading to a more safe and targeted learning space.

### 3.2.3 Course Management

The frontend layer of CrossEval provides solid easy-to-use interfaces for course management which are designed to work efficiently for instructors and students.

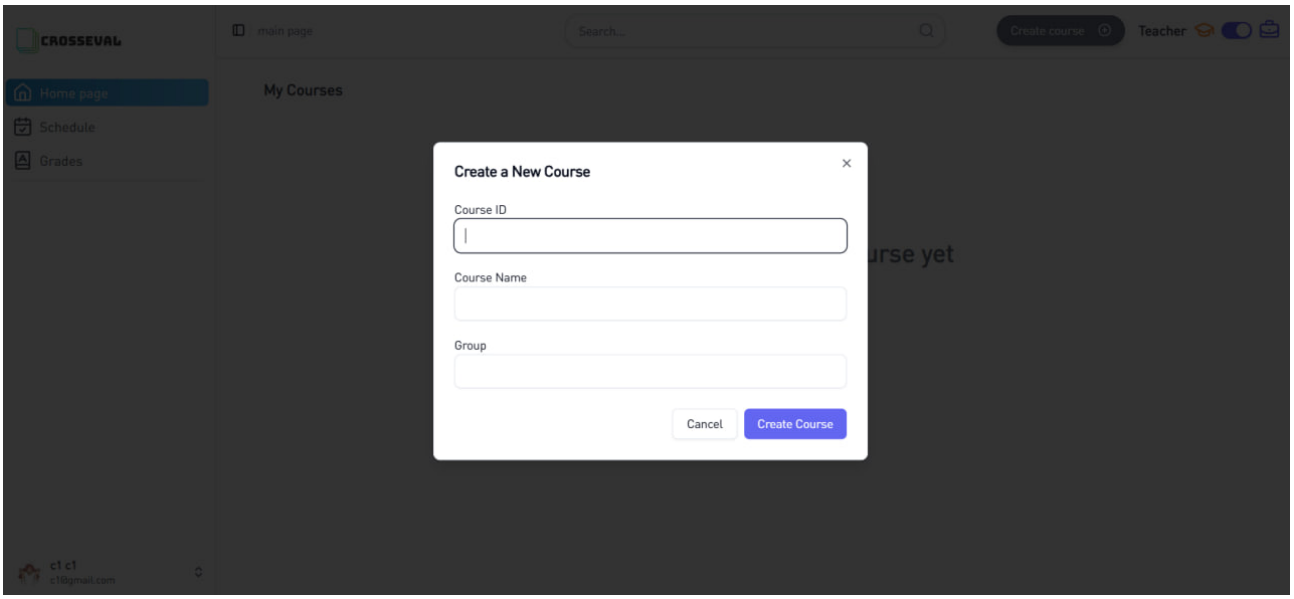


Figure 3.4: Course creation modal

A responsive and accessible course creation interface built using shadcn components delivers a coherent and stylish look on every platform. Validated with Zod schemas in real-time, so that users can get feedback instantly and correct errors before submission. Because Axios is easily integrated with the backend APIs, this includes all operations of storing course data, generating unique invitation codes, and handling response statuses. The editing capabilities will be dynamically limited to the set of allowed instructors based on the role the application indicates and only verified at the frontend to provide security.

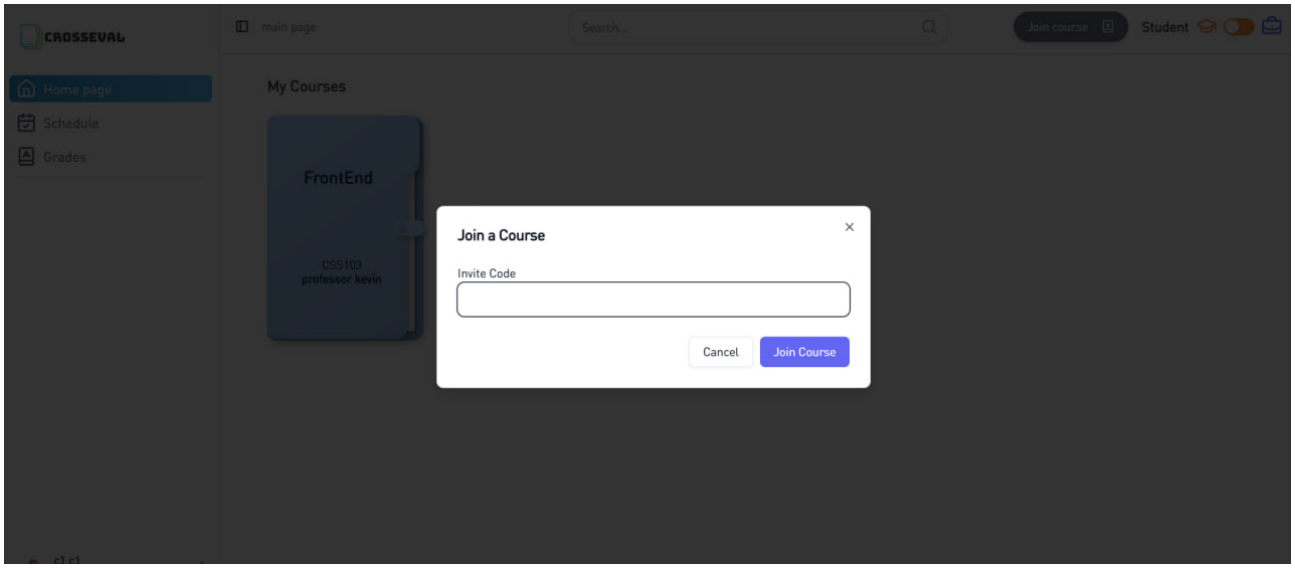


Figure 3.5: Student enrollment interface

The interface provides a simple input form for invitation codes for student enrollment. Instant validation is made from that input to make sure of its correctness and to prevent unnecessary requests. When the enrollment is successful, the course is added to the user's personal course list, and updated data is reflected on the dashboard without the need for a manual refresh. This fluid interaction is made agile by real-time state updates and UI rendering through shadcn components.

Management of the registered users is done via dynamic tables that fetch and show the lists of participants. These tables are searchable, sortable, and responsive giving a quick view of the users involved. Teachers can delete the participants securely through an API control, with the visual end immediately reflecting the dynamic changes. Access control is strictly enforced so as to make sure that only the instructors assigned to a course will be able to manage the participants.

It helps in a good way to manage the life of a course, helps make it easy to use through a design that works well on all devices, and helps stay safe by following what different users should do and look at.

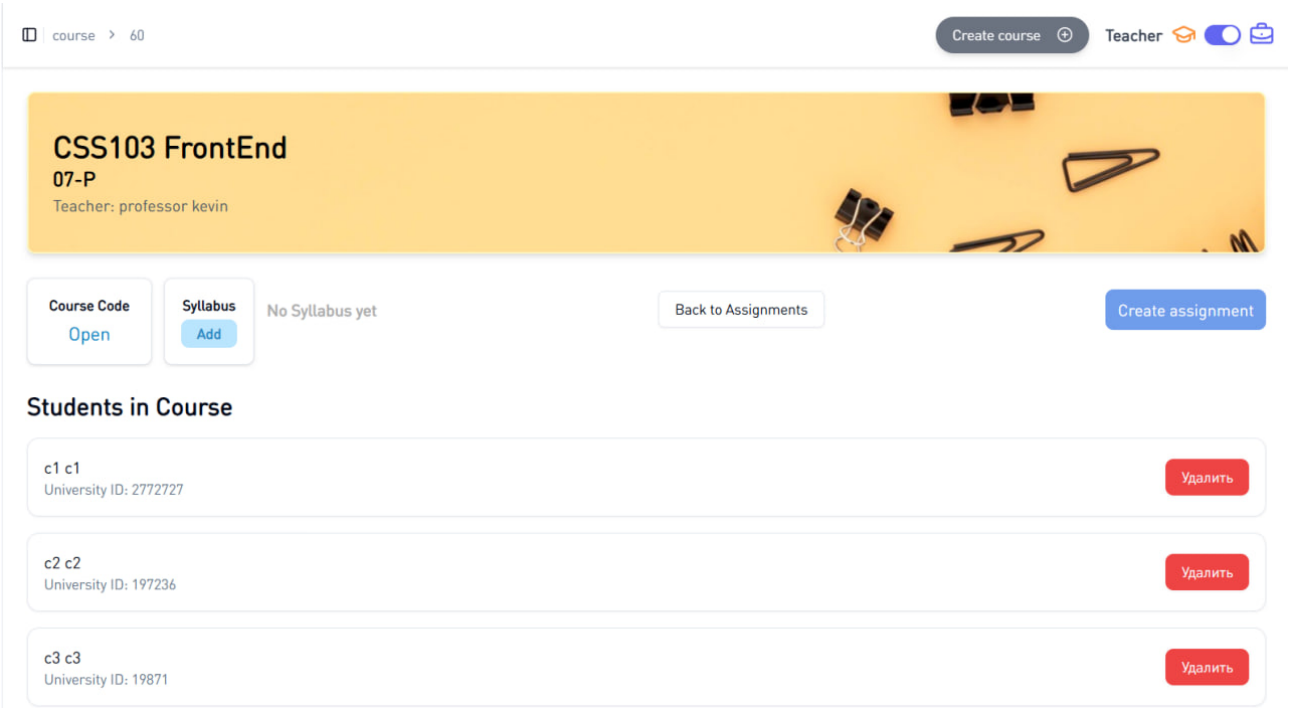


Figure 3.6: Student enrollment interface

### 3.2.4 Assignment Management

The task management system is meant to make easy the making, sight, and tracking of school work. The making interface is built using shadcn and TailwindCSS parts, offering a fitting and reachable layout for teachers. Checking is done in real time with Zod schemas, which force data integrity and cut the risk of form submission errors.

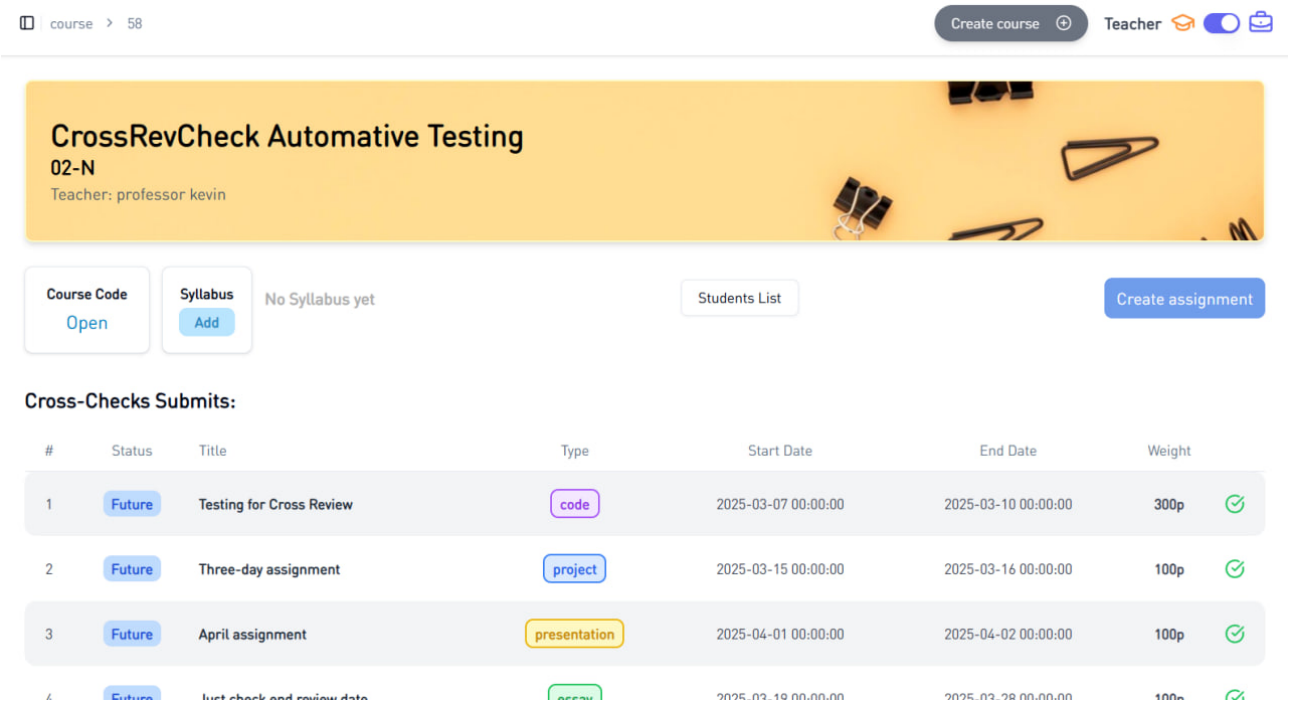


Figure 3.7: Assignments interface in CrossEval Platform

Once an assignment is scheduled, its visibility and status are dynamically managed and updated. The front end makes sure students are given information based on the assignment state such as "Future," "Available," "Done," or "Missed"—giving a clear timeline of task availability.

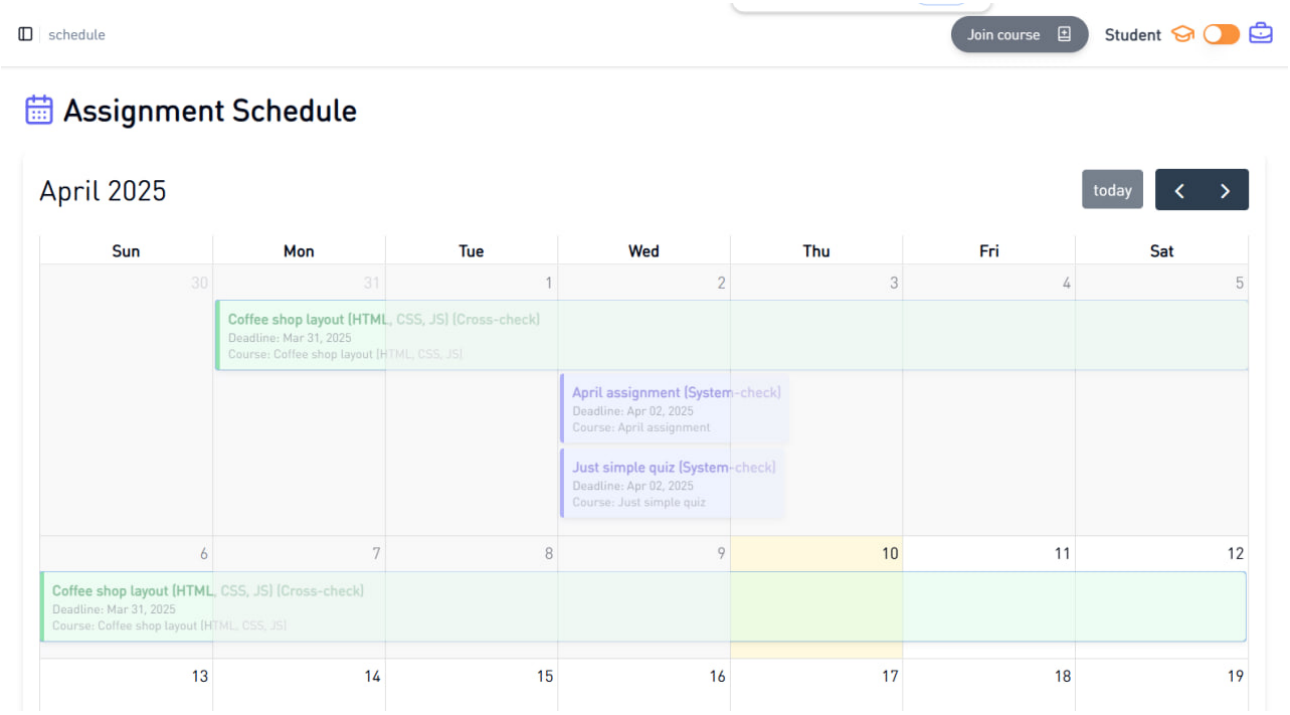


Figure 3.8: schedule page

Entries from Axios requests for future assignments are shown in a dynamic calendar view. It will be done in an interactive iFrame layout to enhance the look and feel of the page. Since the table is where the calendar is placed, the three nearest upcoming assignments will be highlighted right above it to make it easy for the students, increasing their awareness. The frontend will be kept in sync with the latest backends to reflect status updates in real time.

### 3.2.5 Peer-Assessment System

The peer-assessment system in CrossEval should enable rather a structured and transparent process of student work evaluation, while giving the students power and providing the teachers with proper tools for control. This frontend should support the workflow with carefully designed components that guide users through every step for review.

Students interact with the assessment system through dedicated submission and review interfaces. Clearly labeled accessible shadcn components make it possible for them to upload their assignments and to access peer submissions for evaluation, with the frontend enforcing validation rules through Zod schemas to ensure that feedback and provisional grades meet required standards.

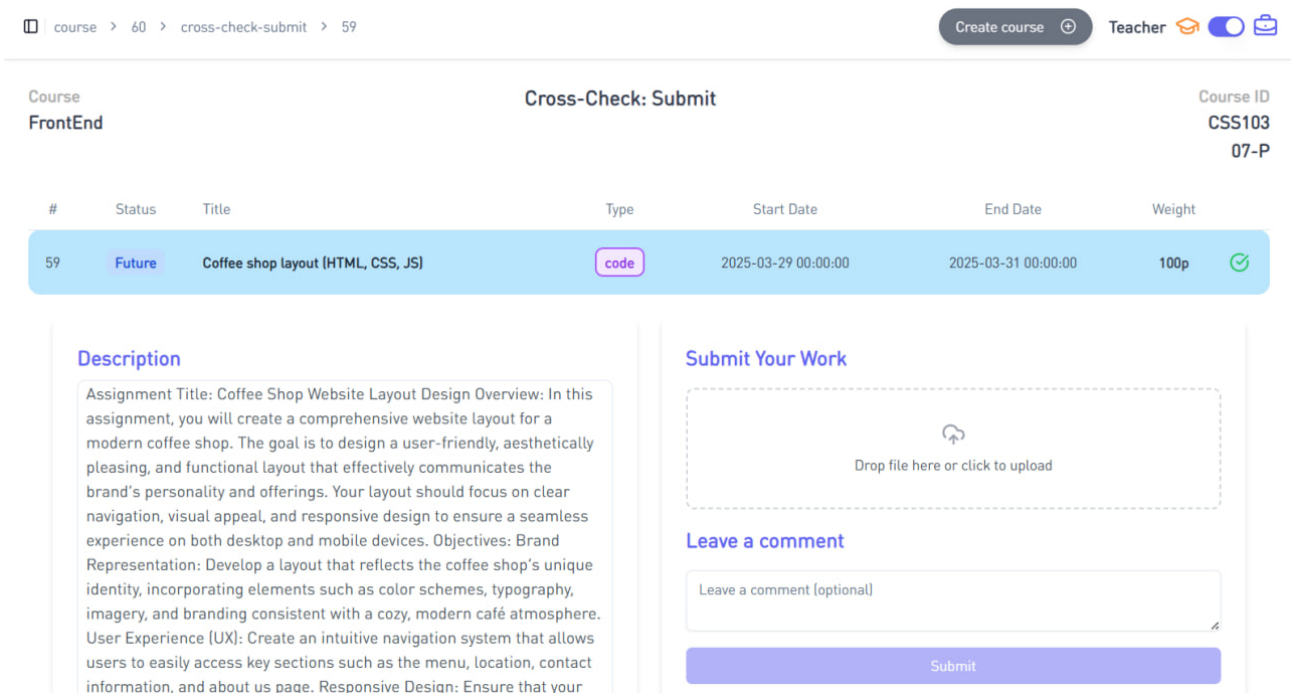


Figure 3.9: Cross-Check: Submit page

The real-time tracked and visually reflected completion statuses make the students immediately aware of their progress.

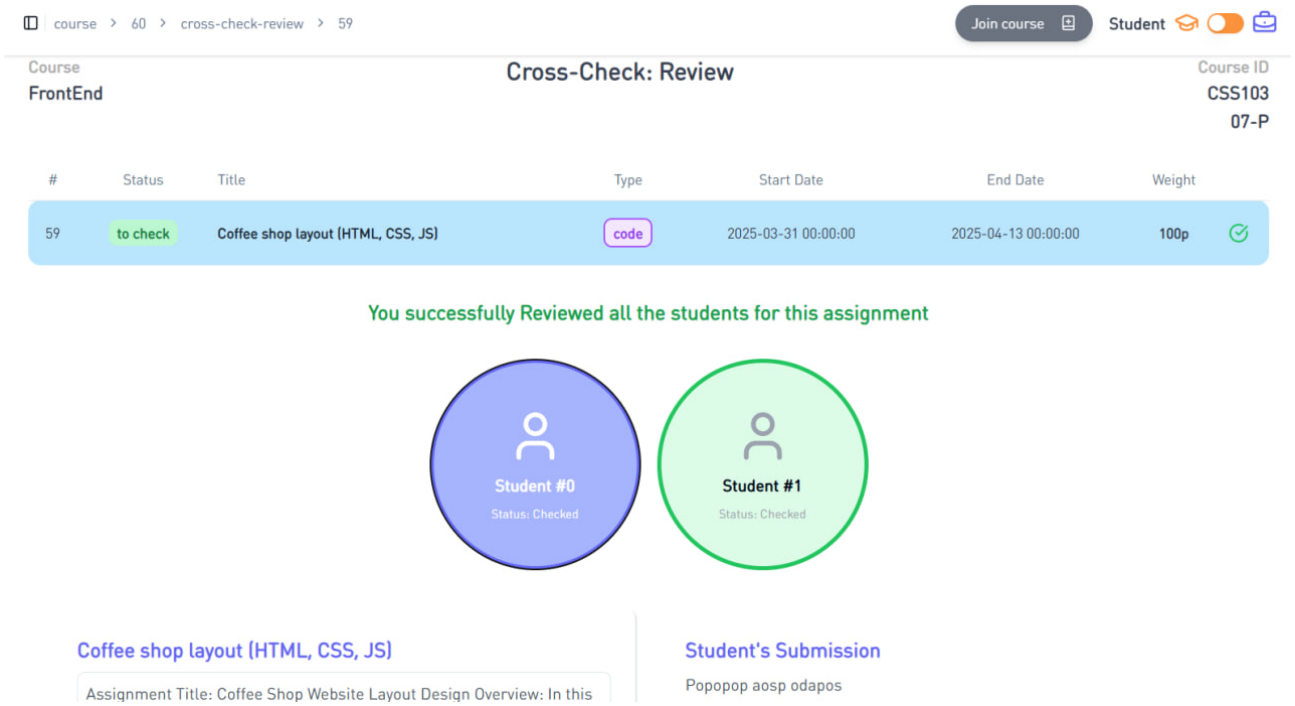


Figure 3.10: Cross-Check: Review page

Once the peer reviews have been completed, the backend collects the inputs and assessment weights to compute final grades. Results are retrieved dynamically under normal conditions and displayed on the Grades page with the help

of interactive tables, affording students an organized view of their performance. Teachers can manually inspect reviews and make adjustments or add grades or feedback if required. The adjustment interface is built on simple components to make navigation easy and intervention more efficient.

Also, the site offers a feature for teachers. Marks and comments can be gotten in an organized way by making Axios-powered API requests, easing data pull for admin or record needs. This joined plan makes sure that both students and teachers gain from a fair, quick, and easy-to-use peer review experience.

## 3.3 Containerized Deployment

The CrossEval platform is made with a boxed design using Docker to give easy setup, growth, and keep up. This way lets us join many services while keeping apart and using resources well. The plan has linked boxes, each doing one job to make a microservices-based setup.

**Network-Oriented Containerization:**

All services in the CrossEval platform communicate through a dedicated Docker network to ensure secure and efficient data exchange, which acts as a bridge enabling inter-container communication while preserving modularity.

**Reverse Proxy and Web Server Layer:**

The Nginx container acts as the main entry for processing HTTP requests. It acts as a reverse proxy directing the incoming traffic to the suitable backend services, there by enabling efficient request management as well as security, and load balancing when required. It also handles static assets and optimizes how responses work for frontend interactions.

**Database Management and Persistence:**

A specific MySQL container is used for controlling the platform's relational data storage. It works on its own with persistent storage done by mapping volumes—this way, data is kept safe from being lost whenever the container restarts. The database has a structured schema installed to manage user details, course files, tasks, and peer-assessment outcomes.

**Application Processing and Business Logic Execution:**

The backend of CrossEval gets powered by a PHP container that runs the Laravel application, acting as the core processing unit handling authentication, course

management, assignment processing, and peer assessment logic. It works dynamically with the database and may cache some data for it to optimize and be easily accessed by performing some frequent actions.

**Caching Mechanism for Optimized Performance:**

The backend of CrossEval runs a container Redis which runs the Laravel application dynamically acting as the core processing unit handling authentication, course management, assignment processing, and peer assessment logic. Data may cache some for it to optimize and be easily accessed by performing some frequent actions since it works dynamically with the database and may cache some data for it.

**Dependency Management and Development Environment Setup:**

Two more boxes, Composer and NPM, are added to handle needs well. Composer makes sure all Laravel wants are put in and updated as required. NPM helps front need control and setup, making sure UI parts work well with back logic.

**Task Scheduling and Command Execution:**

An Artisan container is included to carry out Laravel specific commands; such as migrations, and scheduled tasks- a one for each to make sure that the background tasks have to run separately without having to affect the main of the application flow.

**Email Handling for System Notifications:**

A MailHog container is used to enable email-based notifications. This is a test setup for email functionality where on a different tab, admins, and developers can check email communication without sending actual messages.

**Database Administration Interface:**

An Adminer container is available for database management and can execute queries. It is a simple web-based database management tool that can allow the administrators to direct view and manage data by executing own queries.

The CrossEval platform uses containerized environments for easy service management, as well as scalability and maintainability with no downtime to make the whole setup and achieved modularity within it. It now becomes much easier to scale, update, and roll out new instances without disturbing the already running system. The fast execution does not only enhance performance but also initiates an efficient resource utilization which leads to a strong and flexible learning management system.

# Chapter 4

# Results and Discussion

## 4.1 Technical Results

The CrossEval frontend was able to deliver a high-performing role-adaptive user-friendly interface to support the peer-to-peer assignment reviews. Major technical outcomes were:

Evolving role-based interface rendering via Redux Toolkit for razor-sharp UI adaptation for Students and Teachers. This includes conditional logic throughout components for making access to role-specific functionalities more usable and at the same time improving platform security

The tabbed peer assignments in a dynamic dashboard, updating based on backend API responses, would go a long way in improving the clarity of navigation and help the students better manage the tasks

Scores and qualitative feedback were submitted by the students through intuitive interfaces. The structured components of peer review interaction also involved submission from the students. Data integrity, regarding submission of the review, is enforced by Zod-based validation. Clarification of request outcomes, notifications and feedback modals makes the submission reviews much easier

Server-side rendering (SSR) using Next.js was implemented for review and listing pages. This approach positively impacted the time-to-interactive metric, as well as the first paint performance and allowed secure access control since now the server could perform authentication checks.

Redux Toolkit helps manage the state at scale by normalizing the state of the application, ensuring easy debugging with Redux DevTools and simplifying the management of complex data flow. It also allows for additional module support with the current architecture and minimal refactoring.

## 4.2 Student Feedback and Usability Evaluation

A structured pilot test with 40 undergraduate students was carried out to assess the usability of the platform. The students interacted with the CrossEval system

for a peer review cycle after which they submitted their feedback through a Likert-scale survey. Table 4.1 presents the results.

Table 4.1: Summary of Student Usability Feedback

| **Feedback Aspect** | **Average Rating (out of 5)** |
|---|---|
| Ease of Use | 4.7 |
| Performance | 4.6 |
| Review Process Clarity | 4.0 |
| Device Compatibility | 4.3 |
| Overall Satisfaction | 4.5 |

Students stressed the intuitiveness of the interface, especially the tabbed assignment dashboard is clear. Performance feedback is that they have seen very fast responses and low latency in interactions. Though a subset of users found that they could not comprehend the assessment rubric, onboarding tutorials and contextual tooltips could make it more clear, etc.

## 4.3 Comparative Survey on Traditional vs. CrossEval Assignments

A comparative analysis was conducted among 30 students and 10 instructors, comparing traditional workflows for assignments to those done by peer review using CrossEval's system. Table 4.2 summarizes the key differences observed.

Table 4.2: Comparative Survey Results

| **Aspect Evaluated** | **Traditional Method** | **CrossEval Platform** |
|---|---|---|
| Student Interest in Peer Work | 2.9 | 4.5 |
| Quality of Feedback | 3.2 | 4.4 |
| Student Engagement | 3.0 | 4.6 |
| Teacher Evaluation Time (hours/week) | 6 | 1.5 |
| Assessment Consistency | 3.3 | 4.2 |

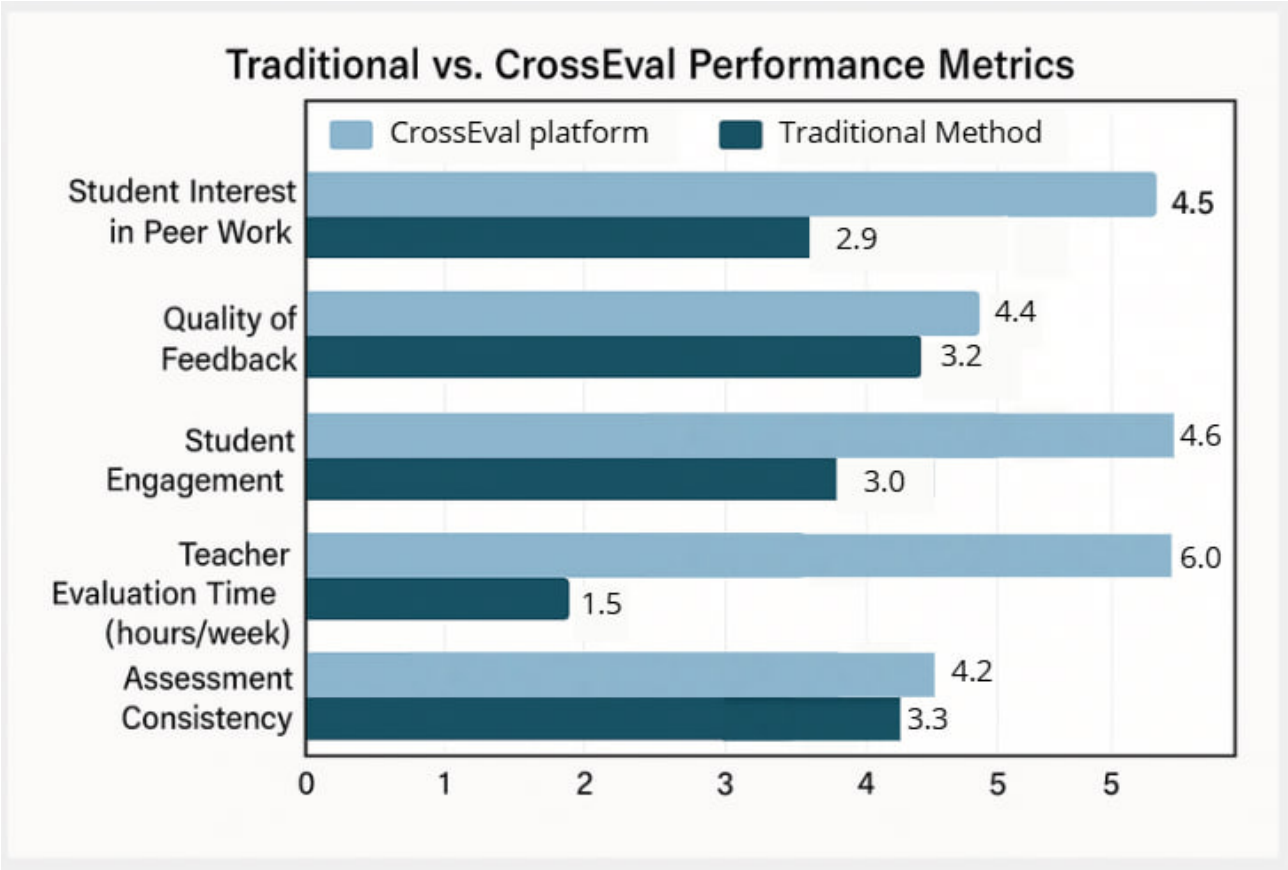


Figure 4.1: Traditional vs. CrossEval Performance Metrics

The data show that CrossEval increased student engagement and feedback quality while cutting teacher grading time by over 75%. Students prefer to review peer submissions and claim greater interest in the subject through collaborative evaluation.

# Chapter 5

# Conclusion

## 5.1 Conclusion

CrossEval appears as a full solution that joins modern edu research with new web tech to change peer review in college settings. By mixing a strong backend make in Laravel with a fancy, user-centric front run by Next.js, Redux Toolkit, TailwindCSS, and Zod, the site reshapes how students and teachers take part in the learning and grading cycle. This mix helps teachers move from doing dull, long marks to more useful, student-centered actions, while learners gain from steady, clear, and group made feedback.

Throughout its development, CrossEval addressed several core challenges that plague traditional assessment models. It alleviated the excessive administrative burden on instructors, enforced standardized grading practices, and provided an interactive environment where students actively participated in peer reviews, thus enhancing critical thinking and self-reflection. Pilot studies—supported by quantitative metrics on system performance and qualitative user feedback—validated the platform's ease of use, swift performance, and considerable efficacy in engaging students through structured, meaningful assignments.

Moreover, its capacity to serve diverse educational contexts including hybrid and remote learning formats. CrossEval can be deployed within containers, supported by microservices and automated orchestration available for the easy scalability of the platform's capabilities by any institution without sidelining reliability and performance. Better yet, it integrates with the existing Learning Management Systems so as to remove any traces of duplication regarding functionality, therefore making CrossEval a complete tool for a very wide set of academic disciplines.

### Future Vision and Development Prospects

The CrossEval has proved successful in increasing the reliability of the assessments and decreasing the work that the instructors have to do. The fact that the program is built up from small parts means that there is a long-term plan in place

for continuous improvement toward full implementation in the abovementioned pedagogical context. The planned advancement areas include:

- **Quality Assurance for AI:** Building intelligent models to identify grade inconsistencies, propose better rubrics, and automate some feedback tasks for a wide variety of courses.
- **Adaptive Learning and Evolution Analytics:** Extending current analytics capabilities to provide deep performance visibility, tailored advice, and early interventions for at-risk learners.
- **Gamified Elements:** Use trophies, badges, and competition to make the learners continue and perform in groups, making the whole learning experience more interesting.
- **More Access and Local Versions:** Add help for many languages, reading tools, and wider rules for access to fit all kinds of learners in university contexts around the world. Item: **Multi-Institutional Implementations:** Making it easier to use Single Sign-On (SSO)

The plans show CrossEval can stay in front with pedagogical change leading schools toward more data-based and fair assessment

## Broad Educational Impact

Besides technological efficacy, CrossEval starts a teaching change by focusing the student experience on positive feedback and peer interaction. Its cooperative spirit fits well with new educational styles that highlight active learning, reflective practice, and learner independence. With quick progress checking, detailed review rules, and instant peer-to-peer conversation, CrossEval raises learning from an individual effort to one done with others.

Instructors, in turn, gain the bandwidth to focus on higher-order mentoring and course refinement, thus enhancing academic outcomes. The collective feedback processes foster transparency and reduce subjectivity, ultimately leading to more robust, equitable evaluation frameworks that can evolve alongside institutional needs.

## Final Remarks

CrossEval, in turn, gives the instructors the capacity to concentrate on the higher-level aspects of mentoring and course development, which enhances academic results. The combined feedback develops openness and minimizes a certain degree of subjectivity, thus leading to more solid, fair evaluation criteria that could also develop with the needs of the institution. This, in turn, gives instructors more

time to concentrate on the more important aspects of mentoring and course development, thus improving academic results. The shared review processes promote openness and cut down on bias, leading to stronger, fairer assessment tools that can progress hand-in-hand with institutional needs.

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# Appendix A

# Landing Page

This appendix offers a concise overview of the CrossEval platform's landing page, emphasizing its function as the main entry point to the system and a vital interface for both new and returning users. The landing page serves as the first point of contact and reflects the platform's user experience strategy and educational philosophy in addition to being a navigational tool.

## A.1 Purpose of the Landing Page

The landing page is purposefully made to be both functioning and educational. It presents the main features of the platform, explains its advantages for both teachers and students, and offers clear access to the classroom. New users can quickly get oriented thanks to the page's layout, which facilitates simple, action-based navigation with little cognitive strain.

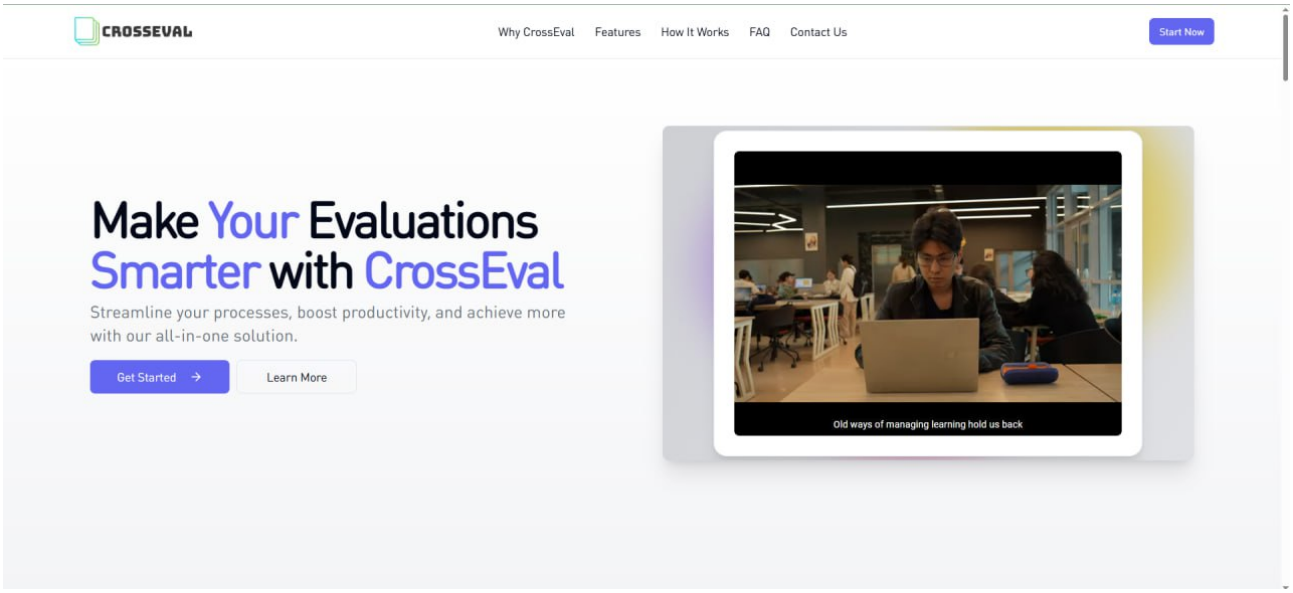


Figure A.1: First look of the landing page

**Visual Overview of Features:**

Interactive features and iconography draw attention to the platform's primary features (such as communication tools, assignment tracking, and content distribution), enhancing the system's applicability and usability.

**Call to Action (CTA):**

Well-placed CTA buttons (such as "Get Started," "Start Now," "Get Started Now," and "Learn More") offer clear instructions for registering or logging into the system, which lowers user conversion friction.

**Clear Value Messaging:**

The platform's primary goal of facilitating efficient and accessible teaching and learning is instantly conveyed by a succinct title and subheadline.

## A.2 Design Philosophy

The landing page's design is simple and focused on the user, with a foundation in digital pedagogy and cognitive psychology. It supports accessibility and readability with a simple layout that includes high contrast text, clear iconography, and uniform spacing. In order to ensure inclusivity and reach, the page is responsive and completely compatible with all devices.

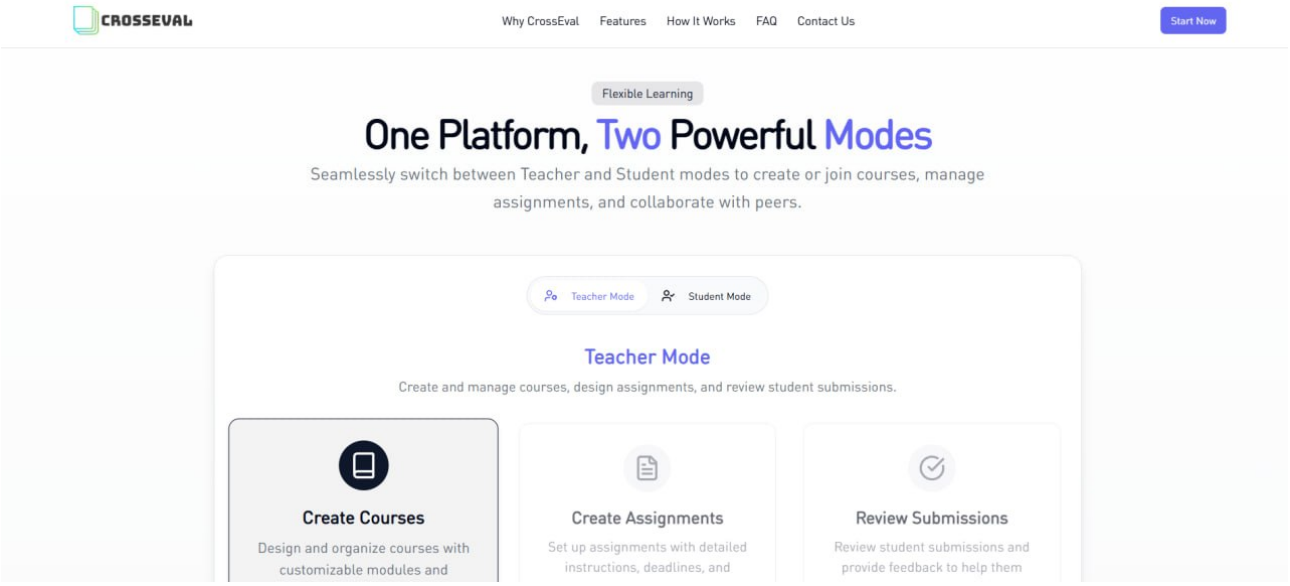


Figure A.2: About CrossEval section

## A.3 Educational Impact and Contextual Integration

Even if the landing page doesn't provide instructional content directly, it is crucial in determining how a user perceives the platform and how they interact with it. The landing page increases user retention, trust, and preparedness to study or teach in a digital setting by outlining the platform's advantages and making it easier to access its capabilities.

The landing page's function as a digital front door and an administrative communication channel can also be strengthened in institutional contexts by adapting it to convey academic calendars, policy updates, or customized messaging.

# Appendix B

# Feedback

**Nurbosyn Adlet**

So far everything seems official, with innovative design. There is some minimalism, which is good, all the drawings are high-quality. But the teacher's and student moments are similar, I think it is possible to confuse them, also, if you add something symbolic or something specific to the background, it would be better.

**Archynbek Yerkin**

Web app is convenient (user friendly but with minor bugs) I think not every user should become a teacher and it would be better to add language switch.

**Yasin Sabitov**

Excellent application with a convenient and intuitive interface. Also the design looks very modern. But it seems empty in places and it would be good if there was text filtering.

**Alikhan Sadykov**

The application is well-structured, it's easy to navigate in it, there is also the interesting part that you can switch from teacher and student sides. But maybe if there would be more small details it would be better. Simplicity just not my type.

**Nurdos Sarbalin**

Everything looks fine. I like the design, simple and good to the eye. Nothing superfluous. Assignments and courses, easy to create. And the grade export is a great feature!

**Yeldos Yerekenov**

As a Student I don't get the feature of the university_id in the beginning, but after I got it, it shows up the good idea. The target aimed platform to focus only on education is great. Also the Peer-assessment is awesome. Because you not only check others work, but also learn buy checking. Great work!