Feedback Focus: A Tool for Evaluating and Reflecting on Instructor to Student Feedback Communication

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Abstract

A critical challenge in education is enabling instructors to provide adaptive and constructive written feedback that supports life-long learning and enhances communication with learners. Effective feedback not only influences student engagement but also drives their learning progression. Currently, instructors provide feedback on assessments without tools to analyze or adapt their feedback practices in response to learner needs. Addressing this gap is essential to fostering a dynamic, adaptive, and supportive learning environment. This paper introduces Feedback Focus (FeeFo), a software tool designed to help educators adapt their feedback practices by offering actionable insights through advanced dashboards. FeeFo collects and analyzes written feedback, enabling instructors to identify trends and refine their communication strategies across courses, assessments, and individual learners. By empowering educators to visualize and track feedback effectiveness (e.g., through sentiment, emotions, and grades), FeeFo facilitates informed decision-making, fostering a cycle of continuous improvement in teaching practices. By supporting adaptive teaching methods, FeeFo enhances instructor-student interaction and fosters life-long learning for both educators and students. For instructors, FeeFo provides a pathway to continually refine their feedback practices, helping them develop the skills needed to craft more impactful and constructive feedback over time. For students, the tool encourages life-long learning by ensuring the feedback they receive is constructive in nature, fostering a sense of support and progress. By promoting meaningful, adaptive communication, FeeFo empowers educators to inspire persistence and growth in their students while also advancing their own professional development in delivering effective feedback.

Keywords

teaching analytics, teacher feedback, teacher dashboard, feedback analysis

1. Introduction

Providing students with constructive written feedback from instructors is a pivotal element in the educational process [5, 24], significantly impacting student engagement and their subsequent learning progression [16]. Beyond immediate performance improvement, feedback serves as a vital mechanism for fostering adaptive, life-long learning. Despite its importance, the current practice within educational institutions largely overlooks the analysis of such feedback, missing out on invaluable insights for instructors to improve the way they write such feedback. This lack of reflection on feedback practices restricts the ability of instructors to adapt their teaching methods effectively and undermines their capacity to foster constructive communication that supports life-long learning. Addressing this gap is crucial to enabling both students and instructors to thrive in an educational environment. As instructors continue to provide feedback for assessments, there is a shortfall in the feedback loop, as the communication between instructors and students is rarely analyzed or assessed. As such, there is a need to assist educators in refining their feedback process and reflecting on how their feedback have an impact on learners [18].

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To address this gap, the central focus of this research is on how to design an effective tool that can collect, analyze, and visualize the communication that occurs within instructor feedback data, based on the experiences and recommendations from literature. As a result, this paper introduces the intelligent software tool Feedback Focus (FeeFo) which is suitable for use at all instructional levels but is anticipated to be especially beneficial for secondary and post-secondary courses in online and blended delivery. By helping educators adapt their communication strategies and feedback practices through longitudinal analysis, FeeFo promotes a culture of continuous professional development for instructors and sustained engagement for students. FeeFo allows educators to import feedback and performance data from well-known learning management systems (i.e., Moodle and Blackboard). To analyze the data, FeeFo uses quantitative and qualitative (sentiment and emotion) analysis techniques and then visualizes the data through three main dashboards, providing an overview of instructor derived feedback communication at the course, assessment, and student level across longitudinal periods. FeeFo detects and quantifies specific aspects such as emotional tone, sentiment patterns, and the volume of feedback. The tool integrates this analysis with student performance data over time, providing dashboards to visualize the relationship between instructor feedback and its effects on student learning outcomes.

This tool empowers instructors to craft feedback that is constructive and adaptive, ensuring it remains supportive rather than overly critical. By making instructors aware of how their feedback may be perceived, where they dedicate most of their time in writing feedback, and how their feedback affects learners, instructors can gain valuable insights for improving their feedback practices. This tool not only assists educators in refining their communication through feedback but also fosters a supportive learning environment where students are encouraged to persist and thrive, embracing challenges as part of their life-long learning journey. In addition, such insights can also provide information on problems within the course (e.g., an assessment that requires much more feedback than others) and could point out opportunities for improvement in the course designs.

This research intersects in the fields of Learning Analytics, Intelligent Systems, Teaching Analytics, and Learning Design, pushing beyond the traditional boundaries of learning analytics that primarily focus on student data [9, 22]. Putting an emphasis on teaching analytics and the effective use of machine learning techniques help provide instructors with insights into their feedback practices, identifying where they may need to adapt their communication strategies to ensure students are encouraged to continue their education and not become discouraged.

The paper is structured as follows: Section 2 outlines related literature. Section 3 describes the main features of the proposed tool with an emphasis on the functionality of the end user dashboards, the primary analysis techniques that are used to provide insight into feedback, and how those dashboards can be utilized. Section 4 describes the architecture of the software tool and the technical details including which components are in place to make the software tool function. Finally, in Section 5 we conclude the paper and discuss the directions for future research.

2. Literature Review

Assessment feedback data exists in most courses and is the written words that an instructor writes to the student regarding the assessment that has been completed throughout the course usually associated with a mark on the assessment. Many research articles consider such feedback to be an important aspect of education and that such feedback can either positively or negatively influence a student's learning experience as well as their outcome [8, 12, 14, 24]. For example, Henderson and colleagues found "students to prefer comments that were framed positively and focused on good aspects of the students' performance" [8], reinforcing that the tone of feedback is important.

Just as feedback from educators to students is important for learning [26], feedback for educators is equally important for the self-improvement of educators and their teaching practices [12, 21]. When educators receive feedback about their teaching practice they can use this

information for reflection and to adapt their feedback practices [4, 19]. Course evaluations are often the only way that educators receive feedback regarding their teaching methods. However, the feedback that is provided by students in course evaluations about their educator are often biased [23], often the feedback is overly negative [4], and it typically does not go into detail on the way an educator writes their feedback to students. In most cases educators strive to improve their teaching practice, but without feedback on their written feedback to students it can be difficult to reflect on and improve this important skill. Presenting educators with information on how they provide feedback to students would give those educators insight into their process and areas for potential improvement.

When it comes to analyzing feedback data, most of the research in the area focuses on the analysis of student generated feedback data about the course and/or the educator [7, 15, 23]. Data mining techniques such as text mining and summarization have been applied to student feedback to help quantify data in student responses [3]. Sentiment analysis has been used extensively to quantify the responses students provide in feedback [3, 20, 25]. Shaik et al. highlighted that natural language processing (NLP) in the form of chat bots could be used to gather and analyze student feedback and point out chapters of a course that could benefit from revision [20]. Okoye et al. used emotion detection on student surveys to predict whether or not they would recommend the instructor's course after they had completed the course [15]. Feature extraction has also been used to evaluate student opinions in feedback at the course, program and university level, providing important insights into teaching and curriculum [20].

While there is less research on analyzing feedback from educators compared to feedback from students, findings suggest that such feedback can have a significant impact on student performance [5, 15]. Data mining and NLP techniques have been successfully used to provide valuable insights into student-generated feedback [3, 15, 20]. However, using such techniques for educator-generated feedback, for example, to understand whether the feedback educators provide is positive or negative and how it impacts learners, is equally critical for enhancing teaching strategies [2, 13]. Nicoll, Douglas and Brinton developed a method that uses NLP to analyze feedback given to students and correlate it with changes in student grades [18]. Their research found a high level of correlation between the way that feedback was constructed and future student performance, the most critical feature being the inclusion of the student's name at the beginning of the assessment feedback [18]. The researchers also mention that very little work has been done to provide educators with tools to help evaluate and craft effective feedback for students [18]. In addition, Lin et al. used NLP techniques on the feedback given by the instructor on the first assessment to extract features in feedback text that lead to both increased and decreased performance in the second assessment [10]. Furthermore, based on their findings, related research by Dawson et al. highlights the need for a tool that can not only look at feedback for a single assessment, but also collect the data over longer periods of time such as an entire program [5].

Rubie noted that negative feedback should be delivered in a manner that engages and energizes the recipient, otherwise, it may not be perceived as constructive or seen as an opportunity for growth [17]. Similarly, in their review of the literature, Mercer and Gulseren identified research demonstrating that constructive criticism, characterized by a considerate tone, can be effectively used as a form of negative feedback to promote improvement [13]. However, they note that negative feedback can also sometimes lead to unintended consequences [13]. While there are instances where negative feedback can benefit learners, it can also have adverse effects that vary from one learner to another [13, 17]. Further research by Câmpean et al. reinforces the fact that positive feedback has a profound effect on student motivation and that educators overwhelmingly agree that providing positive feedback is an extremely important aspect of education [2]. To improve the way in which educators write feedback to learners they need to receive feedback on the words they write to learners so they can reflect on how the feedback is perceived, improve their feedback writing skills and as such adapt the way in which they provide feedback to learners. Integrating insights about the nature of positive and negative feedback into analysis tools would not only help educators reflect on their practices [2] but could guide the development of future

software that offers a holistic view of their feedback's influence. However, to the best of our knowledge, no tool exists that analyzes and visualizes feedback data from educators to allow them to learn more about their feedback practices, reflect on how they provide feedback to students and better understand potential shortcomings in their course designs.

3. TOOL FEATURES

The next subsections describe in detail the three main dashboards of the FeeFo tool, as well as how they can benefit educators and support them in reflecting on their feedback practices at the course, assessment, and individual student levels. The tool has been designed for educators at any level of education. However, we see the tool being most effective in an online or blended learning context at the secondary and post-secondary levels.

Each dashboard in FeeFo shows results and visualizations that were found to be useful and recommended by literature. For the visualizations that present the sentiment and emotion of feedback, the overall sentiment and emotion data has been produced by existing machine learning models that have been trained and verified [1, 6, 11].

3.1. Course Dashboard

The course dashboard allows educators to look at all collected instructor-to-student feedback data from the course level, which includes all assessments such as assignments, quizzes, exams, etc. The course dashboard is geared toward the summarization of the collected data by course. Data can be filtered by year, semester, and course as viewed at the top of Figure 1, allowing educators to extract insight from their feedback data at specific timeframes and courses. Each filter option allows the selection of one or more courses, years, or semesters.

At the top of Figure 1, just below the filter, there are four cards that show a summary of the data that is being inspected as follows:

- **“Total Feedback Items”** card tallies all feedback items/comments written by the instructor. The “More info” link reveals a data table with individual feedback items.
- **“Average Words in Feedback”** card shows the mean word count per feedback item. The “More info” link shows detailed word count analytics.
- **“Min/Max Words in Feedback”** card indicates the range of word counts in feedback. The “More info” link provides a detailed breakdown by course.
- **“Total Courses”** card counts the courses in the dataset. The “More info” link leads to a detailed course list.

Within the dashboard six visualizations are provided to help the educator better understand the processed data:

- **“Overall Course Emotion”** shows the aggregation of all emotion in the selected courses.
- **“Course Emotion”** breaks down the emotion observed in feedback from each course that is selected.
- **“Course Sentiment”** shows the sentiment of feedback in each selected course.
- **“Course Grade Distribution”** shows student marks in all selected courses grouped into ranges.
- **“Average Grade in Course”** shows every selected course and what the average grade of all assessments was in each year.
- **“Average Words in Course Feedback”** lets the educator see how many words they typically write to each student on average in each selected course.

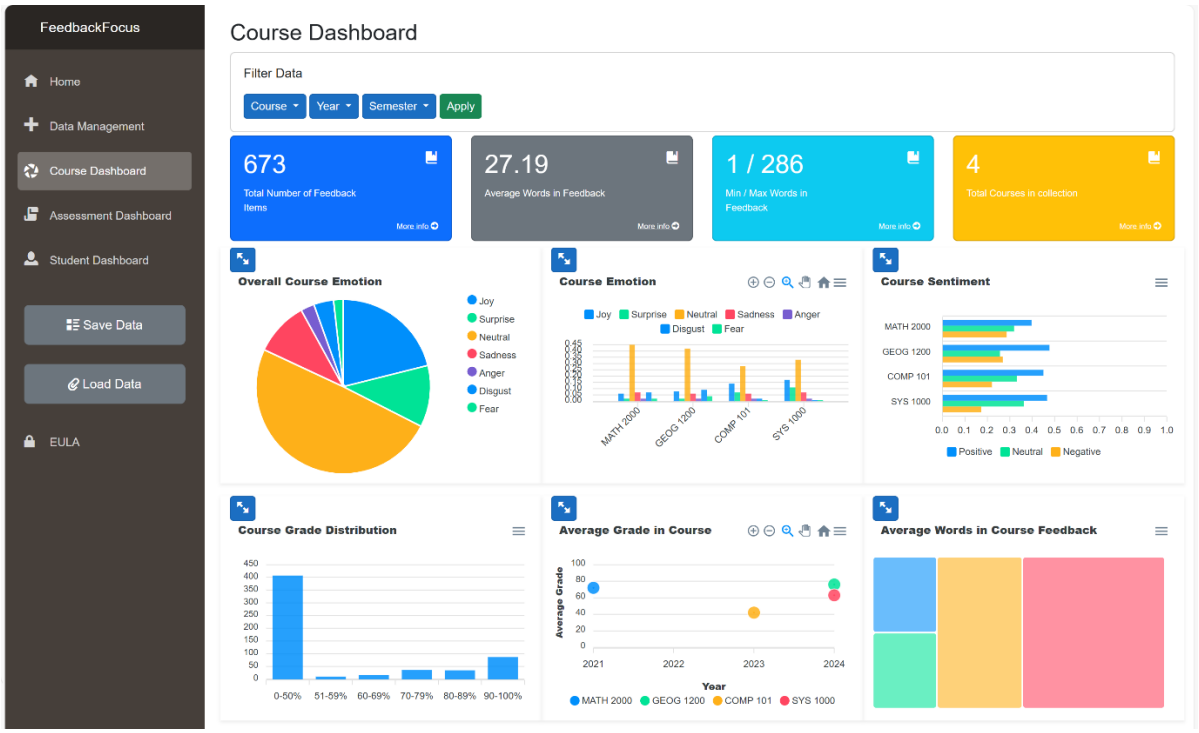

Figure 1: Course Dashboard (using simulated data)

The Course Dashboard is a powerful visualization instrument that can help educators identify how their feedback is being perceived as well as how much feedback is written in each course. Looking at the overall sentiment and emotion aids the instructor in being mindful of how positive or negative their writing is, or at least how it may be perceived. Keeping track of the average amount of words in feedback gives an idea of how much time is spent marking assessments in the courses. Keeping track of the grades overall and over several time periods may prompt the instructor to reflect on the attainment of course objectives or the difficulty of each course.

3.2. Assessment Dashboard

The Assessment Dashboard allows educators to investigate more specific data related to their feedback and student outcomes at the assessment level. Educators can again filter by course, semester and year, but additionally they can also filter by assessment name. Each filter option allows again the selection of one or more courses, years, semesters, or assessments.

As seen in Figure 2, the assessment dashboard provides the following cards to summarize the data that is active in the dashboard:

- **"Total Words in Assessment Feedback"** card sums up the words in all feedback items for the chosen assessments. In addition, it provides information on how many feedback items are analyzed. The "More info" link leads to the raw feedback items for review.
- **"Most Prevalent Emotion in Feedback"** card highlights the dominant emotion in the feedback from the selected assessments. The "More info" link leads to the emotion analysis for each feedback item.
- **"Feedback Length Comparison"** card evaluates if the feedback length for the selected assessments is below, at, or above the average compared to all data. The "More info" link shows how the length of feedback in each assessment compares to the average length of feedback across all assessments.

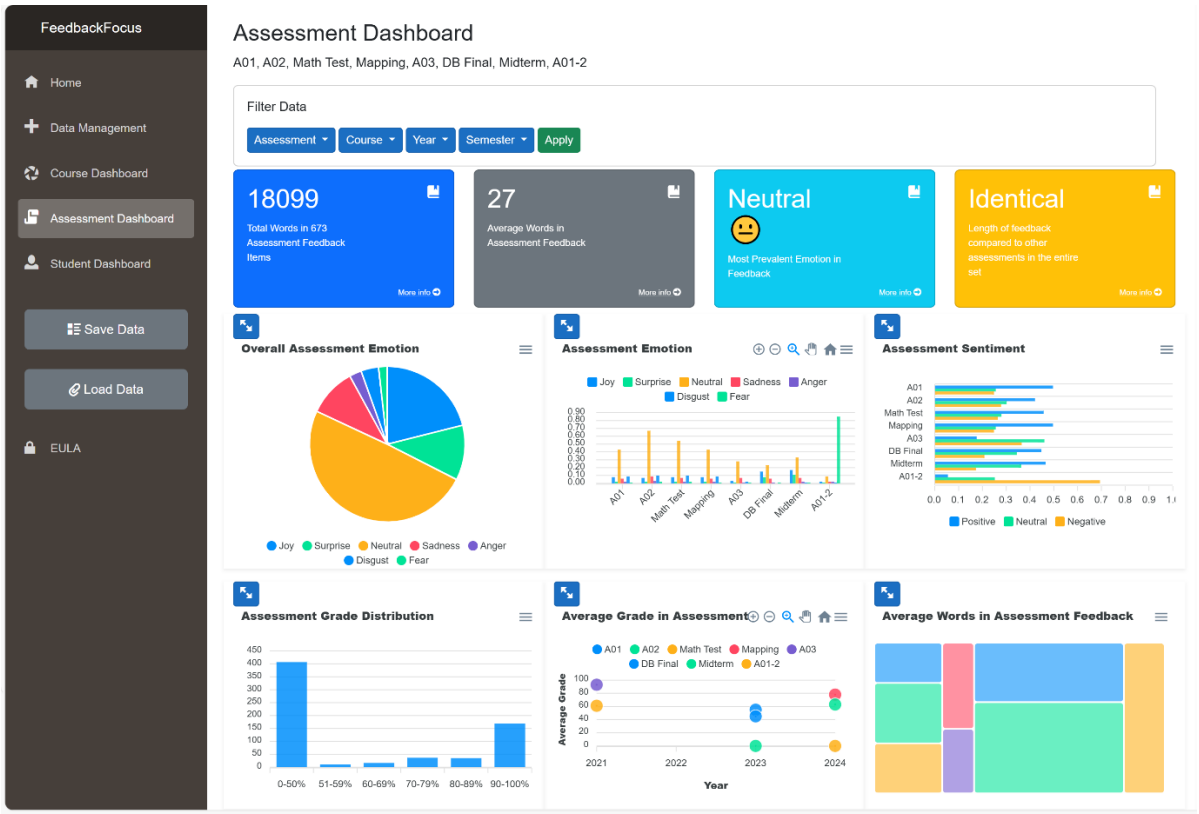

Figure 2: Assessment Dashboard (using simulated data)

The following six charts are presented in the Assessment Dashboard (as shown in Figure 2), focusing on providing an overview of the feedback and grade data with respect to the selected assessments:

- **"Overall Assessment Emotion"** shows the aggregation of emotion across all selected assessments.
- **"Assessment Emotion"** breaks down individually the amount of each emotion for the selected assessments.
- **"Assessment Sentiment"** showing the positivity and negativity detected within the feedback of each selected assessment.
- **"Assessment Grade Distribution"** visualizes how students performed on the selected assessments.
- **"Average Grade on Assessment"** shows how students performed on average in each selected assessment per year.
- **"Average Words in Assessment Feedback"** shows the number of words that have been written on average for each selected assessment, allowing a quick comparison between assessments.

The visualizations at the assessment level let the educator investigate detailed data regarding emotion and sentiment at the assessment level. Assessments that show overly negative emotions and sentiment may be an area where the instructor wishes to investigate why the feedback exhibits those issues. Further, allowing the instructor to zero in on assessment data allows them to investigate specific assessments that students consistently perform poorly on or where educators give more feedback than the usual amount found in other assessments.

3.3. Student Dashboard

This dashboard puts the emphasis on student specific data, allowing educators to choose a selection of one or multiple students that have feedback data available. In addition, the dashboard enables the user to filter based on one or more years, semesters and courses. With this dashboard, instructor can investigate the learning outcomes of their students and how they have interacted with those students through feedback.

As seen in Figure 3 the student dashboard provides the following cards to summarize the data in the dashboard:

- **"Number of Students"** shows a number of students selected and being analyzed in the dashboard. The "More info" link leads to the raw feedback entries for those students.
- **"Number of Courses"** card displays the distinct number of courses in the dashboard for selected students. The "More info" link displays a more detailed list of the courses.
- **"Total Words in Feedback"** card shows the total number of words in all feedback items for selected students. "More info" link shows the educator a detailed summary of each student and the number of words in each of their feedback items.
- **"Average Sentiment Score"** card shows the average sentiment score for all selected students and their associated feedback items. More concretely, the percentage score for positive, neutral and negative sentiment in the feedback items is displayed. The "More info" link goes to a summary page with sentiment for each feedback item grouped by student and assessment.

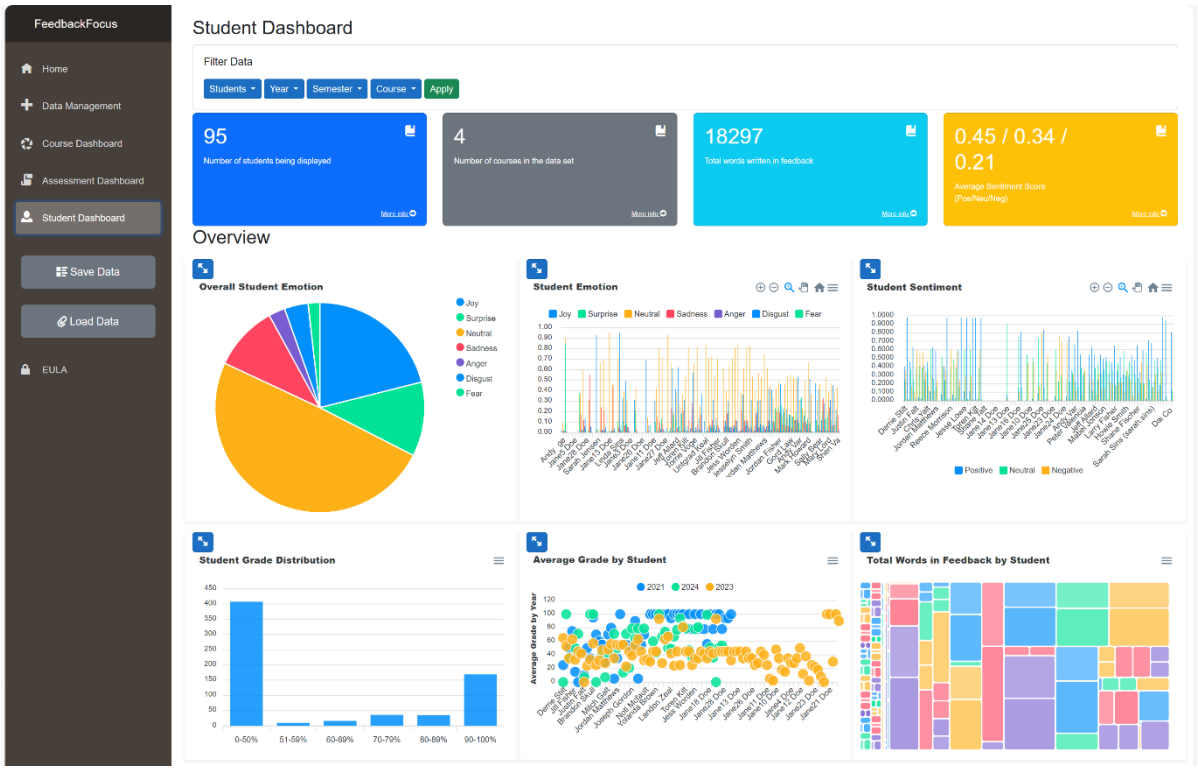

Figure 3: Student Dashboard (using simulated data)

The student dashboard also includes the following six charts:

- **"Overall Student Emotion"** shows the aggregation of emotion across the feedback items of all selected students.
- **"Student Emotion"** breaks down the individual emotions for the selected students.

- **“Student Sentiment”** shows the positivity and negativity detected within the feedback for each individual student who has been selected.
- **“Student Grade Distribution”** visualizes how selected students performed on all assessments.
- **“Average Grade by Student”** shows the average grade on how selected students performed overall on all assessments per study year.
- **“Total Words in Feedback by Student”** shows the number of words that have been written for each selected student.

The Student Dashboard provides a granular view of the feedback and performance of individual students. This feature enables educators to monitor how much feedback each student receives, how they are doing in their assessments and track the sentiment and emotional tone of feedback comments.

Analyzing the feedback per student helps instructors identify patterns in how students of varying performance levels are receiving and perceiving feedback. Additionally, tracking the grades and progress of each student can assist in identifying students who may need extra support or those who consistently excel, thereby helping to tailor teaching strategies to the needs of individual learners.

4. Architecture

The overall architecture of FeeFo is shown in Figure 4. FeeFo is built using C# in the .NET ecosystem utilizing a single page application framework called Blazor and is designed to run in the browser as a progressive web application. As a progressive application, once the user browses to the tool’s URL, they are presented with an optional install button in the address bar for offline use. Whether used online or offline, no user registration is required because the application is designed to run in a stateless manner on the client’s device. The application continues to work even when the user does not have an internet connection. The only limitation is that new sentiment and emotion analyses cannot be conducted but previously analyzed data can still be loaded and visualized.

Designing the tool as stand-alone tool instead of a plugin within a learning management system (LMS) has the advantage that instructors can immediately use it once they have data they want to analyze, rather than having to go through lengthy institutional approval processes to get a plugin integrated into the institutional LMS.

To streamline the data transfer between FeeFo and the LMS, FeeFo offers an easy import feature. Essential data such as student identifier, names, grades, and written feedback can be exported from an LMS (e.g., Moodle or Blackboard) using the "Work Offline" feature. This data can then be seamlessly imported into a pre-configured course assessment in FeeFo. In addition, a manual data entry feature is available to manually enter or revise relevant data.

The application is designed with a focus on security and privacy since sensitive data (i.e., student names, student identifier, feedback data, and grades) are stored. As such, the application stores all sensitive information entirely on the user’s device instead of hosting the data on an external database server. The only data that leaves the device is the written feedback which is sent in anonymous form to an external API for sentiment and emotion analysis.

To run the machine learning algorithms for sentiment and emotion analysis, the external API connects to machine learning models hosted on hugging face [1, 6, 11]. This allows the user to browse the application and immediately gain access to the machine learning models without having to register for any services.

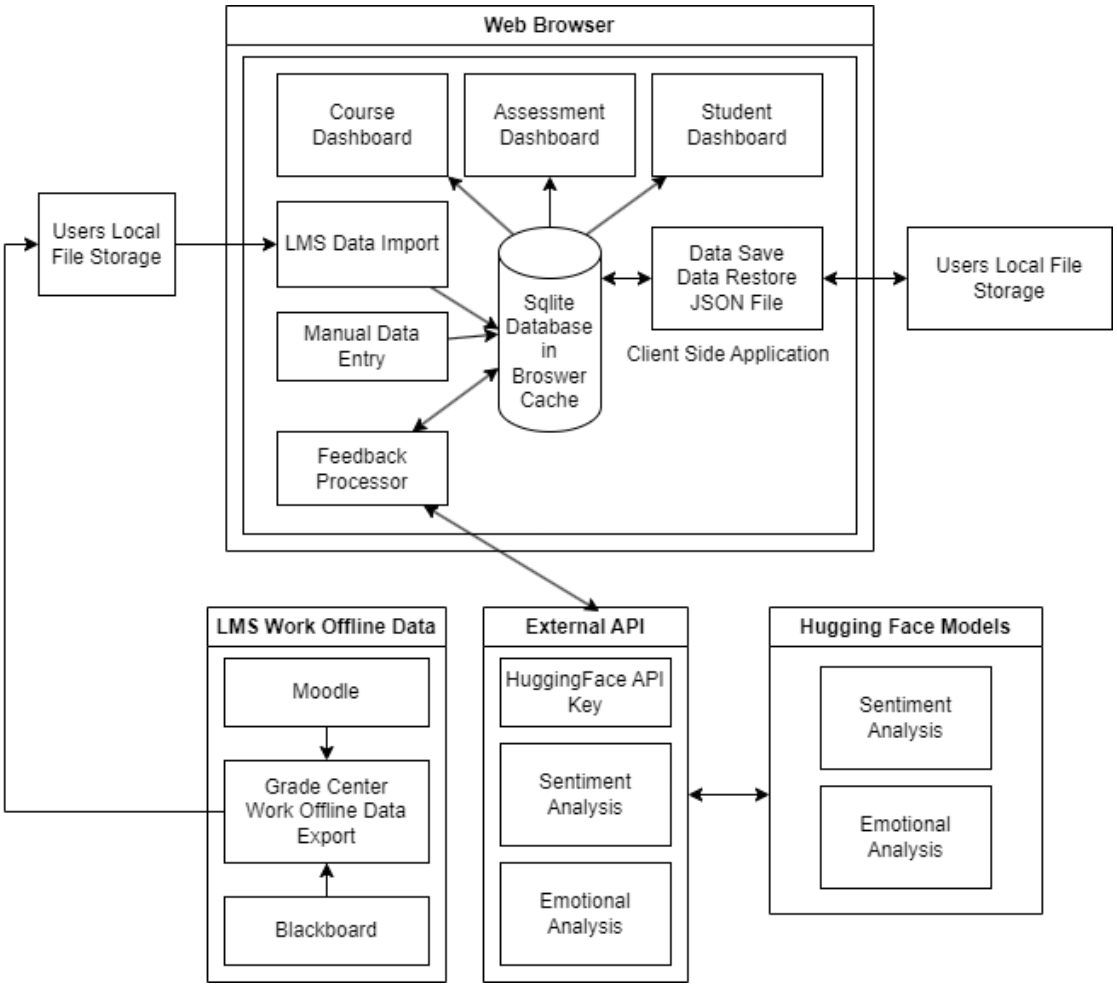

Figure 4: FeeFo Architecture Overview

FeeFo uses a Sqlite database that runs completely in the browser and is set up automatically when the application is accessed. To connect to the database, an object relational mapper (ORM) called Entity Framework (EF) is in place. Using EF allows the entire codebase to rely on objects that can be easily extended or modified by developers who wish to clone and modify the source code.

To facilitate an app that runs locally FeeFo utilizes the WebAssembly environment keeping the entire application inside modern browsers such as Chrome and Firefox. The underlying Sqlite database is a local file database that remains in the browser cache keeping all data stored locally.

Since all data are initially stored only in the browser cache, FeeFo has a function that allows users to store data locally as backup file and then restore them again in case the browser cache was emptied. Making the user save the data in this way ensures sensitive student data remains private and is never uploaded to a third party for storage.

5. Conclusion

This paper introduces FeeFo, a teaching analytics tool for collecting, analyzing and visualizing instructor-to-student feedback data. FeeFo supports instructors in crafting feedback that is both constructive and adaptive, empowering them to foster more effective communication with learners. The analytics tool presents the instructor with three main dashboards that they can use to investigate feedback data and student grades at course level, assessment level and student level. Using data aggregation and machine learning techniques, the dashboards show different types of information such as emotion and sentiment detected in the feedback sent to students, student overall grades, average student grades per course, assessment or student, and average word count of feedback items.

Traditionally, instructors receive feedback on their performance primarily through student evaluations conducted at the end of a course. However, these evaluations rarely provide insights into the quality or impact of the feedback instructors give to students, limiting opportunities to improve and adapt their teaching practices. FeeFo addresses this gap by enabling instructors to analyze their feedback practices using visualizations that encourage reflection and self-improvement. As such, FeeFo enables educators to adapt their teaching practices to provide more constructive feedback that better supports students. While models trained on data from social media come with limitations for sentiment and emotion analysis, such as challenges in interpreting the formal and nuanced language of an educational context, based on our experimentation they still offer a good foundation for sentiment and emotion analysis.

To ensure that FeeFo becomes a valuable tool for educators, future research aims to gather supporting empirical data by evaluating the tool through educator usage and feedback on its usefulness and usability. This iterative feedback process ensures that FeeFo continues to evolve to meet the dynamic needs of educators and learners. Additional research considerations include integrating new and emerging machine learning models such as Large Language Models (LLMs) into the application for further analysis of feedback data. Furthermore, while the current version of FeeFo focuses on areas like positivity, negativity, and emotion within feedback, future extensions can explore additional aspects of feedback, such as its focus on specific tasks, processes, or cognitive strategies, as well as how feedback is structured and delivered to enhance its effectiveness.

FeeFo is available at https://feefo.ca, and the source code is available for download and modification at https://github.com/FeedbackFocus/FeeFo. FeeFo is released with an MIT License, which means that contributors can modify the source code as they see fit. By allowing contributors to integrate more powerful models or add new features, FeeFo encourages a collaborative approach to enhancing teaching practices.

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Declaration on Generative AI

During the preparation of this work, the author(s) used ChatGPT-4o to assist with grammar and spelling checks. The author(s) reviewed and edited the content as needed and take(s) full responsibility for the publication's content.

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