Empathetic Feedback Mechanisms for Enhanced Emotional and Academic Support in Online Learning Environments

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The shift to online learning has highlighted significant gaps in how students' emotional and social needs are supported (Bao, 2020). This paper explores innovative pedagogical feedback mechanisms designed to enhance emotional and social support in online settings. It introduces frameworks for delivering feedback that are both academically relevant and sensitive to students' well-being. This paper advocates for more empathetic and socially aware practices in providing feedback, especially in online discussion boards. Key mechanisms include AI-driven tools, social network analytics, multimodal tools, and sentiment analysis. These tools aim to create a more inclusive and supportive online learning community, boosting student engagement, retention, and satisfaction.

***Keywords**:* Empathetic feedback, Online Learning, Discussion Board, Artificial Intelligence, SNA, Multimedia, Sentiment Analysis.

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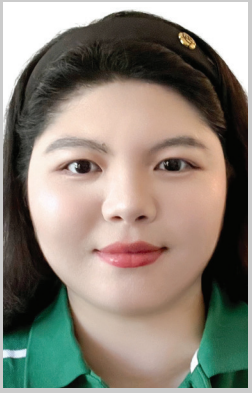

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Introduction

The expansion of online learning platforms has significantly transformed the education landscape through digital technology. Recent data suggest that the number of students enrolled in online courses has dramatically increased over the past decade. According to Allen and Seaman (2017), more than 30% of higher education students in the United States take at least one online course. This trend is echoed globally, with online education markets projected to grow by 9.23% annually from 2020 to 2025 (Research and Market, 2020).

The COVID-19 pandemic accelerated the adoption of emergency remote teaching and learning (ERTL), a rapid response often lacking the planning and resources of thoughtfully designed online courses (Bao, 2020). Many of the perceived shortcomings of online education stem from the rushed and temporary nature of ERTL rather than the potential of well-constructed online learning environments (Hodges & Fowler, 2020).

While online education offers numerous benefits, including flexibility and accessibility, it also introduces unique challenges, especially in providing students with adequate emotional and social support. However, challenges such as feelings of isolation and lower satisfaction levels are not exclusive to online education. Similar issues can be found in large on-site lecture courses where students may feel lost and disconnected from peers and instructors (Cash et al., 2017). It's important to recognize that while isolation can occur in online learning, it should not define the modality. Instead, viewing online education through a deficit lens limits our understanding of its potential.

The importance of emotional and social support in educational settings is well-documented. According to the theory of social presence, feeling connected with others in a learning environment enhances cognitive and affective learning outcomes (Garrison et al., 2000). While online learning environments sometimes struggle to facilitate this sense of connection, innovative solutions can bridge this gap (Stone & Springer, 2019).

In this article, we propose feedback mechanisms to enhance emotional and social support in well-designed online discussion boards. These mechanisms include AI-driven tools, social network analytics, multimodal tools, and sentiment analysis, aiming to foster a more inclusive, engaging, and supportive learning community. Online discussion boards, which are often integral to online courses, serve as platforms for class participation and discussions centered around module topics and reading materials. These discussions are typically a cornerstone of online courses, featuring prompts and questions tailored to each module's content. By focusing on personalized and empathetic feedback on these discussion boards, we advance mechanisms aiming to improve the quality and effectiveness of online learning environments specifically. This approach not only enhances academic performance but also addresses the emotional and social aspects of learning, fostering a more holistic and responsive educational experience.

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Online Discussion Boards

Online discussion boards are crucial in online learning, facilitating asynchronous communication where students interact and collaboratively construct knowledge. These forums can promote active learning and critical thinking, fostering cognitive and social presence as per the Community of Inquiry (CoI) framework (Garrison et al., 2000). Their impact depends on thoughtful design and use (Hrastinski, 2008). Well-designed discussion boards feature structured prompts, group activities, role-playing, and multimedia elements to encourage meaningful interaction and connectivity (Dennen, 2005; Mayer, 2014). Personalized, immediate, and interactive instructor feedback is vital. Such feedback acknowledges individu-

al contributions, provides specific guidance, and fosters two-way dialogue, enhancing post quality, engagement, and empathy (Hattie & Timperley, 2007). Instructor feedback helps maintain discussion focus and active participation. Highlighting exemplary posts, encouraging reflection, and facilitating peer interaction can model critical thinking and respectful discourse, building a supportive online learning community (Gikandi et al., 2011; Tu & Corry, 2003).

Empathetic Feedback in Online Discussions

Empathetic feedback involves designing humanized, personalized, and on-time responses to students' work. It not only assesses their academic performance, but it also fosters a supportive and encouraging learning environment. This type of feedback addresses students' emotional needs, offers encouragement and motivation, and provides constructive criticism in a kind and supportive manner. By tailoring feedback to individual students' needs and delivering it promptly, empathetic feedback helps keep students engaged and informed about their progress. It also cultivates multi-directional communication, recognizing students' efforts and improvements, thereby creating a more inclusive and effective online learning environment (Boud & Molloy, 2013; Hattie & Timperley, 2007).

Empathetic feedback in online discussion boards addresses both academic and emotional needs of students. It can be tailored to reflect on students' interactions. It should provide clear directions for improvement while being sensitive to the students' emotional state. This kind of feedback becomes crucial in making students feel supported and understood, where they are discussing their understanding, ideas, or even feelings in written isolated format of discussions. It acknowledges individual contributions, provides specific guidance, and fosters a multi-directional dialogue, thereby improving the quality of student posts and promoting deeper engagement and empathy.

Types of Empathetic Feedback

Current online feedback tools offer advantages in scalability and immediacy. Automated systems in LMSs quickly evaluate quizzes and assignments, essential for large classes. Tools like Turnitin assess academic integrity and provide grammatical and citation feedback, aiding writing development. However, these mechanisms have limitations, especially regarding personalization and emotional support. Automated feedback often lacks the nuanced understanding of individual learning contexts, making it seem irrelevant or impersonal. Such systems focus on cognitive and content-specific aspects, neglecting critical affective and motivational dimensions needed for student engagement (Cavalcanti et al., 2021; Mamoon-Al-Bashir et al., 2016).

Asynchronous discussion boards offer communication flexibility but can delay feedback, hindering timely support and progression, exacerbating feelings of isolation and disconnection. Text-based feedback also struggles to convey tone and empathy, essential for emotional support, leading to decreased motivation and satisfaction (Jensen et al., 2021). To address these challenges, there are several ways to design empathetic feedback for students' online discussions, some of them will be discussed below.

Sentiment Analysis (SA). Sentiment analysis is a powerful tool that helps instructors understand and respond to students' emotional states, fostering a supportive learning environment (Pang & Lee, 2008). Batrinca and Treleaven (2015) defined SA as "the application of natural language processing, computational linguistics and text analytics to identify and extract subjective information in source materials" (p. 90). Instructors can analyze text data, such as discussion posts, to determine the emotional tone (positive, negative, or neutral) and specific emotions (e.g., happiness, frustration, and/or confusion) of each individual student. This also can help the instructors to identify overall patterns of emotional states, challenges, and areas where additional support may be needed in the whole class. This analysis can inform personalized feedback strategies, targeted interventions, or adjustments to the course design to better cater to students' emotional and academic needs (Pang & Lee, 2008).

By understanding the emotional states of students, instructors can tailor their feedback to be more empathetic and supportive. Sentiment analysis can help instructors identify negative emotions early on. For instance, if a student consistently shows signs of stress or disengagement, the instructor can intervene promptly with support, such as one-on-one meetings, counseling referrals, or

adjusted workloads. Early intervention can prevent minor issues from escalating into major problems, thus maintaining a positive learning environment (Calvo & D'Mello, 2010). To implement SA feedback, several tools can be integrated into LMSs to facilitate these benefits including IBM Watson, Google Cloud Natural Language, NodeXL, and NVivo. Instructors should review the analysis results and provide personalized feedback, addressing both academic and emotional aspects.

Multimodal Tools. A multimodal approach to feedback combines various modalities, such as text, audio, video, and images, to convey emotional nuances and provide comprehensive feedback. For example, instructors could provide video feedback with their facial expressions and tone of voice to convey empathy and emotional support, while also including annotations, diagrams, or screen recordings to give specific academic guidance on students' work or discussion posts. Several free-of-charge multimodal feedback tools can be utilized to enhance the feedback process (such as Loom, Screencast-O-Matic, Vocaroo, Prezi, Panopto, or Kami).

To implement multimodal feedback, instructors can utilize tools that support various feedback formats, such as video recording software and annotation tools. It is important to provide clear and concise feedback, using the appropriate modality for each type of comment. For instance, use text for straightforward corrections, video for more detailed explanations, and diagrams for visual representations. Regular training and support for instructors can help them develop the necessary skills to use multimodal feedback effectively.

Social Network Analytics. Social Network Analysis (SNA) provides a deeper understanding of interaction behaviors in online discussions by examining more than just the frequency of interactions. It delves into various types of interactions, including learner-learner, learner-content, and learner-instructor interactions. SNA looks at how participants connect and respond, identifying clusters, subgroups, social relationships, and structures within the network. It uses metrics such as centrality and graph theory to assess the influence, prominence, and roles of individuals in the network, as well as the flow of resources they facilitate (Yen et al., 2022).

SNA helps to reveal how network participants connect and respond, the roles they play, and their influence within the network. Researchers have used SNA to understand online interaction patterns, social and cognitive presence, group cohesiveness, and knowledge co-construction. For example, Kale and colleagues (2011) discovered that online discussion participants were influenced by more knowledgeable peers. Enriquez (2008) noted that SNA focuses on the relational effects of multiple technical and social engagements beyond simple response relations. Researchers (see Jo et al., 2017; Tirado et al., 2015) have applied SNA to examine and understand these patterns, enhancing the comprehension of social presence and cognitive presence, as well as group cohesiveness and knowledge co-construction (Heo et al., 2010).

To implement SNA in online discussions, instructors should collect data on student interactions, such as posts and replies. This data should be organized into an edge list format and analyzed using SNA tools like Gephi or NodeXL. The resulting network graphs can help identify central and isolated students, informing targeted feedback and interventions (Harati et al., 2023). Instructors can provide prompt guidance on effective communication and encourage students to engage with their peers, fostering a more inclusive learning environment (Tu et al., 2023).

Artificial Intelligence. Artificial Intelligence (AI) is transforming the education field, particularly in assessments and scoring (Watermark Insights, 2024). Intelligent tutoring systems offer content-specific guidance, as well as motivational and metacognitive support, mimicking human feedback (Akyuz, 2020). AI's ability to analyze large datasets helps identify patterns in student behavior, providing personalized feedback that adapts to each student's learning pace and style, enhancing efficiency and effectiveness in large-scale online educational environments (Michelle, 2023).

Instructors can integrate AI tools, such as ChatGPT, to analyze students' online discussions and provide more personalized, effective, and engaging feedback. This not only addresses academic content but also supports students' emotional and cognitive development, enhancing engagement and outcomes (Sethi & Jain, 2024).

These tools can quickly analyze student submissions, forum posts, and prompts, offering a comprehensive overview of individual and overall class performance. AI tools can highlight nuances in class interactions that may be overlooked by instructors. For example, ChatGPT can analyze

student responses to identify common misconceptions or gaps in knowledge or generate follow-up questions or discussion prompts tailored to individual student responses. Also, ChatGPT can be used to track student progress over time by analyzing the evolution of their responses and interactions in discussions. This longitudinal analysis helps instructors tailor their feedback based on the student's development. Based on these analyses, instructors can provide personalized feedback and detect emotional cues. To ensure the accuracy and supportiveness of AI analysis, instructors should supplement it with their own oversight. Training on the ethical use of AI and maintaining transparency with students about data usage can help address privacy concerns.

Challenges of Empathetic Feedback Mechanisms

As mentioned earlier, implementing each of these empathetic feedback mechanisms not only entails many benefits, but it also helps instructors create a more socially and emotionally supportive learning environment for online students. However, these mechanisms face several challenges, some of which are summarized below:

Sentiment Analysis

Effective SA tools are essential for accurately interpreting students' emotional states, which are often complex and multifaceted. These tools must be sophisticated enough to detect subtle emotional cues and variations in language that reflect students' feelings (Hutto & Gilbert, 2014). However, the implementation of such tools also raises significant privacy concerns. Students might feel uncomfortable or even violated if they perceive that their personal reflections are being scrutinized too closely, leading to potential issues around trust and consent in the educational environment (Graesser & D'Mello, 2012). Therefore, it is crucial to balance the benefits of emotional insights with the ethical implications of privacy to maintain a supportive and respectful learning atmosphere for online students.

Multimodal Feedback

Creating multimodal feedback is time and resource-intensive, making it particularly challenging to sustain especially in large classes (Ice et al., 2019). Additionally, instructors need technical skills to effectively use and implement these tools, which can present a significant barrier for some educators (Borup et al., 2015). Institutions can offer training and professional development programs to help instructors develop the necessary technical skills to implement multimodal feedback effectively. Collaboration among instructors to share resources and best practices can also alleviate individual burdens.

Social Network Analysis (SNA)

Collecting and analyzing interaction data is complex and demands sophisticated software and expertise (Heo et al., 2010). This challenge can be daunting for instructors who may lack the technical skills required for effective data management and analysis. To address this issue, providing training sessions and ongoing technical support for instructors can help them develop the necessary skills to utilize these tools effectively. Collaborating with data analysts or leveraging educational technology specialists can also enhance the accuracy and usefulness of the data collected, ultimately leading to better-informed instructional strategies and improved student outcomes.

AI-Driven Feedback

AI systems may lack the nuanced understanding of student emotions and contexts that human instructors provide (Akyuz, 2020). Furthermore, the implementation of AI raises significant privacy and ethical concerns that institutions must address (Akgun & Greenhow, 2022). To mitigate these issues, instructors can balance automated feedback with personal, human interaction to ensure that students' engagements are well received emotionally and critically. Institutions should also establish clear ethical guidelines and robust privacy protections to safeguard student data and maintain trust in AI applications in education (Akgun & Greenhow, 2022).

What Empathetic Feedback Mechanisms Research is Needed

Future research should focus on enhancing the effectiveness of empathetic feedback in online learning. Longitudinal studies are needed to examine the long-term impact on student outcomes, including academic performance, emotional well-being, and retention rates. Additionally, exploring the effectiveness across different educational contexts—such as various disciplines, age groups, and cultural settings—can help identify best practices and potential adaptations.

Investigating advanced AI capabilities, such as predictive analytics and adaptive learning technologies, is another important area. These technologies could offer more personalized and proactive support for students. Understanding the perspectives of instructors using these feedback mechanisms is also critical. Researching their challenges, needs, and suggestions can enhance the implementation and effectiveness of these tools. The last but not least, exploring ways to increase student autonomy and agency in the feedback process is another path of future research.

Conclusion

Designing and teaching online learning necessitates innovative feedback mechanisms that support students' academic and emotional needs. Integrating AI-driven tools, Social Network Analytics, multimodal feedback tools, sentiment analysis, and other mechanisms can create a more supportive and engaging educational experience. These tools can enhance academic performance and address the emotional and social aspects of learning, fostering a more inclusive and responsive online learning community. However, the implementation of these mechanisms comes with challenges such as privacy concerns, the complexity of data collection and analysis, and the need for technical skills. Addressing these challenges through training, ethical guidelines, and a balanced approach that combines automated and human feedback will ensure that empathetic feedback mechanisms are effective and sustainable. Future research should focus on refining these mechanisms, exploring their effectiveness across different educational contexts, and ensuring seamless integration into existing online learning platforms. By prioritizing students' emotional and social well-being alongside their academic success, instructors can create a more holistic and effective online learning environment.

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