ChatGPT as a Game-Changer for Embedding Emojis in Faculty Feedback

Ethan Kupershtein, Yulia Kumar, Anjana Manikandan, Patricia Morreale, and J. Jenny Li
Department of Computer Science and Technology
Kean University, Union NJ 07083, USA
ykumar@kean.edu

***Abstract*—This study explores the potential of integrating emojis, and digital pictographs, into faculty feedback to augment student learning outcomes. This additional layer of expressiveness, encouragement, and involvement adds a personal touch to the often distant and virtual student-educator communications, fostering motivation. The study focuses on the impact of emojis on the learning process within the scrutinized Computer Science (CS) Department. Capitalizing on the capabilities of OpenAI's Large Language Model (LLM) ChatGPT-4, its Application Programming Interface (API), and associated tools and third-party plugins, a system that translates text into corresponding emojis and vice versa has been developed. The proposed application offers direct benefits to educators by simplifying the provision of detailed and extensive feedback to students. The primary research question is: Can the appropriate use of emojis, matched with the sentiment of the feedback text, contribute to enhanced student learning outcomes, higher retention rates, and boost the reputation of the educators providing it? Two surveys on the impact of emojis across selected course sections were conducted to answer the question: a pre-survey and a post-survey involving 175 active participants. The results were analyzed, and it was concluded that integrating emojis in faculty feedback, particularly when grading student work, could potentially enhance student learning outcomes and their overall course experience.**

Keywords— emojis, Feedback Emojifier, ChatGPT, computer science education, text-to-emoji translation.

I. Introduction

In the contemporary era of digital communication, a period influenced by the aftermath of the COVID-19 pandemic, emojis have ascended as a pervasive form of communication. They augment the conveyance of emotions and sentiments in text-based interactions, which is paramount when many young individuals navigate mental or emotional challenges [1-3]. Emojis have seamlessly woven themselves into the fabric of the digital communication landscape. This integration spans many platforms, from mass video-communication platforms such as Microsoft Teams, Zoom, Cisco Webex, and Google Meet, to widely utilized applications like Google Docs, Microsoft Word, Discord, and Slack [4-7]. The Computer Science (CS) Department under examination currently leverages a web-based learning management system (LMS), specifically Canvas [8]. This platform has a prebuilt assessment and an integrated emoji module [9]. Figure 1 visually represents the faculty feedback Graphical User Interface (GUI) component. This component encourages educators to incorporate emojis in their feedback by prominently displaying the feature in two locations: beneath the feedback text area and as a placeholder.

Figure 2 further highlights the commitment to diversity and inclusion in Canvas's emoji GUI component, a particularly beneficial feature for accommodating diverse student populations.

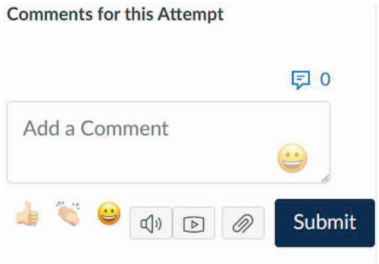

Fig. 1. Canvas feedback GUI component with the use of emoji.

As shown in Figure 1, Canvas vendors actively recommend emojis as part of faculty feedback.

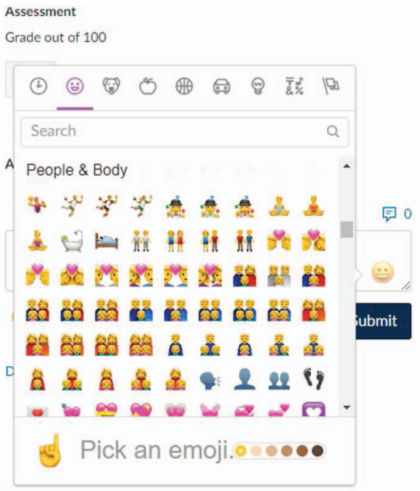

Fig. 2. Diversity and Inclusion in Canvas's emoji GUI component.

Figure 2 exemplifies the faculty's capacity to select specific emojis that align with their feedback and the color of the clapping hands and specific LGBTQ+-oriented emojis. This feature holds significant potential on an individual basis as it facilitates more personalized feedback. The availability of country/ethnicity-specific emojis is particularly fitting in the

979-8-3503-2759-5/23/$31.00 ©2023 IEEE
DOI 10.1109/CSCE60160.2023.00173

context of a diverse student community, which includes many Hispanic students and those who identify as 'they' and use nicknames in every course section [10][11]. From the perspective of seasoned researchers, fostering effective communication between students and faculty, and bridging any potential gaps in understanding that may arise due to age differences, is crucial in cultivating an environment conducive to innovation and learning. To equip students with a skill set that is relevant to the 21st century and prepare them for their future careers, it is incumbent upon universities to explore and implement innovative strategies that enhance learning outcomes and student engagement. One such strategy, which is this study's focal point, is emojis in faculty feedback.

II. Related Work

In distance education, particularly in the wake of the COVID-19 pandemic, emojis have carved out a significant role, serving as a conduit for expressing emotions that may not be adequately conveyed through text alone [12-14]. They have been recognized as adequate substitutes for nonverbal communication in face-to-face settings, often favored by both students and faculty as feedback mechanisms [15-17]. However, the efficacy of feedback using emojis is amplified when combined with text. This amalgamation has enhanced students' academic performance by providing a more unambiguous indication of areas requiring improvement [18]. Conversely, consistent negative feedback can lead to a lack of motivation and unchanged behavior [13]. Emojis play a pivotal role in student learning outcomes as they can elicit emotional responses, which are integral to the learning experience [19]. The advantages of emojis in feedback encompass self-expression, mitigation of misunderstandings, enhancement of communication, softening of intercultural communication, infusion of humor, and facilitation of a congenial digital environment [20-22]. Notably, positive emojis can foster positive student emotions, augment academic performance, and nurture a productive learning environment. The concept of a growth mindset, which perceives setbacks as opportunities for improvement, is also crucial in the learning environment [23]. Faculty instructors with a growth mindset are likelier to exhibit flexibility in their teaching approach, provide positive reinforcement for effort, and commend students for their accomplishments [24][25]. This approach can stimulate students to learn and grow, irrespective of their challenges. A cadre of researchers [16] previously delved into the use of words and emojis, underscoring the potential of emojis in sentiment analysis, a critical aspect of this study as it aims to align emojis with the sentiment of the feedback text. Sentiment analysis based on emojis using the KNN approach has been successfully conducted [26]. A hybrid deep learning approach for aspect-level sentiment analysis for Amharic news comments [27] has influenced this work as it is actively working with Transformers in its research [28][29]. Although the context differs, the methodology could be adapted for this study, particularly in analyzing the sentiment of faculty feedback.

III. Embeding Emojis in Faculty Feedback

A. Study Methology and the Surveys

In this investigation, the potential of OpenAI's ChatGPT to incorporate emojis into faculty feedback was explored to enhance the expressiveness of scholarly communication. A hypothesis was formed based on surveys conducted among students regarding their experiences with faculty feedback containing emojis. It was postulated that the appropriate use of emojis, when matched with the sentiment of the feedback text, could lead to improved student learning outcomes, higher retention rates, and, consequently, increased graduation rates, which could also enhance the positive reputation of the faculty and the department. The research question was: Can the appropriate use of emojis, matched with the sentiment of the feedback text, contribute to enhanced student learning outcomes, higher retention rates, and boost the reputation of the educators providing it?

Two identical surveys were created to investigate the question, a pre-survey and a post-survey, each containing 16 questions via Google Forms. The surveys involved 175 students and were approved by the Institutional Review Boards (IRB), with all organizers obtaining the necessary certifications to handle human subjects. Figure 3 illustrates the main statistics from the pre-survey.

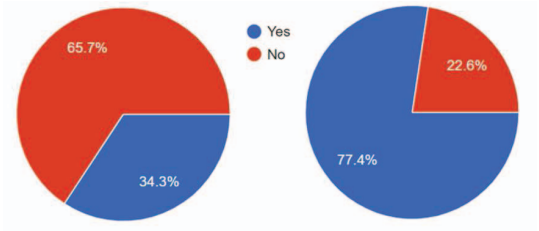

Fig. 3. Students' answers: Do you have any experience receiving emojis in your assignments/exams feedback? (left) Do you think it is appropriate for your instructors to include emojis in the feedback? (right).

As depicted in Figure 3, 115 out of 175 student participants (65.7%) had prior experience receiving emojis in faculty feedback before the study, and the majority (77.4%) deemed this practice appropriate. After conducting the pre-survey, the Computer Science faculty were asked to use emojis in their feedback, exposing the remaining 34.3% of students to this practice. The study primarily focused on positive emojis representing joy, love, and admiration. Many student participants expressed that using emojis in feedback was appropriate and added a unique touch to the learning experience. Figure 4 demonstrates the use of diverse emojis within the study.

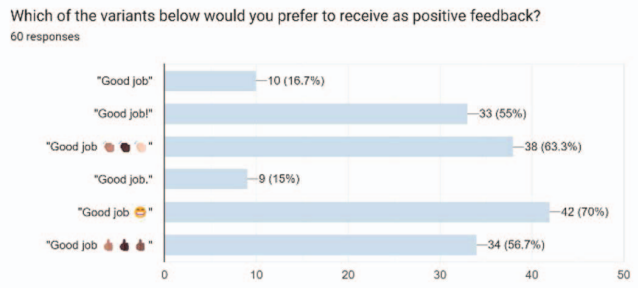

Fig. 4. Diverse Emojies in Pre-survey

As shown in Figure 4, feedback containing diverse and joyful emojis received the highest rating, among others. Punctuation signs, such as the exclamation mark at the end of

the sentence "Good job," also mattered. Initially, the importance of gifs – small clips expressing positive reactions – was also considered for exploration in the study, but it was decided to focus on this in independent research. Once the pre-survey data was collected, subsequent analysis was begun using Python and Jupyter Notebook. It was realized that with the help of ChatGPT-4 and its Noteable plugin, the creation of graphs could be automated, and data analysis and visualization could be streamlined and efficient. Figure 5 provides an example of communication with ChatGPT-4 related to the topic.

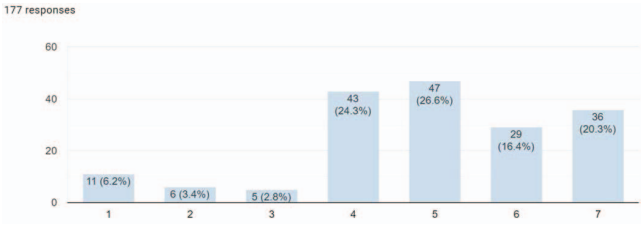

Fig. 5. Student answers on Emoji's relation to the concept of Growth Mindset.

As depicted in Figure 5, 25% of respondents think emojis are related to the Growth Mindset (GMS) concept. In comparison, 14.3% believe they are related, and 21.4% think unrelated (color-coded in red in Figure 5).

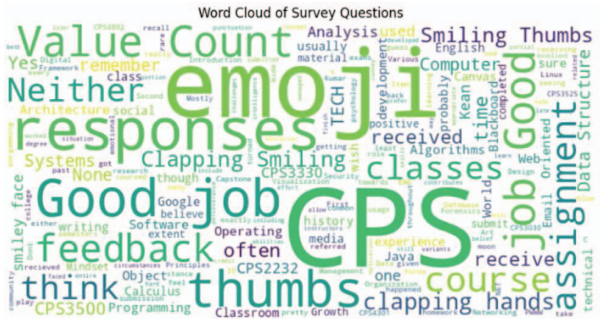

Fig. 6. Word Cloud of the Survey's questions.

As shown in Figure 6, the most frequently used words in the surveys were 'CPS' for computer science and 'emoji.' Feedback 'Good job' and emoji 'thumbs' (👍👍👍) also stand out.

B. *Survey Results*

As previously mentioned, 175 students participated in the pre-survey. The data indicates that students expressed positive sentiments towards using emojis in feedback from their professors. With an average of 5.73 on a scale from 1 to 7, emojis play a substantial role in the student's emotional stance toward the material they are learning. The students believed that the feedback format (placement & type of punctuation & emojis) played a role in their motivation to learn the material. With an average improvement score of 4.99, the student participants believed that including emojis would improve the quality of the feedback. With an average reported GMS magnitude of 4.92, the students believed emojis are related to a GMS. Figure 7 shows the strength of this study's relationships between critical indicators.

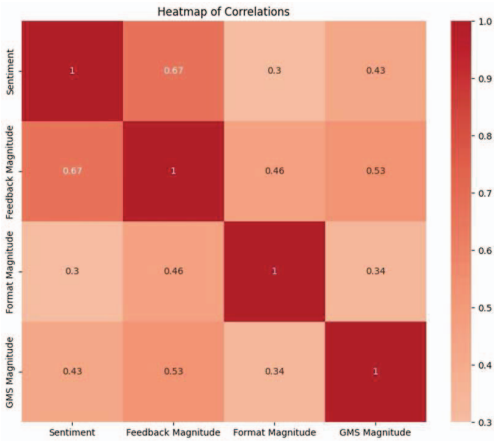

Fig. 7. Heatmap of Sentiment, Feedback, Format, and GMS Magnitudes Correlations..

Figure 7 combines the average statistics between the pre-survey & the post-survey. Across both surveys, students reported an average sentiment of 6.03, meaning they generally reported positive feelings toward using emojis in their feedback. Additionally, with an average feedback magnitude of 5.72, the student participants generally believed that emojis in feedback played a role in their emotional stance toward the material. With an average format magnitude of 5.4, the type & usage of punctuation & emojis played a role in student participants' motivation to learn the material. With a score of 4.95 for improvement, student participants were slightly likely across the two surveys to believe that using emojis in feedback would improve the quality of it. Lastly, the student participants were slightly likely to believe that emojis & GMS were closely related, with an average report of 4.93 on a scale of 1 through 7.

Our analysis focused on understanding the impact of using emojis in faculty feedback on student learning outcomes. The examination of the frequency of different emojis used in the feedback, the student's perceptions of the appropriateness of using emojis in feedback, and the correlation between the use of emojis in feedback and student learning outcomes were carried out. The findings from this analysis provided insights into the potential benefits and challenges of incorporating emojis into faculty feedback in higher education. Embracing a Growth Mindset (GMS), which perceives traits as malleable and adaptable through experiences and setbacks, is crucial in the learning environment. Students with a GMS view each failure as an opportunity for improvement, leading to increased motivation and enthusiasm for learning. This mindset fosters a mutually beneficial learning environment for both students and faculty, and it is within this context that the potential of emojis to further enhance this dynamic is explored. Between the two surveys, the student participants reported an average positive sentiment of 6.025 on a scale of 1-7, meaning that their emotional state significantly improved when shown emojis in feedback from faculty. The ratio of students receptive to the use of emojis by faculty to those who were not receptive supports the claims that using emojis in feedback plays a positive role in one's learning. Detailed analysis shows that the most common favorite emojis reported by students include the clapping emoji (👏👏👏), the smiling emoji (☺X), and the thumbs-up emoji

(👍👍👍), each of which signifies sentiments of a positive nature.

IV. Growth Mindset Classification with Transformers

A Growth Mindset (GMS) is an idea proposed by Stanford Professor Carol Dweck [21, 23]. It focused on how people with said GMS could embrace challenges and improve their skills and intelligence because of the effort they put forth. An individual should be able to transform some feedback into a positive learning experience. A GMS is not something people naturally have, and they will often need to work toward getting their brains to adopt the ideology. GMS could be a solution to many problems within CS education. What if there was a way to take GMS and train a tool to assist professors in maintaining the GMS standard while responding to various kinds of assignments and projects? The Growth Mindset AI Educational Recommendation System will do just that.

The journey to enhance student outcomes by leveraging the Growth Mindset (GMS) and emojis began before ChatGPT-4, a development that later revolutionized the methodology. As is customary in the field of research, the most suitable models available were chosen to carry out the tasks. These models were meticulously trained, tested, and validated using Python and its wide array of frameworks and libraries. The initial model of choice was the Bidirectional Encoder Representations from Transformers (BERT) [31], the official predecessor of ChatGPT. As the research evolved, the arsenal was expanded to include the Robustly Optimized BERT Pre Training Approach (RoBERTa) [32] and the Transformer-XL extension (XLNet) [33], both of which were considered the pinnacle of transformers for natural language processing and classification during that era. The initial dataset was a combination of text that encapsulated encouraging GMS words (categorized as 'correct'), discouraging words (categorized as 'incorrect'), and a third category that was partially correct. This dataset, as visualized in Figure 8, initially exhibited an imbalance, with a disparate number of phrases in each category.

Fig. 8. Word Cloud of Feedback Messages.

The initial dataset was unbalanced, with the number of phrases in various categories significantly varied. To rectify this imbalance, the number of text inputs for each of the three classes was calibrated to achieve parity. The resulting balanced dataset is depicted in Figure 9.

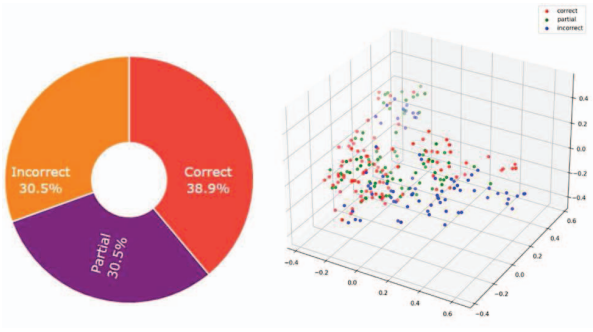

Fig. 9. MS Dataset (left: percentage out of 100, right: embeddings).

The challenges of multi-class classification, which involves more than two mutually exclusive classes, we had previously tackled [34] were encountered as not all predictive models are equipped to handle the complexities of multi-class classification. We started our experiments with Logistic Regression and Random Forest methods (See Figure 10).

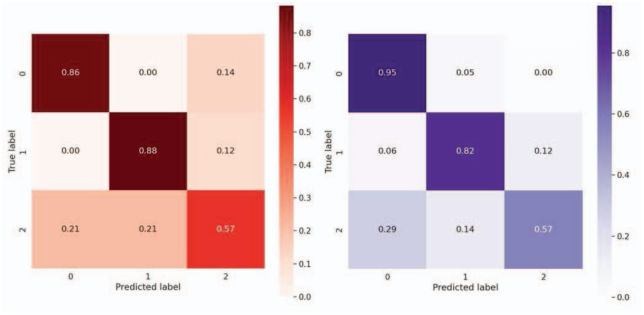

Fig. 10. Heat Map of the Logistic Regression (left) and Random forest (right) models results.

According to Figure 10 The Logistic Regression model demonstrated a robust performance with an overall accuracy of 79%. The F1-score for the 'correct' and 'incorrect' classes exceeded 0.8, while the 'partial' class had a score of 0.6. The Random Forest Classifier improved the performance of the model, achieving an accuracy of 81%. The precision, recall, and F1-score also improved for all classes (correct, incorrect, and partial), indicating a more balanced and accurate model. We then explored the use of Support Vector Machines (SVM) to see if we can further enhance the model's performance. The results demonstrated an overall accuracy of 81%, which is an improvement over the previous models. The precision, recall, and F1-score for the 'correct' and 'incorrect' classes are quite high were above 0.85 (see Figure 11).

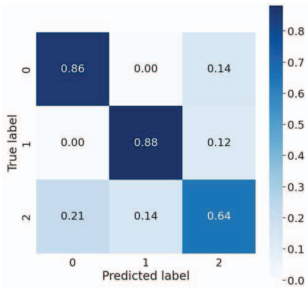

Fig. 11. Heat Map of the SVM model

After experimenting with a variety of models, including ChatGPT-2 with 117 million parameters on a high-performance machine, it was decided to train several other models including Electra, Enhanced Representation through kNowledge IntEgration (Ernie), and DistillRoBERTa. Figures 12 and 13 represent just some of our classification results:

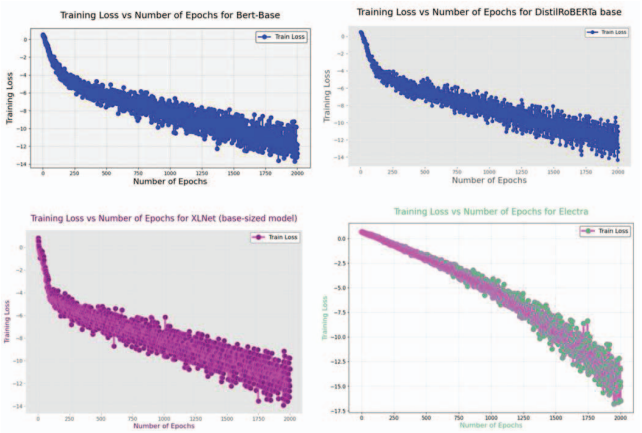

Fig. 12. Training loss of BERT, DistilRoBERTa, XLNet and Electra models.

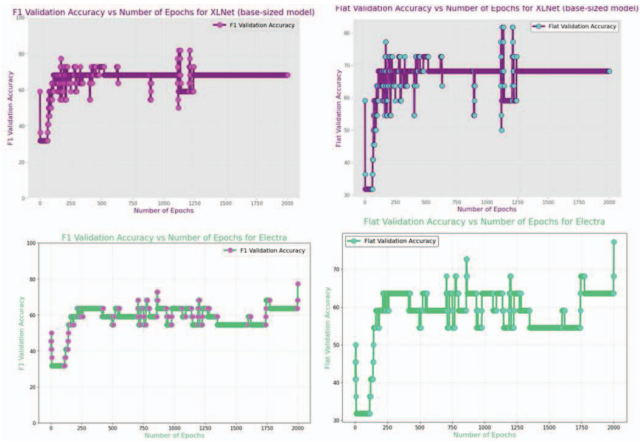

Fig. 13. F1 and Flat Validation accuracy of XLNet and Electra.

Once this work was conducted on Google Collab, it was concluded that deep learning models such as BERT and its counterparts necessitate a substantial volume of training data, robust computational power, GPU hardware acceleration, and a significant investment of time. This realization led to the procurement of the premium Google Collab PRO+ package. An attempt was made to run the code on a high-performance machine with 128 nodes, but this necessitated the setup of an additional environment, migration of training data, and the consumption of a third-party managed development environment. Initially, low classification accuracy was experienced due to the size of the data and considerable time was invested in experimenting with different parameters and optimizers to enhance it using a brute-force approach. Subsequently, opportunities to integrate these results into a new or existing web application were explored. A prototype of such an application was developed based on previous research results [28].

V. ChatGPT: A Game-Cjanger For Embedding Emojis in Faculty Feedback

The innovative approach introduced here streamlines faculty grading using emojis, embodied in the *Feedback Emojifier* application. The app's core concept is to provide prebuilt Growth Mindset (GMS) phrases that faculty can swiftly employ as feedback by simply clicking or tapping on a button displaying a corresponding emoji. This unique 'emoji-feedback dictionary' was brought to life with the assistance of ChatGPT-4. The application's Graphical User Interface (GUI) highlights the 23 most frequently used phrases. Faculty members can select less commonly used prebuilt emoji-feedback pairs by clicking a '+' button, revealing additional choices. Emojis that support a palette prompt an extra block on the page to pop up, enabling faculty to select the colors they prefer. If faculty members wish to provide personalized feedback to a student, they can also do so. In such instances, OpenAI's ChatGPT-4 backend is leveraged to find suitable emojis to match the feedback. The goal is to analyze faculty feedback and seamlessly integrate appropriate emojis into the text. Given that feedback is a string of text and emojis are technically characters, this integration is a feasible task, as the functionality for emojis already exists in programming languages. For instance, the Python snippet shown in Figure 14 converts the word ':smile:' into the actual emoji.:

```
if __name__ == "__main__":
  # Get the input text.
  text = input("Enter the text: ")

  # Convert the emoticons in the text to emojis.
  converted_text = convert_emoticons_to_emojis(text)

  # Print the converted text.
  print(converted_text)

Enter the text: :smile:
😊
```

Fig. 14. Python library emoji converts text to emoji without AI.

Figure 14 represents a code snippet dealing with emoji conversation without AI. The goal is to embed the power of LLMs like ChatGPT-4 into the best possible result. This process can be integrated with ChatGPT by using a key to OpenAI API and a template of react app provided by the creators [31]. The feedback text can be fed to ChatGPT and asked to add appropriate emojis based on the sentiment and theme. ChatGPT's language understanding capabilities can help it understand the context and sentiment of the feedback and choose appropriate emojis. The algorithm works as follows:

Feedback Sentimental Analysis. This step is performed automatically by ChatGPT-4 with the prompt: "Analyze this university faculty feedback, and respond with:" positive," "negative," or "neutral," depending on its nature.

Emoji Mapping: This step is performed automatically by ChatGPT-4 with the prompt "Find the most suitable emoji to add to this feedback." In this case, positive sentiment could be

mapped to emojis like thumbs up (👍) or a star (☆), a light bulb (💡) or a rocket (🚀), etc.

Emoji Integration: Once steps one and two are completed, emojis can be added to the feedback with the help of the QuickStart tutorial [34]. The authors take this step.

Feedback Generation. ChatGPT can generate the feedback text itself or polish / improve existing drafts based on the grading rubric or other inputs. This could allow for a fully automated system where ChatGPT generates feedback and adds appropriate emojis. Currently, there is no access to a Canvas developer environment, and this part of the study will be included in future work. It is not considered difficult as with the help of ChatGPT, integrating into Canvas code can become a No-code activity (as ChatGPT will do all the challenging work). The high-level concept is as follows: the received score, number of attempts, and the time of submission (late vs. on-time) can be fed to ChatGPT, and it generates feedback while keeping the concept of GMS in mind (not too harsh and student-friendly). As many of the assignments are programming assignments, and the model can catch the errors and fix the code or, in many cases, write the same code from scratch, it can be provided the ability to analyze not yet graded code itself and compare compilation results with the rubrics and guidance on which outcome needs what kind of GM's feedback (if this is just an excellent job if there is room to improve or the student received a late penalty while their work is otherwise good). ChatGPT should analyze the history of the student performance and analyze if AI generated the answer and this data as well.

The early prototypes of the *Feedback Emojifier* can be seen in Figure 15. *Feedback Emojifier* prototypes are web-based apps, one in Python utilizing the Flask framework and another in JavaScript utilizing React front-end Framework. Both apps were created Code-Free with the help of ChatGPT-4 and GitHub Copilot [35].

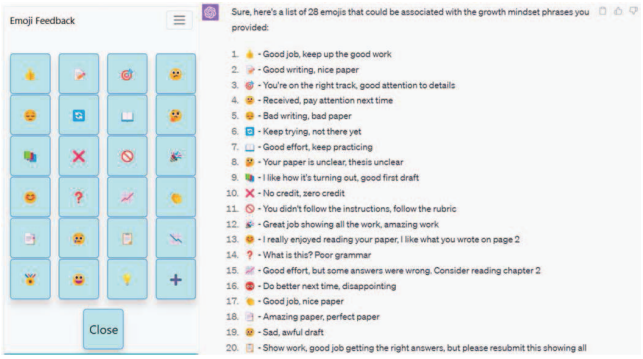

Fig. 15. The Feedback Emojifier Prototype: GUI (left), logic behind (right).

Figure 15 showcases positive emojis and those with negative semantics for comparison. The *Feedback Emojifier* app features a straightforward and intuitive interface with a 4x6 matrix of emoji buttons. Each button is associated with a Growth Mindset (GMS) phrase encouraging students to continue learning. When a faculty member clicks on an emoji button, a pre-defined feedback phrase associated with that emoji is triggered. This feature offers flexibility and personalization, enabling faculty members to tailor their feedback to specific situations or students. The *Feedback Emojifier* is built using Bootstrap 5+, ensuring a responsive design that works seamlessly across different devices and screen sizes. The app is convenient and easy to use.

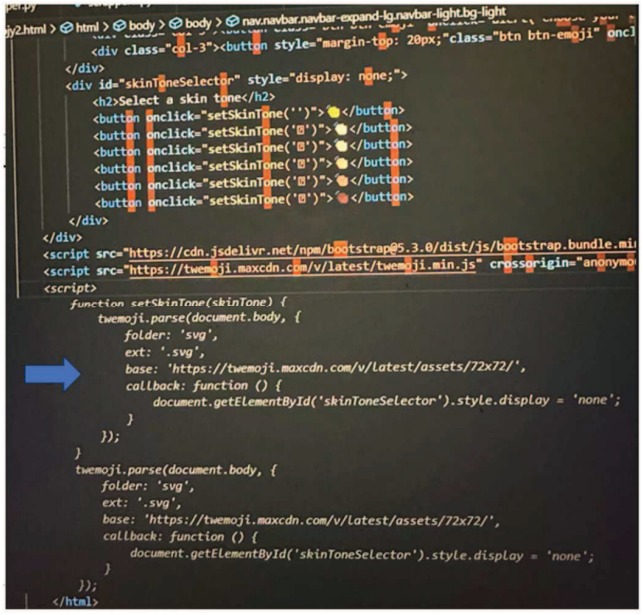

Fig. 16. Code suggestion by GitHub CoPilot.

Figure 16 illustrates how GitHub Copilot suggested two JavaScript functions based on the newly added element. This code is dedicated to emoji diversity, as emojis add a touch of personalization, helping to build a supportive learning environment. The app utilizes two test cases:

- There is prebuilt (hardcoded) feedback associated with a particular 'emoji button' on the app's GUI, so the faculty is aware of the feedback coming after a click and can use the buttons as a shortcut.
- An emoji suggested by the ChatGPT model response is auto generated and attached to customer feedback.

The web page shown in Figure 17 demonstrates the second option.

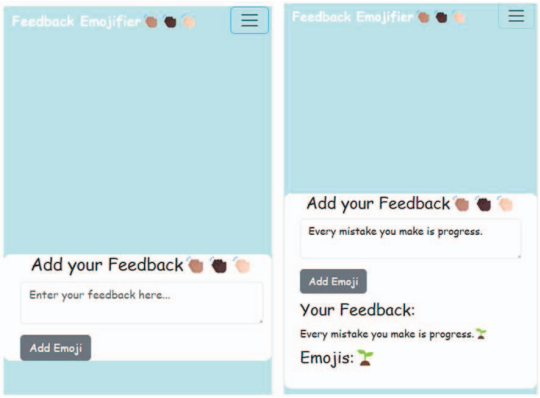

Fig. 17. The Feedback Emojifier: Home Page Adjusted GUI.

In conclusion of this section, the *Feedback Emojifier* represents a significant advancement in the use of AI to enhance the feedback process in educational settings. By leveraging the capabilities of ChatGPT-4, the app provides a user-friendly interface for faculty to provide personalized feedback quickly and effectively to students. Emojis add a layer of emotional context to the feedback, which can help to foster a more supportive and engaging learning environment. Future work will explore integrating this technology into learning management systems like Canvas, further streamlining the feedback process and potentially improving student outcomes.

VI. Conclusion and Future Work

The study underscores the transformative potential of integrating emojis and Growth Mindset (GMS) strategies into educational feedback. As students navigate their academic journey, these innovative tools can foster a passion for learning and resilience in overcoming challenges. This research offers a fresh perspective on using emojis in educational contexts and emphasizes the potential of AI-assisted communication tools in enriching educational interactions. The findings highlight the significant role of emojis in enhancing the educational experience in a digital environment. The data analysis supports several key insights:

- Emojis, when incorporated into faculty feedback, foster a more positive sentiment among students, enhancing their academic efforts and overall performance.
- Students demonstrate a positive attitude and receptivity towards the use of emojis in feedback related to their work.
- Emojis serve as an effective medium for conveying emotions in digital communication, fostering a stronger connection between students and faculty.
- Using emojis in feedback can contribute to cultivating a Growth Mindset among students, leading to increased resilience and academic achievement.
- Given these insights, the researchers advocate for the broader adoption of emojis in student feedback. This practice can enhance student engagement and lead to improved academic outcomes.

Looking ahead, the researchers aim to develop an AI-powered application that leverages the Natural Language Processing (NLP) and sentiment analysis capabilities of OpenAI's APIs and other AI and machine learning libraries. This application will generate faculty feedback based on student submission and predefined rules with zero faculty involvement, embedding emojis in the feedback. Such a tool will benefit both remote and in-person education, reducing the burden on faculty and allowing for larger class sizes. This application will contribute to more seamless interaction between students and faculty members by facilitating a more efficient grading and feedback delivery process.

During the study, the researchers realized the importance of considering the appropriateness of emojis in different contexts. While emojis can make feedback more engaging and expressive, they may only suit some situations or all students. Therefore, the researchers plan to allow students to turn off emojis from the feedback or customize them in the already developed and upcoming emoji apps.

Acknowledgment

This research is supported in part NSF grants 1834620, 1928452, and 2137791 and Kean University's SpF program.

References

[1] Sontag-Padilla, Lisa, et al. "Supporting the Mental Health Needs of Community College Students. Research Report. RR-A2552-1." RAND Corporation (2023).

[2] Wong, Amy. Stories of Survival: The Paradox of Suicide Vulnerability and Resiliency Among Asian American College Students. Oxford University Press, 2023.

[3] Robertson, Elizabeth. A Preliminary Exploration of the Workplace Expectations of Generation Z Amidst COVID-19. Diss. Pepperdine University, 2023.

[4] M. G. Veytia-Bucheli, J. Gómez-Galán, and D. Vergara, "Presence of New Forms of Intercultural Communication in Higher Education: Emojis and Social Interactions through WhatsApp among Graduate Students," Education Sciences, vol. 10, no. 11, p. 295, Oct. 2020, doi: https://doi.org/10.3390/educsci10110295.

[5] M. Zhang, Q. He, J. Du, F. Liu, and B. Huang, "Learners' perceived advantages and social-affective dispositions toward online peer feedback in academic writing," Frontiers in Psychology, vol. 13, Sep. 2022, doi: https://doi.org/10.3389/fpsyg.2022.973478.

[6] E. Vazquez, et al., "Lessons Learned Using Slack in Engineering Education: An Innovation-based Learning Approach," Sep. 2020, doi: https://doi.org/10.18260/1-2--34916.

[7] E. Albaaly, "Effectiveness of Microsoft Teams in Student Teachers' Achievement in an EFL Teaching Methods Course," English Language Teaching, vol. 16, no. 1, p. 1, Nov. 2022, doi: https://doi.org/10.5539/elt.v16n1p1.

[8] Home Page of Canvas [Online], available at https://www.instructure.com/, last visited in June 2023.

[9] Parkinson, Sharon, and Eva Sweeney. "Creativity with Canvas." (2019).

[10] P. Patel, P. Morreale, Y. Kumar, et al. Embedding Equitable Design in the CS Computing Curricula. Proceedings of the 54th ACM Technical Symposium on Computer Science Education SIGCSE '23, https://doi.org/10.1145/3545947.3576278

[11] P. Patel, P. Morreale, J. Chu, Y. Kumar, et al. (2023) Implementing Inclusive Software Design in the CS Curriculum. Proceedings of the 54th ACM Technical Symposium on Computer Science Education SIGCSE '23, https://doi.org/10.1145/3545947.3573254.

[12] R. Al-Zou'bi and F. Shamma, "Assessing instructors' usage of emojis in distance education during the COVID-19 pandemic.," Cypriot Journal of Educational Sciences, vol. 16, no. 1, pp. 201–220, Feb. 2021, doi: https://doi.org/10.18844/cjes.v16i1.5520.

[13] R. L. Moffitt, C. Padgett, and R. Grieve, "Accessibility and emotionality of online assessment feedback: Using emoticons to enhance student perceptions of marker competence and warmth," Computers & Education, vol. 143, p. 103654, Jan. 2020, doi: https://doi.org/10.1016/j.compedu.2019.103654.

[14] M. Kim, T. L. Knotts, N. D. Albers, and K. E. James, "Emoji Use as a Catalyst for Relationship Building and Sustaining Attention in Online Classes: An Empirical Study," Education Sciences, vol. 12, no. 12, p. 874, Nov. 2022, doi: https://doi.org/10.3390/educsci12120874.

[15] T. Holtgraves and C. Robinson, "Emoji can facilitate recognition of conveyed indirect meaning," PLOS ONE, vol. 15, no. 4, p. e0232361, Apr. 2020, doi: https://doi.org/10.1371/journal.pone.0232361.

[16] C. V. Clark-Gordon, et al. (2018) "As good as your word": face-threat mitigation and the use of instructor nonverbal cues on students' perceptions of digital feedback, Communication Education, 67:2, 206-225, DOI: 10.1080/03634523.2018.1428759.

[17] N. A. Algharabali and H. A. Taqi, "Taming the Sting: The Use of Evaluative Emojis by College Students in Kuwait," International Journal

of Linguistics and Communication, vol. 6, no. 1, 2018, doi: https://doi.org/10.15640/ijlc.v6n1a4.

[18] R. Ronkainen, E. Kuusisto, and K. Tirri, “Growth Mindset in Teaching: A Case Study of a Finnish Elementary School Teacher,” International Journal of Learning, Teaching and Educational Research, vol. 18, no. 8, pp. 141–154, Sep. 2019, doi: https://doi.org/10.26803/ijlter.18.8.9.

[19] Y.-J. Chen, L. Hsu, and S. Lu, “How does emoji feedback affect the learning effectiveness of EFL learners? Neuroscientific insights for CALL research,” Computer Assisted Language Learning, pp. 1–24, Sep. 2022, doi: https://doi.org/10.1080/09588221.2022.2126498.

[20] H. Zeeb, J. Ostertag, and A. Renkl, “Towards a Growth Mindset Culture in the Classroom: Implementation of a Lesson-Integrated Mindset Training,” Education Research International, vol. 2020, pp. 1–13, Mar. 2020, doi: https://doi.org/10.1155/2020/8067619.

[21] C. S. Dweck and D. S. Yeager, “Mindsets: A View From Two Eras,” Perspectives on Psychological Science, vol. 14, no. 3, p. 174569161880416, Feb. 2019, doi: https://doi.org/10.1177/1745691618804166.

[22] S. Oinas, R. Ahtiainen, M.-P. Vainikainen, and R. Hotulainen, “Pupils’ Perceptions About Technology-enhanced Feedback: Do Emojis Guide Self-regulated Learning?,” Scandinavian Journal of Educational Research, pp. 1–15, Jul. 2020, doi: https://doi.org/10.1080/00313831.2020.1788149.

[23] Yeager, David S., and Carol S. Dweck. "What can be learned from growth mindset controversies?." American psychologist 75.9 (2020): 1269.

[24] D. Kwak, P. Morreale, S. T. Hug, Y. Kumar, et. al. Evaluation of the Use of Growth Mindset in the CS Classroom: Proceedings of the 53rd ACM Technical Symposium on Computer Science Education (SIGCSE’22), V. 1, February 2022, p. 878–884, https://doi.org/10.1145/3478431.3499365.

[25] D. Kwak, P. Morreale, J. Jenny Li, C.-Y. Huang, Y. Kumar, et al. Framework for a Growth Mindset Classroom: Proceedings of the 52nd ACM Technical Symposium on Computer Science Education (SIGCSE '21), March 2021, Page 1269, https://doi.org/10.1145/3408877.3439631.

[26] Priya, B. Gnana. "Emoji based sentiment analysis using KNN." International Journal of Scientific Research and Review 7.4 (2019): 859-865.

[27] Zemenu, Mekonnen. Aspect Level Sentiment Analysis Using Hybrid Deep Learning Approach for Amharic News Comments. Diss. 2022.

[28] A. Abduljabbar, N. Gupta, L. Healy, Y. Kumar, J. J. Li and P. Morreale, "A Self-Served AI Tutor for Growth Mindset Teaching," 2022 5th International Conference on Information and Computer Technologies (ICICT), 2022, pp. 55-59, doi: 10.1109/ICICT55905.2022.00018.

[29] N. Tellez, Serra, J., Kumar, Y., Li, J.J., Morreale, P. (2023). Gauging Biases in Various Deep Learning AI Models. In: Arai, K. (eds) Intelligent Systems and Applications. IntelliSys 2022. Lecture Notes in Networks and Systems, vol 544. Springer, Cham. https://doi.org/10.1007/978-3-031-16075-2_11.

[30] Noteable OpenAI plugin[Online], available athttps://noteable.io/chatgpt-plugin-for-notebook/, last visited in June 2023.

[31] Jacob Devlin, Ming-Wei Chang, Kenton Lee, Kristina Toutanova. BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding (2019), https://arxiv.org/abs/1810.04805.

[32] Yinhan Liu, Myle Ott, Naman Goyal, Jingfei Du, Mandar Joshi, Danqi Chen, Omer Levy, Mike Lewis, Luke Zettlemoyer, Veselin Stoyanov. RoBERTa: A Robustly Optimized BERT Pretraining Approach (2019), https://arxiv.org/abs/1907.11692.

[33] Zhilin Yang, Zihang Dai, Yiming Yang, Jaime Carbonell, Ruslan Salakhutdinov, Quoc V. Le.XLNet: Generalized Autoregressive Pretraining for Language Understanding, https://arxiv.org/abs/1906.08237.

[34] Annaliese Watson, Aysha Gardner, Dahana Moz Ruiz, Yulia Kumar, J. Jenny Li, Cody Glickman. Cyberbullying Detection Utilizing Artificial Intelligence and Machine Learning, Reserch Days at Kean University 2023 [Online], available at https://www.keanresearchdays.com/student-poster-presentation-2023-feed/sample-poster-layout-k37sg-btzea-ewstr-lmnln-2s6jh-zr9yy-6a3s6-ex4tb-yfmna.

[35] Quickstart tutorial on embedding ChatGPT-4 model in the react app [Online], available at https://platform.openai.com/docs/quickstart, last visited in June 2023.

[36] Home Page of GitHub Copilot [Online], available at https://github.com/features/copilot, last visited in June 2023.

[37] Burns, Monica. “How to use emojis in teaching”, George Lucas Educational Foundation, online at; https://www.edutopia.org/article/how-use-emojis-teaching/ last accessed on June 20, 2023.

[38] Vareberg, K.R., Vogt, O. & Berndt, M. Putting your best face forward: How instructor emoji use influences students’ impressions of credibility, immediacy, and liking. Educ Inf Technol 28, 6075–6092 (2023). https://doi.org/10.1007/s10639-022-11421-w.