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Assessing the Motivation and Emotion Levels of First-Year Engineering Students Enrolled in an Academic Writing Course

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Assessing the motivation and emotion levels of first-year engineering students enrolled in an academic writing course

Abstract

This Complete Research paper aims to assess the motivation level and emotion states of engineering students enrolled in a writing course. Communication has been identified as one of the important 21st-century skills. Research has revealed that engineers need to develop verbal and written communication skills to share their ideas with others. Engaging engineering students in writing activities is an effective mechanism to help them reflect and develop critical thinking skills. Scholars have argued that engineering students are reluctant and demotivated to engage in courses focused on academic or technical writing. Studies have confirmed that training engineering students in writing will help them to share disciplinary knowledge with the community. Since writing is an essential communication skill that needs to be mastered early on in the program, therefore, engineering institutions need to create courses that focus on writing. In this paper, we intend to focus on a first-year engineering course that introduces students to the art of writing. The objective of the course was twofold: i) to help undergraduate engineering students learn about the intricacies of writing, such as writing an argumentative essay, and ii) to foster a learner-centered environment to keep students motivated and allow them to freely express their ideas through writing. Since the course was targeted at first-year engineering students, instructors refrained from using technical jargon, the concepts were explained using simple English language. For example, students were not asked to propose a research question rather, they were asked to think of the *problems that they wanted to solve*. The instructor and mentors guided the students to modify the identified problems into research questions. The course followed a project-based learning approach, students needed to submit two final projects. In one project, they needed to identify a grand challenge and write a research proposal based on the grand challenge. For both the papers, students were provided some themes based on either daily challenges, or themes from other subjects such as *Artificial intelligence* and *Natures' Machines*. Based on these theme, students were required to write two reflection papers. Students for both these projects worked in a groups of five and were mentored by a research assistant.

The study was conducted in an engineering University located in India. The objective of the study was to understand the motivation and emotion level of students enrolled in a first-year writing course. The study used a 5-point Likert Scale to collect motivation and emotion levels data from 130 students enrolled in the course. The results of the study demonstrated that students showed a moderate to high level of motivation (M=3.62, SD=0.55), moderate to high level of positive emotions, they are *enjoyment, hope, and pride* (M=3.86, SD=0.66), and lower levels of negative emotions they are *anger, anxiety, shame, hopelessness, boredom* (M=2.64, SD=0.76). Further, we conducted multiple regression to assess the relationship between motivation and types of emotions they are *enjoyment, hope, pride, anger, anxiety, shame, hopelessness, and boredom*. The results indicated that enjoyment, anxiety, and shame were the predictors of student motivation [$F(8, 121) = 15.19$, $p < .001$, $R^2 = 0.50$, $R^2_{adj} = 0.47$)]. The results confirmed that enjoyment had a positive impact on student motivation, whereas anxiety and shame were the negative predictors. Overall, the study showcases that helping students to develop positive emotions can lead to higher motivational levels among students. Therefore, instructors need to create learner-centered writing courses that allow the students to express their ideas and feel motivated.

Introduction and Background

Communication skills have become an indispensable part of 21st-century university education. University students today are expected to have a variety of skills, including communication skills such as writing and scientific research abilities, which are critical for their respective future careers. Engineering education is no exception to this academic requirement [1]. The employability of engineering students today depends on more than just using their technical abilities; in order to even secure part-time employment and progress in their careers, they also require complementary professional abilities or soft skills [2], [3], [4]. These professional skills include the capacity for initiative, teamwork, communication, planning and organization, and commercial acumen [5], [6], [7]. Professionals believe that communication skills are one of the most important skills required for employability [8].

Writing and more specifically academic writing and communication is an important component of communication skills, particularly with reference to having success in University life. Furthermore, academic writing is useful not only when a student is in college but also in the workplace [9]. Surveys have also shown that employers also expressed dissatisfaction over engineering graduates' writing skills not meeting acceptable standards required by undergraduate students to fulfil their roles [9]. Therefore, there is a crucial need to teach engineering students skills of academic communication including skills like linguistic proficiency, the ability to obtain credible sources, the capacity to absorb information through various modes of thinking, and the capacity to articulate oneself persuasively to effectively contribute in a professional setting.

To fulfil the gap of lack of communication and more specifically writing skills, numerous engineering institutes have started to incorporate academic writing into undergraduate engineering curriculum. However, this development comes with its own set of problems. For example, the study by Ibrahim and colleagues [9] pointed out that students receive inadequate academic writing instruction prior to enrolling in institutions. Students are taught in schools to write in accordance with the material covered in textbooks and to replicate it while taking exams, as a result, students lack the necessary skills to think critically and creatively when it comes to academic writing. Similarly, the study by Yasin and colleagues [10] mention that the majority of engineering students believe that their technical knowledge is adequate for their jobs and neglect their academic writing skills. Additionally, many of them feel the burden of their academics is already heavy and academic writing adds unnecessary load which is why they don't take it seriously [10]. Moreover, Selvi and Saranya, [11] have revealed that class size and curriculum overload is another important factor that prohibits faculty to emphasize the need of academic writing into the course.

Recent studies have underscored the importance of student motivation in their learning and performance in academic writing. Research suggests that a sufficient amount of both intrinsic and extrinsic motivation encourages effort and perseverance in learning [12]. Motivation is also positively correlated with academic performance and accomplishments [13]. Specifically for academic writing, work by Wang and Troia, [14] reveals that motivation plays a critical role in students' writing achievements. Further empirical research also revealed that individual differences such as motivational beliefs and methods have been found to have a major impact on writing accomplishments [14], [15].

This shows that a more comprehensive understanding of both student motivations as well as emotions is required to fill the gap of writing skills in engineering students.

Student motivation in learning and academic writing

Student motivation directs student beliefs and actions towards a particular goal, which is why student motivation is important in determining academic success [16]. Various studies establish this relationship in terms of vision, goals, beliefs and achievement [17]. In this study, we focused on the basic psychological needs of Self-Determination theory to understand student motivation [18]. This theory has been particularly more applicable to educational settings, more specifically to understand student motives and persistence in universities [19].

Self-Determination theory argues that humans are motivated by the need to fulfil three basic psychological needs. The first need is *relatedness*, which refers to the sense of feeling related to others, to feel taken care of and connected to people around. It is related to a feeling of acceptance and belonging and perception that you are important to others. In a university setting, relatedness is promoted when students feel an emotional and intellectual bond with both their teachers and other classmates. The second need is *competence*, refers to the sense of command over the things that are highly essential to a person and to feel effective in one's surroundings. In educational settings, competence is enhanced by the ability of students to monitor how well they are learning new abilities or comprehending the course material. The third psychological need is *autonomy*, which refers to a set of behavior that is self-endorsed. It is based upon the belief that such actions are self-initiated and, therefore, have higher impetus to be completed. In a university setting, when students are offered choices for how to complete or present their work within a framework, students feel more in control of their learning.

Student emotion in learning and academic writing

Recent studies in the field of learning has also emphasized the role of emotion in learning [20]. Therefore it is crucial in gaining a comprehensive understanding of student emotions while they are engaged in any learning activity. The study conducted by Zambo and Brem [21] emphasized that instructors must acknowledge that emotion and cognition work in parallel during any learning activity [21]. Nugent et al emphasized the importance of positive and negative emotion states [22]. Positive emotional states allow one to see things from a wider angle, continue despite challenges, and react constructively to failures and criticism, which is particularly important while learning to write academically. Negative emotions, on the other hand, may result in low motivation or disengagement, which can impede a student's ability to learn and present challenging circumstances and dynamics for teachers to manage in the classroom.

According to the research of Pekrun et al. [23], emotions have been linked to student engagement and performance. Their research also showed that success and failure for students in writing courses are correlated with achievement emotions, which include motivational, and physiological emotions, as well as specific emotions like pride, shame, worry, and hope [13], [23]. Therefore through this study we want to understand the impact of a writing course on the motivation and emotion level of undergraduate engineering students. The research questions that we plan to answer through this study are: RQ 1: What are the motivational levels and emotional states of the

students enrolled in a first-year engineering writing course? RQ 2: How do the types of emotions differentially impact the motivation levels of first-year engineering students in a writing course?

Methods

Participants: The participants for this study are 130 undergraduate engineering students enrolled in an academic writing course. The data was de-identified prior to the analysis.

Context

The course covered the foundational skills that are central to an academic writing course, these skills are also of critical value for any engineer or technology enthusiast. The Academic Communication course had two major components: the 'Discussion component' and the Lab/ Tutorial component.

The 'Discussion component' has six modules. The first module of the course begins with examining the nature and structure of an argument. The second module dealt with 'academicality,' or the mechanics of academic writing, which includes distinguishing academic and non-academic sources and writing citations and references. It also involved learning about issues of academic integrity and plagiarism, the use and misuse of AI-generated texts and technology tools for writing such as Zotero. The third and fourth modules are concerned with two types of reading: cursory reading and committed reading. The fifth module consisted of two types of writing – representational writing and dialectical writing. The sixth module trains the student to construct an argumentative academic script. Table 1 represents the description of each module.

Table 1: Course Modules and Description

Module Number	Module Title	Description
1	Life as an Argument	Explores Heidegger's idea that life is an argument and the significance of rhetoric in articulating one's interpretation of life. This module draws on examples like the choice of the institution for studies by students to illustrate how our actions represent arguments.
2	Academicality in Writing	Focuses on the mechanics of academic writing, including differentiating between academic and non-academic sources, citations, references, academic integrity, and the use and misuse of AI and technology tools in writing (like Zotero).
3	Cursory Reading	Covers cursory reading strategies, including the steps involved and compiling a critical bibliography. This module teaches how to quickly assess and understand academic texts without

		deep engagement through skimming and scanning texts as well as employ speed reading.
4	Committed Reading	Deals with in-depth reading techniques, emphasizing annotation, and tracing the central argument of academic papers. This module is about engaging deeply with texts to understand, trace and critique the author's argument.
5	Types of Academic Writing	Discusses two types of writing: representational and dialectical. Representational writing includes introducing themes, mapping arguments, presenting evidence, and critiquing. Dialectical writing involves comparing and contrasting different viewpoints and constructing a narrative.
6	Constructing Academic Arguments	Trains students in constructing academic scripts that effectively represent authors' arguments, highlight existing debates, articulate one's stance in relation to these debates, and finally students are able to put forward their argument and provide evidence and reasoning in support of it.

The Lab/ Tutorial component had two parts: projects and a final exam. There were two written assignments of 800 words and 1200 words, respectively. Students were trained and coached to produce two argumentative papers based on themes provided in transdisciplinary collaboration with other courses. Some of the examples of the themes for 800-words paper were: Harnessing Nature's Wisdom, The Power of Genetic Engineering, Marvels of Human Physiology etc. and examples for 1200-words paper were, Water: Challenges in Urban and Rural Areas, Health: Contamination from Untreated Sewage, Education: Awareness and Community Initiatives. The Lab/ Tutorial component was conducted in six sessions of three hours each over a period of six weeks.

Data Collection
The data was collected using an online survey. The survey was conducted at the end of the semester. This survey was primarily designed to gauge the motivation and emotional states of students participating in the academic writing course. To accurately assess the motivational levels of the students, the BPNT-CS scale, developed by Conesa and Dunabeitia [24], was used. Recognizing that the fulfillment of basic psychological needs (BPNs) constitutes a foundational step towards fostering motivation, the survey aimed to first evaluate the extent of BPN fulfillment among the students. This evaluation focused on three critical dimensions: autonomy, competence, and relatedness. A five-point Likert scale survey consisting of eleven (11) questions was used. The questions were divided into three categories: autonomy, competence, and relatedness. The table 2 below represents the questions that were used to assess the BPNs of the students.

Table 2: Student Motivation Survey Questions [24]

BPNs Dimension	Questions
Autonomy Need Satisfaction	I feel I have been doing what really interests me in class.
	The activities I do in class match perfectly with the way I want to do them.
	In my class, I feel a sense of choice and freedom in the things I undertake.
	I feel I get the opportunity to express my ideas in the class
Competence Need Satisfaction	I feel competent to achieve my class/course goals.
	I am capable of effectively doing even the tasks considered difficult by most of my peers.
	In class, I feel confident that I can do things well.
	I think I can meet the demands of the course/class.
Relatedness Need Satisfaction	I feel very comfortable with my teachers and classmates.
	I feel like I have a close bond with my teachers and classmates.
	I get along with my peers very well

In order to mention the emotion states of the students, the learning emotion questions developed by Pekrun and colleagues [23] were adopted. A five-point Likert Scale was used to measure the students' emotional states. The Table 3 represents the questions that were used to assess the emotion level of the students.

Table 3: Student Emotion Survey Questions [23]

Emotion	Question
Enjoyment	I enjoy acquiring new knowledge through this course
Hope	I have an optimistic view toward this course
Pride	I'm proud of my skills and abilities I developed through this course
Anger	This course makes me irritated
Anxiety	I get tense and nervous while studying for this course
Shame	I feel ashamed that I can't absorb the simplest of details discussed in the course
Hopelessness	I feel hopeless when I think about studying this course
Boredom	I feel bored going through the course materials

Data Analysis
The data was analyzed using descriptive and inferential statistics. Descriptive statistics were used to understand the overall motivation and emotion levels of the students. Inferential statistics was used to understand the relationship between BPNs and emotion level of the students. We used multiple regression to understand what types emotion are predictors of student motivation in the academic writing course.

Results
Motivation Level

Descriptive statistics was used to analyze the motivation level of the students for learning and performance in academic writing. The Table 4 represents the mean and the standard deviation of the three dimensions of the Basic Psychological Needs Scale. From the table 4, we can interpret that the mean score for the relatedness was higher, followed by competence and autonomy scores.

Table 4: Mean and Standard Deviation scores for Student Motivation

	Mean	SD
Autonomy Need Satisfaction	3.26	0.69
Competence Need Satisfaction	3.64	0.61
Relatedness Need Satisfaction	3.97	0.73
Overall Motivation Level	3.62	0.55

Further, to visualize the scores of the students and gain a deeper understanding, a box plot was created. The box plots for Autonomy, Competence, and Relatedness present a comprehensive overview of how students perceive these key dimensions of motivation, see Figure 1. The median values, as indicated by the lines within the boxes, show that all three aspects are generally perceived positively, with Competence, in particular, exhibiting a slightly higher median, suggesting a strong sense of skill and efficacy among the participants. The interquartile ranges (IQRs) for Autonomy and Relatedness are relatively tight, indicating that most responses cluster around the median, suggesting a commonality in how participants feel about their autonomy and sense of connection with others. In contrast, the IQR for Competence is somewhat wider, reflecting a more varied experience in perceived skill levels among the participants. Overall, these plots indicate that while there is a general trend of positive perception in Autonomy, Competence, and Relatedness.
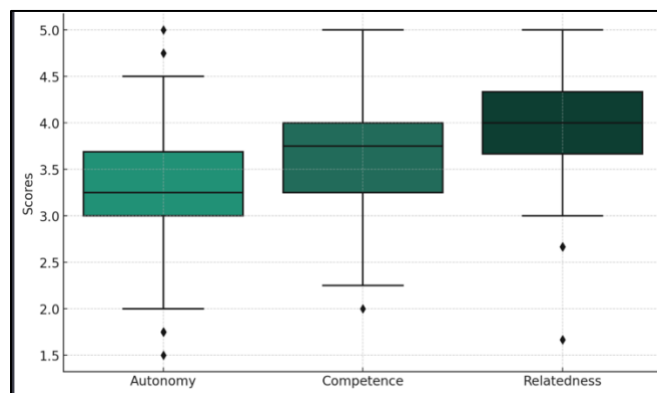

Figure 1: Box plots for BPNS Dimensions

Emotion Level of students

In order to understand the emotional level of the students, descriptive statistics were used to calculate the mean and standard deviation for each emotion type. From the Table 5, we can interpret that students showcased a high degree of positive emotions they includes enjoyment, hope and pride and a low degree of negative emotions, such as, anger, anxiety, shame, hopelessness and boredom. It is also important to note that the degree of pride demonstrated by the students was the highest among all the emotion types.

Table 5: Mean and Standard Deviation scores for Student Emotion

	Emotion	Mean	SD
Positive Emotions	Enjoyment	3.91	0.78
	Hope	3.60	0.89
	Pride	4.08	0.72
Negative Emotions	Anger	2.95	0.96
	Anxiety	2.95	1.17
	Shame	2.12	0.97
	Hopelessness	2.35	1.00
	Boredom	2.86	0.99

Further, the data was visualized using box plots for each emotion type they are Enjoyment, Hope, Pride, Anger, Anxiety, Shame, Hopelessness, and Boredom, revealing significant insights into the emotional states of the students, see Figure 2. The median scores, indicated by the lines within each box, suggest varying central tendencies across these emotions. Notably, Enjoyment and Hope appear to have higher median scores, indicating a generally positive emotional state among the participants. In contrast, emotions like Anxiety and Shame show lower median values, reflecting less intense emotion types.
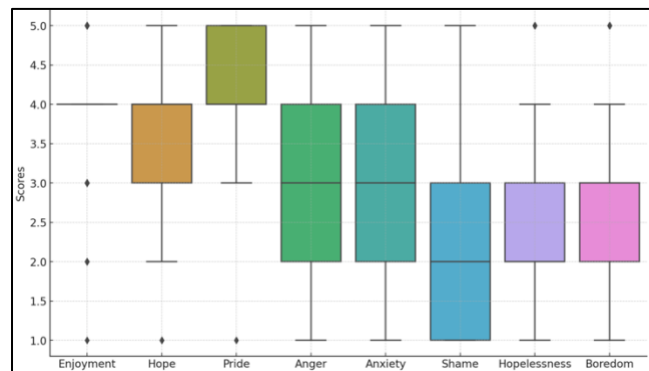

Figure 2: Box plots for Emotion Types

Regression results

A multiple regression analysis was conducted to explore the predictors of motivation. The model included eight predictors: enjoyment, hope, pride, anger, anxiety, shame, hopelessness, and boredom. The model was statistically significant, $F(8, 121) = 15.19$, $p < .001$, and accounted for approximately 50.1% of the variance in motivation ($R^2 = .501$, Adjusted $R^2 = .468$).

The results indicated that enjoyment was a significant predictor of motivation ($\beta = 0.229$, $p = .002$). Similarly, anxiety ($\beta = -0.101$, $p = .014$) and shame ($\beta = -0.152$, $p = .012$) were also found to be significant predictors. In contrast, hope ($\beta = 0.037$, $p = .551$), anger ($\beta = -0.047$, $p = .363$), and boredom ($\beta = -0.070$, $p = .111$) were not significant predictors of motivation. Pride ($\beta = 0.104$, $p = .089$) and hopelessness ($\beta = 0.113$, $p = .049$) were found to be marginally significant.

The regression equation for predicting motivation based on the significant predictors is as follows:

Motivation = 2.866 + 0.229(Enjoyment) - 0.101(Anxiety) - 0.153(Shame)

Residuals were examined to assess the assumptions of the regression model. The scatter plot of observed vs. predicted values and the plot of residuals vs. predicted values indicated that the assumptions of linearity and homoscedasticity were reasonably met. The histogram and Q-Q plot of the residuals suggested that the residuals were approximately normally distributed, with some minor deviations at the tails. The Durbin-Watson statistic was 2.04, indicating no significant autocorrelation in the residuals. These checks support the appropriateness of the regression model for the data.

From the figure 3, we can interpret that the **Observed vs. Predicted Value** scatter plot shows a good alignment of observed and predicted values of motivation, suggesting a reasonable fit of the model. Further, the scatter plot for **Residuals vs. Predicted Values** doesn't show any clear pattern or funnel shape, which is a positive indication of homoscedasticity (constant variance of residuals across all levels of predicted values). The **Histogram of Residuals** was along with the Kernel Density Estimate (KDE), suggests that the residuals are approximately normally distributed, though there might be some slight deviations. Lastly, from the **Q-Q Plot of Residuals,** we can interpret that the residuals mostly follow the line, indicating that they are approximately normally distributed.
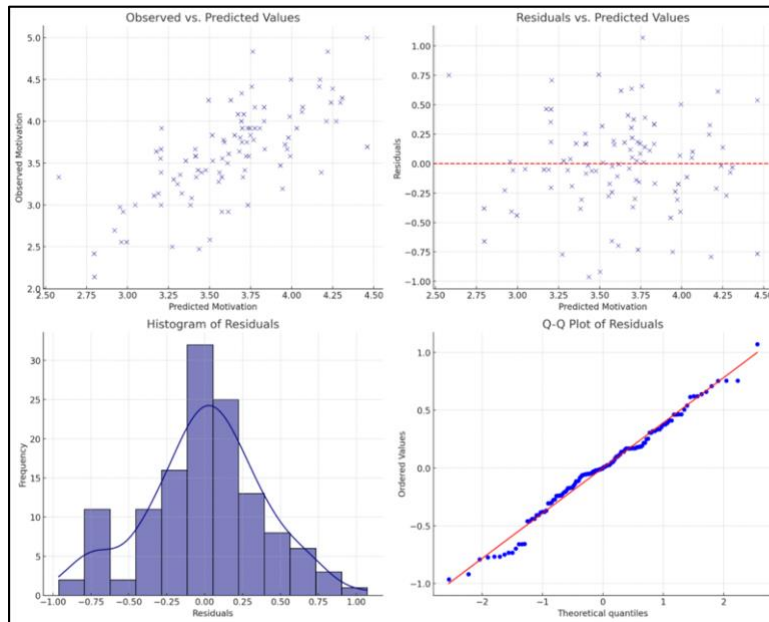
Figure 3: Residual plots

Discussion and Conclusion

The study focused on understanding the motivation level and emotional states of engineering students enrolled in an academic writing course. The study used a Basic Psychological Needs survey and an Achievement Emotion Questionnaire to collect data regarding student motivation and emotions. The study answered two research questions. The first research question was, *what are the motivational levels and emotional states of the students enrolled in a first-year engineering writing course?* In order to answer this research question, the survey data collected for motivation and emotion were quantitatively analyzed using descriptive statistics. The results of the analysis revealed that students demonstrated a moderate level of motivation and a high level of positive emotion. It was also noted for emotions the students as a group showed a moderate level of autonomy which suggests that students did not entirely feel, self-directed in their actions. Scores for competence were a bit higher than autonomy, but overall students showcased a moderate level of competence which means that students probably felt capable and effective in managing tasks and challenges in the course. Among the three dimensions of the BPNS, the scores for relatedness were the highest which suggests that these students felt supported and understood in their relationships and experienced a strong sense of belonging and connection with faculty, mentors and peers. Analysis of student emotion scores indicated that students experienced high levels of positive emotion over negative emotions. Among all the positive emotions the degree of pride demonstrated by the students was very high, this shows that students felt proud of the skills and abilities they developed through this course. Although the negative emotions experienced by the students were less, students did experience some degrees of anxiety, anger and boredom in the course.

In order to understand the relationship between student motivation and student emotion and answer our second research question *RQ 2: How do the types of emotions differentially impact the*

motivation levels of first-year engineering students in a writing course? a multiple regression was conducted. The results of the multiple regression revealed that the Motivation of the students is impacted by three emotion types, which are enjoyment, anxiety, and shame. Based on the regression equation, we can interpret that enjoyment emerges as a significant positive predictor of motivation, which means an increase in enjoyment results in a proportional rise in motivation. This suggests that the goal of the instructors or mentors should be to focus on ways to help students acquire new knowledge so that they can experience a high degree of enjoyment in the course. Some of the strategies that they could employ are incorporating hands-on activities, discussions, and reflections, which will help students make meaning of their learning. Linking course content to real-life scenarios and students' personal interests can also make the material more relevant and interesting.

It was also noted that anxiety and shame were negative predictors or detrimental to student motivation. To mitigate these challenges, educators should cultivate a supportive and inclusive classroom environment, where mistakes are viewed as natural learning steps, and diversity in learning styles is acknowledged and respected. Open communication will allow students to feel comfortable in sharing their concerns, knowing they will be met with empathy and understanding. Adapting teaching methods to accommodate different learning preferences, and providing structured, clear resources will help explain complex concepts in a simpler manner. Instructors also need to encourage self-reflection and a growth mindset. As that will enable students to view challenges as opportunities for growth. These strategies can help instructors to significantly reduce anxiety and shame, creating a more engaging and effective learning environment.

Overall, from this study, we can conclude that motivation and emotion are both important in fostering student learning. Motivation shows a strong relationship with student emotion level. Therefore, the goal of the instructors should be to create opportunities that foster positive emotions and lower negative emotions. Providing students with opportunities to have some control over their learning and giving them the opportunity to learn new concepts with their peers can also help them foster autonomy, competence, and relatedness.

Implication for Teaching and Learning and Future Work
To foster autonomy, competence, and relatedness in the classroom, along with cultivating positive emotions like enjoyment, hope, and pride, instructors must provide students with choices and encourage more self-directed learning projects as it enhances autonomy. Instructors should provide students constructive feedback on their projects to ensure incremental success will help to build competence and pride. Creating collaborative learning environments and open discussions will promote a sense of relatedness and connectedness. Lastly, incorporating novel and real-life content into the curriculum will foster enjoyment and hope among students. These strategies can help instructors create a dynamic, supportive learning environment where students feel empowered, connected, and motivated, fostering both academic success and personal growth. Moreover, as a part of future work, we intend to compare the motivation and emotion levels of engineering students enrolled in academic writing courses in the United States and India. We also plan to conduct interviews to understand the impact of large language models (LLMs) such as ChatGPT on academic writing skills of the students.

References

[1]   R. Núñez-Pacheco, E. Vidal, A. Barreda-Parra, and E. Castro-Gutierrez, "Scientific Research and Writing Skills in Engineering Students," in *Information Technology and Systems*, vol. 692, Á. Rocha, C. Ferrás, and W. Ibarra, Eds., in Lecture Notes in Networks and Systems, vol. 692. , Cham: Springer International Publishing, 2023, pp. 75–83. doi: 10.1007/978-3-031-33261-6_7.

[2]   H. Menand, "Critical instruction, student achievement, and the nurturing of global citizens: Global and comparative education in context," in *Critical Practice in P-12 Education: Transformative Teaching and Learning*, IGI Global, 2014, pp. 1–23. Accessed: Jan. 24, 2024. [Online]. Available: https://www.igi-global.com/chapter/critical-instruction-student-achievement-and-the-nurturing-of-global-citizens/93526

[3]   A. Jaiswal, T. Karabiyik, P. Thomas, and A. J. Magana, "Characterizing Team Orientations and Academic Performance in Cooperative Project-Based Learning Environments," *Educ. Sci.*, vol. 11, no. 9, Art. no. 9, Sep. 2021, doi: 10.3390/educsci11090520.

[4]   A. J. Magana, T. Karabiyik, P. Thomas, A. Jaiswal, V. Perera, and J. Dworkin, "Teamwork facilitation and conflict resolution training in a HYFLEX course during the COVID -19 pandemic," *J. Eng. Educ.*, vol. 111, no. 2, pp. 446–473, Apr. 2022, doi: 10.1002/jee.20450.

[5]   P. Bahrami, Y. Kim, A. Jaiswal, D. Patel, S. Aggrawal, and A. J. Magana, "Information Technology Undergraduate Students' Intercultural Value Orientations and Their Beliefs about the Influence of Such Orientations on Teamwork Interactions," *Trends High. Educ.*, vol. 2, no. 2, pp. 270–282, 2023.

[6]   A. Jaiswal, K. Patel, D. Patel, and A. Magana, "Perceived scrum Values, Conflict Resolution Ability, and Cultural Self-Awareness in the Context of System Analysis and Design Teamwork," in *2022 ASEE Annual Conference & Exposition*, 2022.

[7]   A. Jaiswal, T. Karabiyik, L. Jin, and K. Acheson-Clair, "Enhancing Team Communication Skills via Portable Intercultural Module in a Systems Thinking Class," in *2023 ASEE Annual Conference & Exposition*, 2023.

[8]   O. K. Bee and T. S. Hie, "Employers' emphasis on technical skills and soft skills in job advertisements," *Engl. Teach.*, vol. 44, no. 1, 2015, Accessed: Jan. 24, 2024. [Online]. Available: https://meltajournals.com/index.php/TET/article/view/87

[9]   S. Ibrahim, M. A. M. Yunus, and M. T. M. Khairi, "Teaching academic writing for engineering students: Challenges and recommendations," *Int. J. Educ. Psychol. Couns.*, vol. 2, no. 5, pp. 160–169, 2017, Accessed: Jan. 24, 2024. [Online]. Available: https://www.researchgate.net/profile/Mohd-Taufiq-Mohd-Khairi/publication/324217728_Teaching_academic_writing_for_engineering_students_Challenges_and_recommendations/links/5ac575caa6fdcc051daf27a7/Teaching-academic-writing-for-engineering-students-Challenges-and-recommendations.pdf

[10]   A. Y. M. Yasin, "The English proficiency of civil engineering students at a Malaysian polytechnic," 2010, Accessed: Jan. 24, 2024. [Online]. Available: http://103.62.146.201:8081/jspui/handle/1/1841

[11]   M. T. Selvi and P. Saranya, "The Difficulties Encountered by English Professors when Attempting to Teach Writing Skills to Freshman Engineering Students," *J. Lang. Linguist. Soc. JLLS ISSN 2815-0961*, vol. 2, no. 05, pp. 30–47, 2022, Accessed: Jan. 24, 2024. [Online]. Available: http://journal.hmjournals.com/index.php/JLLS/article/view/1176

[12]   C. Liu, Y. Shi, and Y. Wang, "Self-Determination Theory in Education: The Relationship between Motivation and Academic Performance of Primary School, High School, and

College Students," in *2022 3rd International Conference on Mental Health, Education and Human Development (MHEHD 2022)*, Atlantis Press, 2022, pp. 923–929. Accessed: Jan. 24, 2024. [Online]. Available: https://www.atlantis-press.com/proceedings/mhehd-22/125975933

[13] M. McBride and M. A. Sweeney, "Frustration and Hope," *J. Basic Writ.*, vol. 38, no. 2, pp. 38–63, 2019, Accessed: Jan. 24, 2024. [Online]. Available: https://www.jstor.org/stable/27027814?casa_token=D7zoIYPMuC8AAAAA:FiugHFvg6gG rXSSkjh-rSV-U_wp3-tSrcaxdQqlS-ssW7-FvSmTgtSjI1GR_yFkHFr29gZhB_Ekb2paUW4EGndl-qQG_pnm8_GjmtWJZXMdC8QKxPJPB

[14] H. Wang and G. A. Troia, "How students' writing motivation, teachers' personal and professional attributes, and their writing instruction impact student writing achievement: A two-level hierarchical linear modeling study," *Front. Psychol.*, vol. 14, p. 1213929, 2023, Accessed: Jan. 24, 2024. [Online]. Available: https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1213929/full

[15] S. Graham, D. McKeown, S. Kiuhara, and K. R. Harris, "A meta-analysis of writing instruction for students in the elementary grades.," *J. Educ. Psychol.*, vol. 104, no. 4, p. 879, 2012, Accessed: Jan. 24, 2024. [Online]. Available: https://psycnet.apa.org/record/2012-18075-001

[16] R. Steinmayr, A. F. Weidinger, M. Schwinger, and B. Spinath, "The importance of students' motivation for their academic achievement–replicating and extending previous findings," *Front. Psychol.*, vol. 10, p. 1730, 2019, Accessed: Jan. 24, 2024. [Online]. Available: https://www.frontiersin.org/articles/10.3389/fpsyg.2019.01730/full?ref=blog.toptutors.dk

[17] A. Wigfield, S. Tonks, and S. L. Klauda, "Expectancy-value theory," *Handb. Motiv. Sch.*, vol. 2, pp. 55–74, 2009, Accessed: Jan. 24, 2024. [Online]. Available: https://books.google.com/books?hl=en&lr=&id=P5GOAgAAQBAJ&oi=fnd&pg=PA55&d q=Wigfield,+A.,+Tonks,+S.,+%26+Klauda,+S.+L.+(2016).+Expectancy-value+theory.+In+K.+R.+Wentzel+%26+D.+B.+Miele+(Eds.),+Handbook+of+Motivation +in+School,+2nd+Edn.+(pp.+55%E2%80%9374).+New+York,+NY:+Routledge.&ots=S1 Ufb_Gv6Z&sig=_smOdSEAFvenuyDa7PeP6vGVeHE

[18] E. L. Deci and R. M. Ryan, "Self-determination theory," *Handb. Theor. Soc. Psychol.*, vol. 1, no. 20, pp. 416–436, 2012, Accessed: Nov. 13, 2023. [Online]. Available: https://www.torrossa.com/gs/resourceProxy?an=4912667&publisher=FZ7200#page=438

[19] C. B. Yarborough and H. N. Fedesco, "Motivating students," *Vanderbilt Univ. Cent. Teach.*, 2020.

[20] A. Jaiswal, J. Divya Venkatesh, and G. Nanda, "Understanding Student Engagement during an Experiential Learning Task Using Eye Tracking: A Case Study.," presented at the IEEE Frontiers in Education, 2023.

[21] D. Zambo and S. K. Brem, "EMOTION AND COGNITION IN STUDENTS WHO STRUGGLE TO READ: NEW INSIGHTS AND IDEAS," *Read. Psychol.*, vol. 25, no. 3, pp. 189–204, Jul. 2004, doi: 10.1080/02702710490489881.

[22] A. Nugent *et al.*, *Higher education learning framework: An evidence informed model for university learning*. The University of Queensland, 2019. Accessed: Jan. 30, 2024. [Online]. Available: https://eprints.qut.edu.au/207793/

[23] R. Pekrun, T. Goetz, A. C. Frenzel, P. Barchfeld, and R. P. Perry, "Measuring emotions in students' learning and performance: The Achievement Emotions Questionnaire (AEQ)," *Contemp. Educ. Psychol.*, vol. 36, no. 1, pp. 36–48, 2011.

[24] P. J. Conesa and J. A. Duñabeitia, "The Basic Psychological Needs in the Classroom Scale (BPN-CS)," *Behav. Sci.*, vol. 11, no. 7, p. 96, Jun. 2021, doi: 10.3390/bs11070096.