

Self-Reported Emotions of Engineering Instructors During and After a Sudden Change

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I am an engineer who loves to work with people, learn about new ideas and developments in my field, and spend quality time with friends and family. My goal is to inspire the next generation of engineers to be curious, excited, and passionate about engineering and life. In my free time I enjoy playing flag football, crocheting, cooking, and gardening.

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Abstract

There is a need for a deeper understanding of instructors' adaptability so that supports can be put in place to sustain teaching and learning in times of considerable disruption (e.g., natural disasters, public health emergencies, and man-made incidents). This study is an investigation into the emotional adaptability of engineering instructors over three disrupted semesters and how their self-reported emotions compared to those experienced during a non-disrupted semester. Study participants were engineering instructors from a U.S. research intensive institution. Weekly online surveys were administered to instructors during the last seven weeks of the Spring 2020 semester and biweekly in the Fall 2020 and Spring 2021 semesters which included an item about their emotions and an item about the normality of their emotions. Descriptive statistics were used to identify trends in self-reported emotions. Generally, instructors self-reported more positive emotions than negative emotions across all three semesters. As the original disruption continued to impact teaching, instructors reported their emotions to be more similar to pre-disruption times. By studying engineering instructors' emotions during a disruption that impacted teaching, the groundwork has begun to help identify supports needed for instructors to adapt to sudden change and continued uncertainty.

Keywords

Faculty, Descriptive Statistics, Adaptability, Emotion

Background

Natural disasters (e.g., hurricanes, tornadoes, wildfires), public health emergencies (e.g. COVID-19, H1N1 novel influenza), and man-made incidents (e.g., terrorism, war, cyber-attacks) disrupt educational systems locally and globally. Disruptions often require educators to re-think how to deliver educational material in new ways. But prior research indicates that engineering instructors in higher education have been slow to change their teaching practices [1], [2], [3]. This may indicate that instructors may not be adequately prepared for disruptions. Most recently, the impact of COVID-19 resulted in significant alterations in educational spaces on a global scale as demonstrated in [4], [5], [6], [7], [8]. At the university level, the upheaval and the uncertainty due to the evolving situation forced instructors to adapt their teaching to new and changing circumstances. As instructors adapted to the new and changing circumstances, their emotions were impacted. Focusing on the emotional impact the situation had on university engineering instructors can, in combination with other data sources, lead to considerations for support systems for current and future educational disruption events. To understand how a sudden change affected engineering instructors' emotions, this study used adaptability as its theoretical framework.

Theoretical Framework

Adaptability

In the psychology-related fields, adaptability is seen as combining different aspects of change and includes cognitive, behavioral, and emotional dimensions. The definition of adaptability used in this study was the “capacity to adaptively regulate cognition, emotion, and behavior in response to new, changing, and/or uncertain conditions and circumstances” [9, p. 90].

The Cognitive-Behavior-Emotional Adaptability Model (CBEAM) was created by Martin et al. [9], [10] and modified versions of it have been used in studies to look at the adaptability of students and instructors within the context of the COVID-19 pandemic [11],[12],[13],[14],[15],[16]. CBEAM has three dimensions: cognition, behavior, and emotion.

When faced with a challenging, novel, or uncertain situation, cognitive adaptability involves thinking about the situation in different ways or changing one’s thoughts about the situation or circumstance. Behavioural adaptability involves adjusting one’s actions in order to manage the change in situation or circumstance. Emotional adaptability involves adjusting one’s emotions to reduce less helpful emotions (e.g. anxiety) or increase positive emotions (e.g. hope) in the face of novelty, change, or uncertainty. [17, p. 61]

To adapt, a person, or engineering instructor in this case, must adjust these dimensions in the face of a novel or changing event [18]. The research presented here builds upon previous work [15] to examine emotions over a prolonged and often evolving change situation.

Emotions

Emotions in an educational setting are defined as “socially constructed, personally enacted ways of being that emerge from conscious and/or unconscious judgements regarding perceived success at attaining goals or maintaining standards or beliefs during transactions as part of social-historical contexts” [19, p. 344]. Therefore, emotions are the way a person feels about changes in their context and these feelings/emotions are relatable to other people in the same culture since history is shared in the group.

Research has found that emotions can impact the “attention, memory, thinking and problem solving” ability of educators [20, p. 610]. Negative emotions can cause working memory to be limited and decrease motivation, whereas positive emotions can promote creativity [21]. Furthermore, emotions can impact the “well-being, job satisfaction, burnout risk and retention” and “teaching strategies, curriculum selection and lesson planning” [22, p. 1236]. Positive emotions have been correlated with success in teaching and research [23]. Research findings have also pointed to the idea that fostering positive emotions may improve instructors’ ability to teach and complete research.

However, there is limited research on engineering instructors’ emotions during and after a sudden change in the educational space. The need to look at emotions in engineering education was encouraged at the beginning of the pandemic [24]. In multiple studies, instructors experienced both negative and positive emotions [15], [25]. However, researchers found that during the initial

months of the COVID-19 pandemic, instructors experienced more positive emotions than negative emotions [15], [25]. While these findings start to reveal engineering instructors' emotions and provide insight into how to support engineering instructors in uncertain times, additional research needs to be done to better understand the evolution of emotions as the change event continued across multiple semesters.

This study took a closer look at the emotional aspect of adaptability of engineering instructors during a global disruption. The goal of this research was to understand the emotions engineering instructors experienced during these unprecedented times.

Research Purpose and Questions

The purpose of this descriptive quantitative survey study was to gain an understanding of how engineering instructors at a research-intensive institution adapted emotionally over three pandemic impacted semesters and how their self-reported emotions compared to those experienced during pre-pandemic semesters. The research questions guiding this study are:

- (1) How do engineering instructors' self-reported emotions change over the course of three pandemic impacted semesters?
- (2) How do instructors perceive the normality of their emotions over the course of three pandemic impacted semesters compared to pre-pandemic conditions?

Methods

Setting and Participants

The disruption event, COVID-19, occurred during Spring 2020 and the subsequent semesters, Fall 2020 and Spring 2021. Teaching that occurred in the Spring 2020 semester is referred to as Emergency Remote Teaching (ERT), which is defined as "a temporary shift of instructional delivery to an alternate delivery mode due to crisis circumstances" [26]. Teaching that occurred in the Fall 2020 and Spring 2021 semesters is referred to as Pandemic Impacted Teaching (PIT) and is defined as the delivery of course instruction following the ERT period in which instructors have time to prepare and adjust their teaching to policies about when (e.g., schedule changes, synchronous vs. asynchronous), where (e.g. in-person vs. remote vs. online), how (e.g., taking into account students' preparedness), and specific conditions (e.g., mask policies in response to infection rates, student absences due to contracting of disease). During ERT and PIT, instructors had to adapt their teaching, in terms of delivery mode (e.g., online, in-person, or hybrid, synchronous or asynchronous), to accommodate various and changing levels of safety precautions.

The research participants were engineering professors of practice, tenure-track, and tenured faculty that held the ranks of assistant, associate, and full, from an U.S. research intensive institution. Lectures and adjuncts (non-ranked positions) were not included as they often have different motivations and duties relative to teaching compared to ranked positions. Instructors represented seven different engineering departments. Of the 160-175 (variation depended on the semester and course offerings) engineering instructors that were invited to participate and met the

selection criteria (position code), 39 participated in Spring 2020, 46 in Fall 2020, and 45 in Spring 2021.

Participant demographics are shown in Table 1. The number of participants who participated in all three semesters was 19. The number of participants who participated in Spring 2020 and Fall 2020 was six. The number of participants who participated in Fall 2020 and Spring 2021 was seven. Compared to the College’s demographics (19% female), females were overrepresented in the sample during Spring 2020 and Fall 2020.

Table 1. Demographics of engineering instructor participants over three semesters

Demographics	Spring 2020 (n=39)		Fall 2020 (n=46)		Spring 2021 (n=45)	
	n	%	n	%	n	%
Gender						
Female	11	28%	14	30%	8	18%
Male	28	72%	32	70%	37	82%
Position						
Assistant Tenure-Track Professor	12	31%	15	33%	14	31%
Associate and Full Professor	15	38%	18	39%	15	33%
Assistant, Associate, and Full Professor of Practice	12	31%	9	20%	14	31%

Data Collection

The data for this study were collected through online surveys. During ERT, Spring 2020 (March – May), online surveys were administered in the last seven weeks of the semester. During PIT, Fall 2020 (August – November) and Spring 2021 (January – May), surveys were administered across each semester. All surveys contained multiple select, multiple choice, and open-ended items that were mapped to the three dimensions of the CBEAM[9], [10]. Seven data collection points occurred during Spring 2020; surveys were released weekly starting in Week 12 (beginning of ERT) and ending the week after finals when grades were issued. Eight data collection points occurred during Fall 2020 and Spring 2021; surveys were released biweekly starting at the beginning of the semester and ending during the week of final exams. In all semesters, surveys were released on a Friday, with reminders on Monday and Tuesday, before closing at midnight on Tuesday. As necessary, the end date was extended by up to three days to encourage greater participation during stressful times. The Cronbach’s alpha coefficient for the instrument was 0.83 [16].

This study was an analysis of the responses to one multiple select and one multiple choice item mapped to the emotions dimension of CBEAM [9], [10]. The multiple select item on each survey asked instructors to reflect on their emotions since the last survey and select from a randomized list of 48 positive and negative emotions mapped to eight positive and eight negative categories as shown in Table 2 [14]. The survey item asked: “which words best describe how you felt about teaching during [specified period]?” The list of emotions was based on Drummond’s Emotions/Feelings Vocabulary [27] and expanded and adapted to include an equal number of positive and negative emotions appropriate for the teaching context [14], [15].

Table 2. Positive and negative emotion categories

Positive Emotions		Negative Emotions	
Happiness	Positivity	Depression	Hurt
Adequate	Stable	Inadequate	Anger
Committed	Braced	Fear	Loneliness
Caring	Accomplished	Confusion	Remorse

The multiple choice item asked participants whether they perceived the emotions they had felt since the last survey were similar or different to ones they experienced during a non-COVID-impacted semester. The survey item was worded as: “The feelings I indicated above are similar to those I have felt when teaching in a typical semester prior to COVID-19.” The 4-point scale used for this item was collapsed into two categories labelled ‘Typical’ (agree and strongly agree) emotions and ‘Atypical’ (disagree and strongly disagree) emotions.

Data Analysis

Descriptive analysis of the responses to the multiple select item about the emotions instructors self-reported experiencing was conducted. If an instructor selected any one of the three words that represented an emotion category, the participant was counted as having experienced that emotion. For example, if an instructor selected one or more of the words ‘Excited,’ ‘Happy,’ or ‘Pleased’, they were counted once as having experienced the emotion of ‘Happiness.’ These values were used to determine frequency counts for the overall positive and negative emotions as well as each emotion category. Due to a changing number of participants per survey, frequencies were changed into percentages to normalize the data presented. These percentages were then compared across the three semesters of ERT and PIT.

The perceived normality of the emotions experienced by instructors was also compared over the three semesters. The percentages of ‘Typical’ and ‘Atypical’ responses over the three semesters were compared to determine trends.

Results

In Figure 1, the percentage of participants that selected at least one positive or negative emotion on each survey are shown.

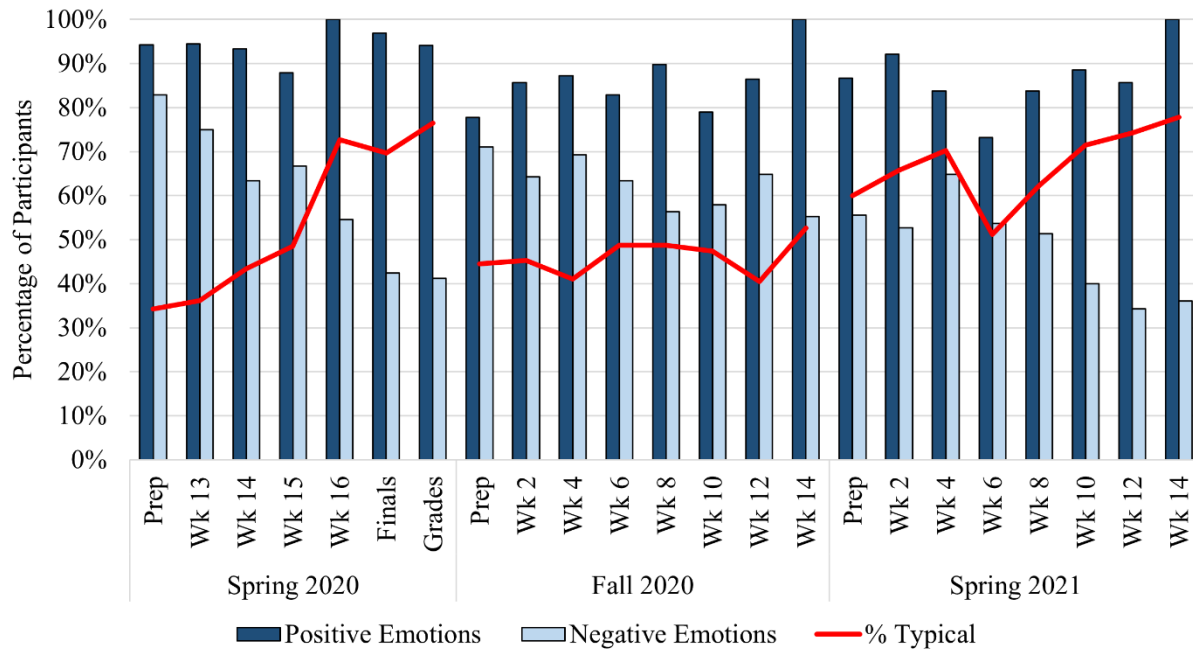
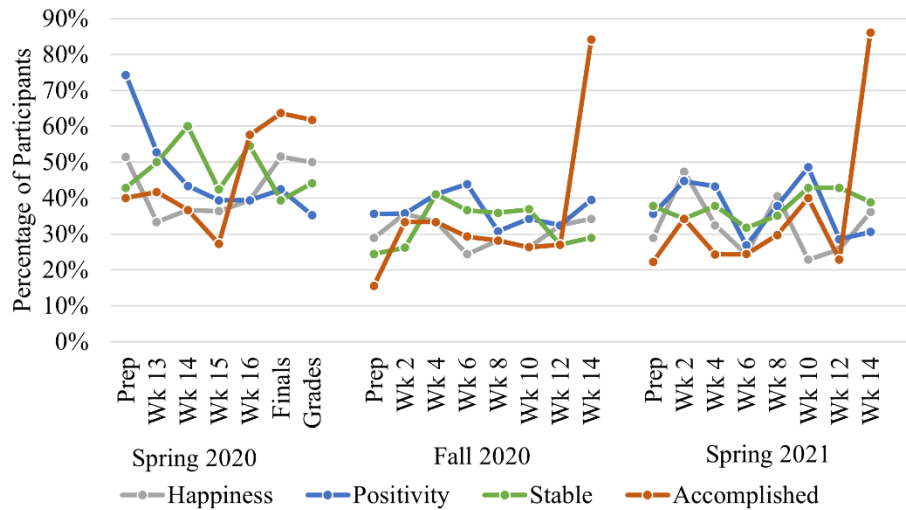


Figure 1. Percentage of participants that selected at least one positive or negative emotion per survey and percentage of participants that indicated that the emotions they selected were typical of a non-COVID semester.

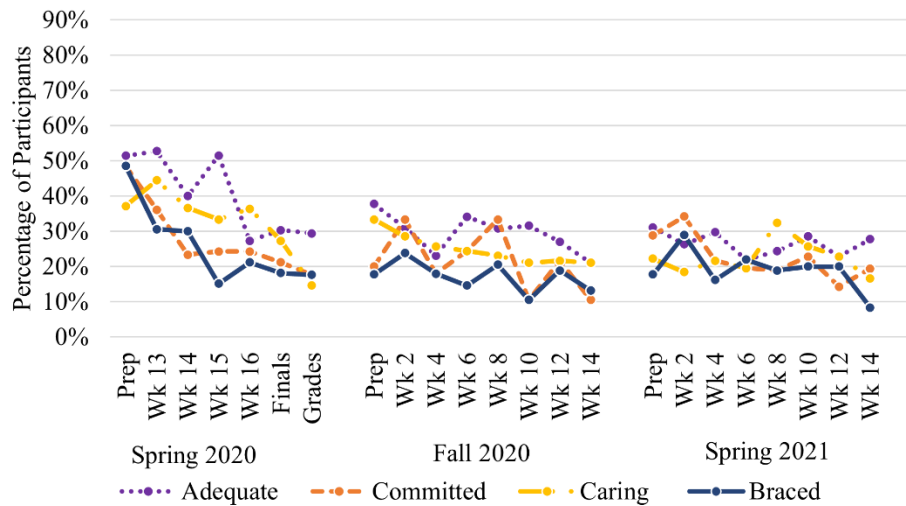
In all three semesters, the percentage of instructors that selected one or more positive emotions was higher than the percentage of instructors that selected one or more negative emotions. For the last week of classes in each semester (Week 16 in Spring 2020, and Week 14 in Fall 2020 and Spring 2021), 100% of participants indicated one or more positive emotions. Compared to Spring 2020, the average percentage of positive emotions in Fall 2020 was lower (94% vs. 86%). Spring 2021 had similar average positive emotions compared to Fall 2020 (87% vs. 86%). However, in Week 6 of the Spring 2021 semester, the lowest recorded percentage of participants selecting positive emotions was reported across all three semesters (73%). In Spring 2020, there was a decrease in participants selecting at least one negative emotion from a high of 83% during the prep week to a low of 41% during grades week. In Fall 2020, the percentage of negative emotions showed less range throughout the semester (55% - 71%) than in Spring 2020 with a range from 41% to 83%. The variation of at least one negative emotion selected in Spring 2021 was greater than the prior two semesters (34% to 65%).

The red line in Figure 1 represents the percentage of participants who indicated that the emotions they had experienced in the survey period were typical of emotions experienced during a pre-COVID semester. In the first semester, Spring 2020, the percentage of participants that reported the emotions they experienced were typical during the semester went from 34% to 76%. In Fall 2020, participants reported their emotions as being typical around 50% of the time with a low of 41% in Week 4 and a high of 53% in Week 14. Lastly, a majority of participants reported typical emotions throughout Spring 2021 with the percentage increasing from 60% at the start of the semester to 78% by the end of the semester. There was, however, a drop to 51% in Week 6.

The percentages of participants that selected at least one positive emotion in each positive emotion category are displayed in Figure 2. In this figure, half of the emotion categories are displayed on the top (Figure 2(a)) and the other half are displayed on the bottom (Figure 2(b)) for readability. A ‘Positivity’ emotion (Figure 2(a)) was selected by the most participants at the beginning of ERT in Spring 2020 (74%). Fewer participants selected an emotion in this category across the remaining weeks of the semester, with the lowest percentage of participants selecting an emotion in this category during the final grading period (35%). The percentage of participants selecting emotions in the other positive categories followed a similar decreasing trend in Spring 2020.



(a)



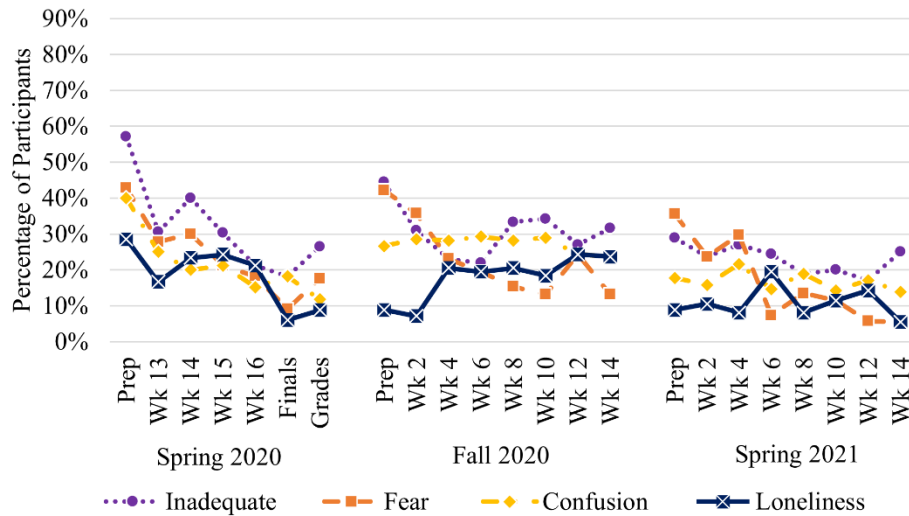
(b)

Figure 2. Percentage of participants that selected at least one positive emotion in each positive emotion category per survey.

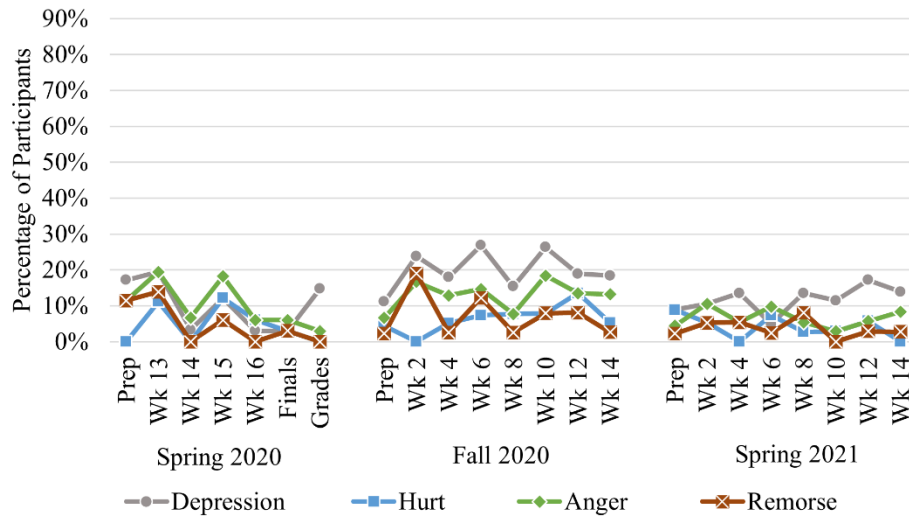
Positive emotions selected by participants in Fall 2020 and Spring 2021 tended to vary across the semester over a smaller overall range, with the exception of ‘Accomplished.’ In Spring 2020,

there was an increase in the participants selecting an emotion in the ‘Accomplished’ category (Figure 2(a)) starting in Week 16 to the end of the grading period. In the following two semesters, selection of emotions in the ‘Accomplished’ category increased from 27% to 84% (Fall 2020) and 23% to 86% (Spring 2021) during Weeks 13 to 14. An emotion in the ‘Braced’ category was selected the least often by participants (Figure 2(b)) and followed a similar trend to the other emotion categories across the three semesters.

The percentages of participants that selected at least one negative emotion in each negative emotion category are displayed in Figure 3. Again, half of the emotions are displayed on the top (Figure 3(a)) and half on the bottom (Figure 3(b)) for readability.



(a)



(b)

Figure 3. Percentage of participants that selected at least one negative emotion in each negative emotion category per survey.

In Spring 2020, the percentage of participants that selected emotions in the negative categories of ‘Inadequate,’ ‘Fear,’ ‘Confusion,’ and ‘Loneliness’ followed a downward trend across the survey periods with a high of 57% during preparation for ERT and a low of 6% during the final grading period (Figure 3(a)). The range in the percent of participants selecting these negative emotions was less during Fall 2020 (7%-44%) and Spring 2021 (6%-36%). On average, an ‘Inadequate’ emotion was selected the most often in all three semesters (Figure 3(a)). In Figure 3(b), an emotion in the ‘Depression,’ ‘Hurt,’ ‘Anger,’ and ‘Remorse’ categories was reported within a narrower range of 20% and below during Spring 2020 and Spring 2021 while Fall 2020 had a slightly greater range of up to 30%. Emotions in the categories of ‘Hurt’ and ‘Remorse’ were the least selected, with no participants selecting these words on some of the surveys each semester (Figure 3(b)).

Discussion

The results from this study provide insight about the emotional aspect of instructor adaptability when teaching during a changing and evolving situation. As engineering instructors taught during ERT and PIT, they faced multiple challenges [13], [28], [29], [30], [31]. The results here indicate that instructors experienced a range of emotions when facing the challenge of adapting to the situation. The variation in emotions decreased over time which might indicate that instructors were adapting emotionally as the shift from ERT to PIT occurred.

The selection of the positive emotion ‘Accomplished’ was an exception to the idea of less variation in emotions over time. ‘Accomplished’ peaked at the end of each semester though the increase was less during Spring 2020. The impacts of ERT appear to have suppressed instructors’ emotions of accomplished. Feeling accomplished may be a typical emotion felt by instructors at the end of a semester regardless of circumstances.

The perceived normality of emotions compared to pre-COVID times appears to confirm the transition from ERT to PIT. The end of Spring 2020 and Spring 2021 show similar perceived normality, perhaps indicating similar end-of-year relief. The perceived normality also tended to increase as PIT progressed, perhaps indicating that instructors were starting to adapt to the new normal.

And yet the transition from ERT to PIT was not smooth. The generally low and mildly varying perceived normality in Fall 2020 seems to reflect the trepidation that came with online instruction and, for those in the classroom, the ever-shifting news and response to COVID concerns. Additionally, the negative emotions (e.g., ‘Loneliness,’ ‘Depression,’ and ‘Anger’) during Fall 2020 were selected by more participants compared to Spring 2020 and 2021 which may indicate the difficulty of transitioning to PIT and the level of uncertainty during this period. During Fall 2020, in-person instruction resumed for some instructors but there were many stipulations attached to being in-person including masks, social distancing of students (and therefore reduced number of students who could attend in-person during any given class period), and routine classroom disinfection.

Referring to the definition of emotions in the background section of this paper, emotions are “socially constructed” and are part of “social-historical contexts” [19, p. 344). As PIT continued instructors started to adapt to their new “social-historical context.” A notable exception to the

perceived normality of emotions occurred during Week 6 of Spring 2021. During a pre-COVID Spring semester this was around the time that a weeklong break would usually occur. However, during Spring 2021, the university put in place a policy that removed the break from the semester to lessen the chance of COVID transmission due to student and faculty travel. The lack of a break may be the cause of the dip in perception of normality and the decrease in participants selecting positive emotions during this time.

Limitations

Limitations of the research exist. The data was collected from one university which has a certain culture around teaching that may or may not compare to that of other universities. Additionally, participation was voluntary which may have resulted in self-selection bias where only instructors who were interested, had the emotional capacity to do so, and had time participated in the research. Data were self-reported; therefore it is likely that instructors were hesitant to select negative emotions. Finally, since no data on emotions were collected before the pandemic, participants had to gauge the normality of their emotions to a reference point which relied on recall, which could be affected by time and memory.

Conclusion

Adaptability as a theoretical lens was used to study the emotions of instructors during and after a significant change event. Instructors' emotions are important to understand as they contribute to the quality of teaching and research and one's overall well-being. Emotions are only one dimension of adaptability and therefore the other two dimensions need to be considered before recommendations for how to support faculty are made. Additional teaching artifacts have also been collected and are being analyzed to help provide a holistic picture of the instructors' teaching experiences. This holistic picture will enable the research team to make recommendations for supporting faculty during change.

Future work relative to emotions will focus on a more in-depth analysis of the emotions data that considers the intensity of selection of each emotion category (for example, selecting one, two or three positive emotions) and instructors' position code, gender, and department.

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References

- [1] M. Borrego, J. E. Froyd, and T. S. Hall, "Diffusion of engineering education innovations: A survey of awareness and adoption rates in U.S. engineering departments," *Journal of Engineering Education*, vol. 99, no. 3, pp. 185–207, 2010, doi:10.1002/j.2168-9830.2010.tb01056.x.

- [2] (ASEE) American Society for Engineering Education, "Creating a culture for scholarly and systematic innovation in engineering education: Ensuring U.S. engineering has the right people with the right talent for a global society," *American Society for Engineering Education*, 2009.
- [3] (ASEE) American Society for Engineering Education, "Innovation with impact: Creating a culture for scholarly and systematic innovation in engineering education," *American Society for Engineering Education*, 2012.
- [4] L. Cerveny, "Teacher stress in response to the COVID-19 outbreak in the spring of 2020," Ph.D. dissertation, Dept. SNSS, RWC, Rochester, NY, USA, 2021. [Online]. Available: <https://search-ebscohost-com.libproxy.unl.edu/login.aspx?direct=true&db=psyh&AN=2021-27920-046&site=ehost-live>
- [5] H. Kovacs, C. Pulfrey, and E. Monnier, "Surviving but not thriving: Comparing primary, vocational and higher education teachers' experiences during the COVID-19 lockdown," *Educ. and Info. Tech.*, vol. 26, no. 6, pp. 7543-7567, 2021, doi: 10.1007/s10639-021-10616.
- [6] B. P. Valsaraj, B. More, S. Biju, V. Payini, and V. Pallath, "Faculty experiences on emergency remote teaching during COVID-19: A multicentre qualitative analysis," *Interactive Tech. and Smart Educ.*, vol. 18, no. 3, 2021.
- [7] P. Warfvinge, J. Löfgreen, K. Andersson, T. Roxå, and C. Åkerman, "The rapid transition from campus to online teaching – How are students' perception of learning experiences affected?" *Eur. J. of Eng. Educ.*, 2021, doi: 10.1080/03043797.2021.1942794.
- [8] M. Weber, "Stress, perceived support, and well-being among teachers during coronavirus pandemic," Ph.D. dissertation, Dept. SNSS, RWC, Rochester, NY, USA, 2021. [Online]. Available: <https://search-ebscohost-com.libproxy.unl.edu/login.aspx?direct=true&db=psyh&AN=2021-65616-278&site=ehost-live>
- [9] A. J. Martin, "Adaptability and learning," in *Encyclopedia of the Sciences of Learning*, N. M. Seel, Ed., Springer, 2012, pp. 90–92.
- [10] A. J. Martin, H. G. Nejad, S. Colmar, and G. A. D. Liem, "Adaptability: how students' responses to uncertainty and novelty predict their academic and non-academic outcomes," *J. of Educ. Psychol.*, vol. 105, pp. 728–746, 2013, doi: 10.1037/a0032794.
- [11] L. Atkinson, G. Panther, and H. A. Diefes-Dux, "Behavioral adaptability of engineering faculty instructors engaging in emergency remote teaching during three semesters of the COVID-19 pandemic," In 127th *ASEE Annu. Conf. & Expo*, Minneapolis, MN, 2022.
- [12] A. Besser, G. L. Flett, T. Nepon, and V. Zeigler-Hill, "Personality, cognition, and adaptability to the covid-19 pandemic: Associations with loneliness, distress, and positive and negative mood states," *Int. J. of Mental Health and Addiction*, pp.1-12, 2020, doi: 10.1007/s11469-020-00421-x

- [13] A. Hamad, A. Rehmat, H. A. Diefes-Dux, and G. Panther, "Challenges and successes of engineering Instructors when forced to deliver courses remotely," in *FIE conf.*, Lincoln, NE, 2021.
- [14] G. Panther and H. A. Diefes-Dux, (2021). "Instruments used to capture instructors' experiences during a forced move to remote instruction," in *ASEE Annu. Virtual. Conf. & Expo.*, July 26, 2021. [Online].
- [15] A. Rehmat, H. A. Diefes-Dux, and G. Panther, "Engineering instructors' self-reported emotions during emergency remote teaching," in *FIE conf.*, Lincoln, NE, 2021.
- [16] A. Rehmat, H. A. Diefes-Dux, and G. Panther, "Engineering instructors' self-reported activities to support emergency remote teaching during the COVID-19 pandemic," in *FIE conf.*, Lincoln, NE, 2021.
- [17] H. G. Granziera, R. J. Collie, and A.J. Martin, "Adaptability: An important capacity to cultivate among pre-service teachers in teacher education programmes," *Psychol. Teaching Rev.*, vol. 25, no. 1, pp. 60-66, 2019, doi: 10.1080/13540602.2020.1832063.
- [18] R. J. Collie, F. Guay, A. J. Martin, K. Caldecott-Davis, and H. Granziera, "Examining the unique roles of adaptability and buoyancy in teachers' work-related outcomes," *Teachers and Teaching*, vol. 26, no. 3-4, p. 351, 2020, doi: 10.1080/13540602.2020.1832063.
- [19] P. A. Schutz, J. Y. Hong, D. I. Cross, and J. N. Osbon, "Reflections on investigating emotion in educational activity settings," *Educ. Psychol. Rev.*, vol. 18, no. 4, pp. 343-360, 2006, doi:10.1007/s10648-006-9030-3.
- [20] K. Trigwell, "Relations between teachers' emotions in teaching and their approaches to teaching in higher education," *Instructional Sci.*, vol. 40, pp. 607-621, 2012, doi:10.1007/s11251-011-9192-3.
- [21] C. M. Tyng, H. U. Amin, M. Saad, and A. S. Malik, "The influences of emotion on learning and memory," *Frontiers in Psychol.*, vol. 8, pp. 1454, 2017, doi: 10.3389/fpsyg.2017.01454.
- [22] D. Naylor and J. Nyanjom, "Educators' emotions involved in the transition to online teaching in higher education," *Higher Educ. Research & Develop.*, vol. 40, no. 6, pp. 1236-1250, 2021, doi: 10.1080/07294360.2020.1811645.
- [23] R. H. Stupnisky, N. C. Hall, and R. Pekrun, "Faculty enjoyment, anxiety, and boredom for teaching and research: Instrument development and testing predictors of success," *Studies in Higher Educ.*, vol. 44, no. 10, pp. 1712-1722, 2019, doi: 10.1080/03075079.2019.1665308.
- [24] J. J. Park, M. Park, K. Jackson, and G. Vanhoy, "Remote engineering education under COVID-19 pandemic environment," *Int. J. of Multidisciplinary Perspectives in Higher Educ.*, vol.5, no.1, pp.160-166, 2020. <https://ojed.org/jimphe>

- [25] H. Meishar-Tal and A. Levenberg, "In times of trouble: Higher education lecturers' emotional reaction to online instruction during COVID-19 outbreak," *Educ. and Inf. Technol.*, vol. 26, no. 6, pp. 7145-7161, 2021, doi: 10.1007/s10639-021-10569-1.
- [26] C. Hodges, S. Moore, B. Lockee, T. Trust, and A. Bond, "The difference between emergency remote teaching and online learning," *Educause Review*, vol. 27, pp. 1-12, 2020.
- [27] T. Drummond, "Leading and caring for children: Emotion/feeling vocabulary," 2021, [Online]. Available: <https://tomdrummond.com/leading-and-caring-for-children/emotion-vocabulary/>
- [28] M. Chierichetti and P. Backer, "Exploring faculty perspectives during emergency remote teaching in engineering at a large public university," *Educ. Sci.*, vol. 11, no. 8, 2021, doi: 10.3390/educsci11080419.
- [29] J. Ross, N. Bravo, and J. Solis, "Overcoming crisis: A portrait of the adaptation of engineering professors to remote teaching in Chile," in *4th CISPEE*, pp. 1-7, 2021. [Online]. doi: 10.1109/CISPEE47794.2021.9507236.
- [30] S. Ramlo, "The coronavirus and higher education: Faculty viewpoints about universities moving online during a worldwide pandemic," *Innovative Higher Educ.*, vol. 46, no. 3, pp. 241-259, 2021, doi: 10.1007/s10755-020-09532-8.
- [31] J. R. Morelock, N.W. Sochacka, R. S. Lewis, J. Walther, C. M. Culloty, J. S. Hopkins, S. Vedanarayanan, and C. K. Ofunne, "Using a novel research methodology to study and respond to faculty and student experiences with COVID-19 in real time," *Adv. in Eng. Educ.*, vol. 8, no. 4, 2020. <https://files.eric.ed.gov/fulltext/EJ1287753.pdf>