Emergency Remote Learning: Developing an Understanding about Online Learning Features and Students' Feelings*

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In mid spring 2020, an unprecedented Covid-19 induced switch of learning mode, from face-to-face instruction to online learning, disrupted not only teachers, but also students, both cognitively and emotionally. This study seeks to understand how students felt about their capabilities to succeed in the online learning environment (OLE) and which online learning features (OLF), offered to them by their instructors, positively, negatively, or neutrally impacted their learning. Three research questions guided this study: (1) What online learning features did students perceive as contributing positively, negatively, or neutrally to their learning and how were these perceived contributions related to students' demographics?; (2) How did students feel about their capabilities to succeed in the OLE?; and (3) How did students' feelings change during their online learning experiences and how did these changes relate to students' gender, academic performance, and prior online experience? An online survey was designed and face-validated to solicit information about students' perceptions about online learning features and feelings about their capabilities to succeed in the OLE. The 13-item survey consisted of 10 multiple-choice/multiple-answer and 3 open-ended questions. One thousand two hundred and thirty-seven ($N = 1237$) students taking 27 different courses, from 6 different institutions participated in the study. Presentation of the qualitative analyses of open-ended survey responses is outside the scope of this paper. Findings suggest that the three most frequent OLFs provided to students were electronic homework submission, recorded video lectures, and electronic exams. While video lectures, homework electronics submission, and downloadable documents or files were reported to be the top three OLFs that contributed positively to students' learning, poor internet performance, online exams, and projects were the top three OLFs that were reported to have contributed negatively to student learning. Changes in students' feelings during the online learning experience were also reported.

Keywords: online learning; online learning features; online learning environment; student feelings; emergency remote learning

1. Introduction

The recent worldwide COVID-19 pandemic has created a call for higher education to move their teaching and learning practices from traditional face-to-face interaction to internet-based virtual online learning, popularly called as emergency remote learning (ERL). This is expected to disrupt students' learning. In the United States, for many teaching-focused professors, this call has required redevelopment of existing course content as well as the movement of that content to an online learning management system. In some cases, in which courses are closely tied to labs, faculty have had to redesign hands-on lab activities or group presentations so they are virtually accessible to students. Resultant to these changes, students have been required to adapt and adjust in order to learn successfully from their new learning environment.

Technology enhancements to learning generally focuses on the cognitive rather than the affective domain of learning [1]. Positive impacts of the use of technology-based media on learning have been widely studied and acknowledged (e.g., [2, 3]). However, it is not yet clearly understood how students affectively react to online learning, particularly in an unanticipated situation in which they did not prepare for or freely choose online learning. Questions about "whether negative feelings currently experienced in online learning will negatively impact future online learning experience" need to be studied and understood. In other research, experts found that an environment in which students know that making mistakes is safe can potentially transform negative feelings into positive ones [4]. This study seeks to understand how an unexpected change to online learning relates to students' feelings and how those feelings relate to students' demographic information such as gender, academic status, cumulative grade-point-average (CGPA), and whether the students have (or do not have) any experience participating in online learning before. This research explores quantitative survey responses related to students' feelings as they participated in unplanned and unexpected online learning to complete their education in the spring 2020 semester.

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2. Review of Relevant Literature

This literature review briefly discusses motivational constructs and online learning activities that students experienced while engaging in online learning. Researchers have suggested a variety of motivational theories to explain student's learning performance and choice. The rapid growth of online distance education offers numerous benefits and challenges for teachers, students, and instructional developers. For example, one challenge that teachers and instructional developers face involves knowledge of the level of student engagement and affective domain within a course. In online learning, active engagements are accomplished through learner–content, learner–instructor, learner–learner, and learner–technology interactions [5–7].

Motivation is often associated with engagement and learning environment because motivation is known to have impacts on behavior, as it gives an activity its purpose and goal [8–10]. This motivational aspect can be traced to the environment where online learning takes place. In a study conducted by Ernst [11], a large percentage of respondents (85%) reported feeling at ease in the OLE. Similarly, students in online and traditional classes did not differ in terms of their attitudes about and feelings of self-efficacy towards technology. Despite reports that students in online classes had relatively positive attitudes regarding technology and felt moderately self-efficacious about using technology [12], other studies have suggested that lack of experience with Internet culture can be associated with decreased confidence and increased fear of technology [13, 14].

In addition to negative learning impacts from a lack of experience in using the OLE, designing constructive and supportive interactions between teachers and students within the online communication modes may either negatively or positively impact students' learning experiences [15, 16]. For example, instructors may inadvertently increase students' anxiety if they fail to reply to questions in a timely manner [14]. Also, multi-threaded discussions may confuse and frustrate students. Such frustration can lead students to withdraw or disengage from class activities [17]. Nevertheless, positive experiences with online learning, such as continuous interactions between teachers and students, can lead to higher levels of engagement and positive feelings regarding their course. The social, cognitive, and teaching presence (i.e., structure and process of the online learning) [18] may contribute to student feelings towards their online learning experiences.

LeDoux and Hofmann [19] and Berridge [20] suggested that feelings are subjective emotional experiences, and subjectivity is the essence of an emotion. There is reason to believe that feelings such as excitement and fear are relevant emotions when considering how experiences with online courses relate to student's reactions to online learning. In our research, we evaluated various learning features and activities available to students and students' feelings towards their online learning experience. Thirteen feelings were pre-identified in the survey and they are defined as the following: Motivated (i.e., desire to succeed at tasks); uncertain (i.e., doubtful or unsure); safe (secure from present or future negative conditions); scared (i.e., fearful or anxious leading to dysfunction); confident (i.e., certain about ability to perform task or tasks); isolated/alone (i.e., cut off from people); anxious (i.e., uneasy, nervous, or worried); depressed (i.e., disheartened or sad); comfortable (i.e., contented; enjoy performing task or tasks); stressed (i.e., tense, under pressure); independent (i.e., thinks and acts for oneself); empowered (i.e., ability to perform and make decisions); supported (i.e., assisted or helped).

3. The Study

3.1 Goal and Research Questions

The goal of this study is to understand how 4-year college students motivationally reacted to the unanticipated online learning they experienced during approximately the last 1.5 months of spring 2020 semester when the COVID-19 pandemic began. This understanding will help further improve future online learning, particularly when online learning occurs during an emergency situation. The three research questions guiding the study are: (1) What online learning features did students perceive as contributing positively, negatively, or neutrally to their learning and how were these perceived contributions related to students' demographics?; (2) How did students feel about their capabilities to succeed in the OLE?; and (3) How did students' feelings change during their online learning experiences and how did these changes relate to students' gender, academic performance, and prior online experience?

3.2 Context and Participants

The online survey was administered to one thousand three hundred and forty (1340) students taking 27 different courses at six different institutions of higher education via Qualtrics. Convenience sampling [21] was used because the emergent nature of the study meant that the research team had limited time and access to communicate to a wider university community about the study. The majority of courses studied were engineering (i.e., 19 courses);

Table 1. Survey Instrument

What to assess	Description of survey items
Demographics	• Current academic status (i.e., freshman, sophomore, Junior, and senior) • Current cumulative GPA (i.e., 3.50 or above, 3.00–3.49, 2.50–2.99, 2.00–2.49, below 2.00 • Gender (i.e., male, female, prefer not to disclose) • Taken any online classes before spring 2020 (i.e., yes, no)
Online Learning Features (OLF)	• Online features available – select all that apply (i.e., video-lectures, live synchronous chat/lecture), electronically submitted homework, virtual labs, quizzes including formative/practice quizzes, exams, virtual office hours, virtual group discussion, downloadable documents/files, virtual tutoring by TAs, other – please specify).
OLF contribution towards Learning	• OLF that contributed positively to learning plus a response option "none of the OLF contributed positively to learning." • OLF that contributed negatively to learning plus a response option "none of the OLF contributed negatively to learning." • OLF that had no effect to learning plus a response option "all OLF had some effect on learning."
Feelings about capabilities to succeed	• Feeling about one's capabilities to succeed in the OLE – select all that apply (i.e., motivated, uncertain, safe, scared, confident, isolated or alone, anxious, depressed, comfortable, stressed, independent, empowered, supported, other – please specify).
Feelings change	• Feelings change during online learning experience (i.e., grew more positive toward capabilities to succeed; grew more negative toward capabilities to succeed; feeling did not change).

the remaining courses were mathematics and statistics (i.e., 3 courses), technical writing (i.e., 2 courses), and social sciences (i.e., 3 courses). All courses were initially taught traditionally, offering face-to-face interaction in a classroom learning environment. Near the middle of March 2020, there was a mandatory call for all colleges to immediately move classes online, which led to unexpected modifications of teaching and learning formats in a relatively short available time. Each course was taught using OLE formats comprising numerous online learning features, including video-lectures, live synchronous chat/lecture, virtual labs, and many other features.

3.3 Data Collection and Analysis Procedures

The online survey, which consisted of 13 (i.e., 10 multiple-choice/multiple-answer and 3 open-ended) questions was developed and administered to the participants of this study. Since we were interested in understanding students' feelings and available online learning environments during a forced online learning experience, the survey items specifically addressed these issues. The survey was face-validated and refined to meet the purpose of the assessment and improve the readability of the survey items. In addition to asking four demographic questions, the survey assessed students' (1) perceptions about which of the available online learning features had a positive, negative, or no effect on their learning; (2) feelings about their capabilities to succeed on the OLE; and (3) strategies to adapt to their new OLE in their course as shown in Table 1. Data was collected by administering the survey through a web-based survey tool, Qualtrics. Qualitative analyses of the open-ended survey questions are not included in this paper. Students participation was voluntary, and they could withdraw from the study at any time (opt out). An Institutional Review Board (IRB) approval was awarded for this study. The participating students were invited through their respective course instructors to complete the survey before the final exam at the end of the semester and were informed that this should not take more than 15 minutes to complete.

Before starting the quantitative data analyses, participants' responses were evaluated to clean the data for incomplete and/or irregular responses. Students' responses to survey questions 6, 7, and 8 were used to identify irregularities. For example, question no. 6 asked the students to select all those online features which contributed positively to their learning and the last answer in the list was formatted as a check, stating that "none of the features contributed positively to my learning." Responses that selected at least one feature as contributing positively to their learning as well as the last option (i.e., none of the features contributed positively) were considered as irregular. After discarding irregular and incomplete responses, a total of one thousand two hundred and thirty-seven (N = 1237) respondents' data were considered for analysis. Descriptive and inferential statistics were used to analyze the collected data. Descriptive statistics were used to evaluate student-response counts and percentages were used to answer the research questions presented in this paper. Any potential significant differences that existed among observed counts were also determined through inferential statistics using nonparametric chi-square tests.

4. Results

From 1237 collected data sets, a majority (i.e., 79.5%) of participants were males, 20.1% were

females, and 0.4% preferred not to disclose their gender. Forty-five percent (45%) of the respondents reported being seniors, 26% juniors, 23% sophomores, and 6% freshmen. Sixty percent of participants reported having online learning experience prior to the spring 2020 semester. Eighty-nine percent of participants reported having cumulative grade-point-averages (CGPA) above 3.00 (Table 2).

4.1 Perceived (Positive, Negative, No) Contribution of Online Learning Features (OLF) in Students' Learning (Research Question #1)

Responding to a survey question that asked about online features available to the students, electronic homework submission (1169 counts or 95%) was found to be the most widely available feature, followed by recorded video lectures (1080 counts or 87%), and online exams (960 counts or 78%), as shown in Table 3. The open-ended option (i.e., responded as "Others") was not responded with clear answers and therefore, it was not included in further analysis.

Responses to the multiple-choice/multiple-answer questions asking participants to select

which (one or more) online features had a positive, negative, or no contribution to their learning, reveals that a majority of participants reported that video lectures (72%), electronically submitted homework (65%), and downloadable documents and files (52%) positively contributed to their learning. Similarly, internet performance (i.e., 20%), online exams (i.e., 17%) and projects (i.e., 17%) were the features reported by majority of students to have negatively contributed to their learning. However, it is interesting to note that although 17% of students reported online exams to have negatively contributed to their learning, a 34% majority of the participants selected it as contributing positively to their learning. Another interesting finding is that a considerable majority of 43% of the students reported that none of the features had negative contribution to their learning, 39% reported that all features had some effect, and only 5% reported that all of the features contributed negatively to their learning.

Chi Square analysis was carried out to analyze the associations between demographics and perceived positive and negative contributions of available online features in students' learning. Only the significant associations are reported below.

4.1.1 Gender Association with Perceptions of Positive Contribution

Males and females differed in their opinion regarding the positive contribution of all available online features. Differences in opinion regarding positive contribution of online exams, virtual group discussions, and downloadable documents/files based on gender were found to be statistically significant. Results showed that more males than females reported online exams to have contributed positively to their learning. On the other hand, more females than males reported virtual group discussions and downloadable documents (files) to have contributed positively to their learning. These differences in opinions were statistically significant at $p < 0.05$ as shown in Table 4.

4.1.2 Prior Online Exposure (POE) Association with Perceptions of Positive Contribution

Differences in the perceptions about positive contribution of electronically submitted homework, projects, online quizzes, online exams, virtual

Table 2. Students' Cumulative GPA (CGPA)

CGPA	Number of Count (%)
3.50 and above	629 (51%)
3.00–3.49	476 (38%)
2.50–2.99	110 (9.2%)
2.00–2.49	15 (1.2%)
Below 2.00	7 (0.6%)

Table 3. Available Online Learning Features ($N = 1237$)

Online Learning Feature	Number of Count (%)
E-submitted homework	1169 (95%)
Video lectures	1080 (87%)
Online exams	960 (78%)
Downloadable docs/files	950 (77%)
Virtual office hours	816 (66%)
Online quizzes	797 (64%)
Projects (larger assignments than homework)	554 (45%)
Live synchronous chat/lecture	452 (37%)
Virtual group discussion	449 (36%)
Virtual Tutoring by TA's	411 (33%)
Virtual Labs	188 (15%)
Others (not clearly specified)	26 (2%)

Table 4. Association between Gender and Perceived Positive Contribution of Available Online Features

Available Online Feature	Perceived Positive Contribution Reported by Gender		Chi Square Test of Independence
	Males (%)	Females (%)	
Online Exams	35%	28%	(χ^2 (1) ≥ 4.123, $p = 0.042$)
Virtual Group Discussions	17%	23%	(χ^2 (1) ≥ 5.762, $p = 0.016$)
Downloadable Docs	51%	59%	(χ^2 (1) ≥ 5.287, $p = 0.021$)

Table 5. Association between POE and Perceived Positive Contribution of Available Online Features

Available Online Feature	Perceived Positive Contribution Reported by Prior Online Exposure		Chi Square Test of Independence
	POE (Yes)	POE (No)	
e-Submitted homework	69%	61%	$\chi^2 (1) \geq 8.177, p = 0.004)$
Projects	22%	14%	$\chi^2 (1) \geq 12.478, p = 0.000)$
Online Quizzes	44%	34%	$\chi^2 (1) \geq 11.370, p = 0.001)$
Online Exams	37%	30%	$\chi^2 (1) \geq 4.962, p = 0.026)$
Virtual Office hours	31%	25%	$\chi^2 (1) \geq 4.395, p = 0.036)$
Virtual Group Discussions	22%	11%	$\chi^2 (1) \geq 23.148, p = 0.000)$
Downloadable Documents	58%	44%	$\chi^2 (1) \geq 25.530, p = 0.000)$
Internet Performance	21%	12%	$\chi^2 (1) \geq 16.608, p = 0.000)$

office hours, virtual group discussions, downloadable documents/files, and internet performance were found to be significantly associated with students' prior exposure to online experience (POE) ($p < 0.01$ or $p < 0.05$). Results showed that prior online exposure favored the positive contribution of these online features (see Table 5).

4.1.3 Cumulative GPA (CGPA) Association with Perceptions of Positive Contribution

Association of positive contribution of available online features did not show a clear trend with respect to CGPA. The data violated the assumption of the Chi-Square test having less than 5 counts in two cells due to low number of students in the lower achieving groups. However, *Fisher's exact test* showed that the differences in perceived positive contribution of live synchronous chat and virtual group discussions with respect to CGPA were statistically significant at $p < 0.05$.

4.1.4 Current Academic Status Association with Perceived Positive Contribution

Students had significant differences regarding their opinion about positive contribution of live synchronous chat, projects, virtual labs, online quizzes, virtual office hours, virtual group discussions, downloadable docs/files, and virtual tutoring by TAs in their online learning, with respect to students' current academic status. Perceptions of the

positive contribution of virtual tutoring seemed to significantly decrease ($p < 0.01$) with increasing academic level (i.e., freshmen through senior). For all features, differences were mixed but significantly associated with students' academic level as shown in Table 6.

4.1.5 Gender Associations with Perceptions of Negative Contributions

Chi Square analysis was carried out to find the differential perceptions of students regarding negative contribution of various online learning features based on gender. Out of all features, gender difference in negative perception about contribution of only video lectures was found to be statistically significant. Fifteen percent (15%) of male students reported video lectures to have contributed negatively to their learning compared to 9% female students. The difference was significant at $p < 0.05$, ($\chi^2 (1) \geq 6.314, p = 0.012$). No significant differences in perceptions about negative contribution of other features were found based on gender.

4.1.6 Prior Online Exposure (POE) Associations with Perceptions of Negative Contributions

Students' perceptions of the negative contributions of available online features were differentiated based on their POE. Chi Square tests of independence showed that a larger number of participants with no POE (as compared to those with POE)

Table 6. Association between Current Academic Status and Perceived Positive Contribution of Available Online Features

Available Online Feature	Perceived Positive Contribution Reported by Current Academic Status				Chi Square Test of Independence
	Freshman	Sophomore	Junior	Senior	
Live Syn. Chat	36%	15%	13%	24%	$\chi^2 (3) \geq 30.585, p = 0.000)$
Projects	22%	11%	13%	25%	$\chi^2 (3) \geq 31.574, p = 0.000)$
Online Quizzes	51%	33%	40%	43%	$\chi^2 (3) \geq 11.686, p = 0.009)$
Virtual Office Hours	49%	28%	29%	26%	$\chi^2 (3) \geq 18.290, p = 0.000)$
Virtual Group Discussions	21%	10%	13%	24%	$\chi^2 (3) \geq 32.256, p = 0.000)$
Downloadable Docs/files	41%	42%	54%	58%	$\chi^2 (3) \geq 21.547, p = 0.000)$
Virtual tutoring by TAs	26%	25%	15%	13%	$\chi^2 (3) \geq 24.064, p = 0.000)$

Table 7. Association between POE and Perceived Negative Contribution of Available Online Features

Available Online Feature	Perceived Negative Contribution Reported by Prior Online Exposure		Chi Square Test of Independence
	POE (Yes)	POE (No)	
Video Lectures	11%	18%	$\chi^2 (1) \geq 11.952, p = 0.001)$
e-Submitted homework	3%	6%	$\chi^2 (1) \geq 05.103, p = 0.024)$
Online Quizzes	5%	8%	$\chi^2 (1) \geq 05.010, p = 0.025)$

Table 8. Association between Demographics and Perceived No Contribution of Available Online Features

Demographics	Significant differences in Perceived "No Contribution" of Online Learning Features ($p < 0.05$)
Gender (Male vs. Female)	e-Submitted Homework
POE (Yes vs. No)	Online Exams, Internet Performance
CGPA (sub groups)	No significant differences in "perceived No Contribution" of any online features
Current Academic Status (Fresh., Soph., Jr., Sr.)	No significant differences in "perceived No Contribution" of any online features

chose video lectures, e-Submitted homework, and online quizzes as having contributed negatively to their learning. These results were significant at $p < 0.05$ as shown in Table 7. It is interesting to find that more students with POE reported positive contribution of online learning features while more students without POE reported more negative contributions of online learning features.

4.1.7 Cumulative GPA Association with Perceptions of Negative Contributions

Chi-square analysis of perceptions of the negative contributions of available online features with respect to CGPA violated the Chi-Square assumption of having a minimum expected count of 5 in each cell. However, *Fisher's exact test* showed that differences in the perceptions of negative contributions of online exams, downloadable documents and files and internet performance were significantly associated with CGPA at $p < 0.05$. Frequency analysis reveals that, in moving from higher CGPA towards lower CGPA, perceptions of negative contributions of online exams, downloadable documents, and internet performance in students' online learning increased.

4.1.8 Current Academic Status Association with Perceptions of Negative Contributions

Again, while participants' perceptions of the negative contributions of e-submitted homework, projects, downloadable docs/files, and virtual tutoring by TAs were correlated using the Chi Square test of independence at $p < 0.05$ significance level, these data violated the assumption of minimum expected counts in cells.

4.1.9 Demographic Associations with Perceptions of No Contributions

More females (22%) than males (13%) reported e-submitted homework to have no contribution in

their online learning and the difference was significant at $p < 0.05$, $(\chi^2 (1) \geq 8.618, p = 0.003)$.

Significant differences based on POE were found in participants' reports of online exams $(\chi^2 (1) \geq 5.318, p = 0.021)$ and internet performance $(\chi^2 (1) \geq 7.965, p = 0.005)$ having no contribution to their online learning. Fewer males (10%) than females (15%) reported that online exams had no contribution to their learning. On the other hand, more males (13%) than females (8%) reported internet performance to have no contribution to their learning.

4.2 Students' Feelings about their Capabilities to Succeed in the Online Learning Environment (Research Question #2)

Of 13 pre-identified feelings provided in the survey, seven feelings were considered positive and six were considered to represent negative feelings. Positive feelings are defined as subjective feelings that lead to temporary peak of desire to willingly engage in learning. Negative feelings, in contrast, are subjective feelings leading to a lack of desire for learning engagement. Experiencing both positive and negative feelings while engaging in online learning is defined as having mixed feelings.

Participants were asked to report how they felt about their capabilities to succeed in online learning environment by selecting from the list of 13 feelings. Participants were able to select any number of feelings from the list and were expected to select either positive or negative feelings or combination of both. As reported by the participants, the feelings of independent, motivated, and confident were to be the most frequently reported of the positive feelings (reported by 33%, 25%, and 25% of the participants respectively). The feelings of uncertain, stressed, and anxious were found to be the three most frequently reported negative feelings (reported by 61%, 55%, 41% students respectively) as shown in Table 9.

Table 9. Students' Feeling about Students' Capabilities to Succeed in the OLE

	Feelings	Number of Count (%)
Positive Feeling	Independent	401 (33%)
	Motivated	311 (25%)
	Confident	305 (25%)
	Comfortable	283 (23%)
	Supported	222 (18%)
	Safe	188 (15%)
	Empowered	100 (8%)
Negative Feeling	Uncertain	748 (61%)
	Stressed	674 (55%)
	Anxious	504 (41%)
	Isolated	413 (34%)
	Depressed	195 (16%)
	Scared	178 (15%)

Table 10. Mixed Feelings

Positive and Negative Feelings	Count (%)
Independent (+)	281 (27%)
Motivated (+)	175 (17%)
Confident (+)	158 (15%)
Supported (+)	154 (15%)
Comfortable (+)	134 (13%)
Safe (+)	96 (9%)
Empowered (+)	36 (4%)
Uncertain (–)	359 (29%)
Stressed (–)	331 (27%)
Anxious (–)	229 (19%)
Isolated (–)	197 (16%)
Depressed (–)	54 (4%)
Scared (–)	54 (4%)

Table 9 also shows that negative feelings were more prevalent among students compared to positive feelings. In analyzing students' tendency towards selection of positive, negative or mixed feelings, it was found that only 17% of student participants reported exclusively positive feelings (i.e., at least one positive and no negative feelings), while the other 39% of them reported exclusively negative feelings (i.e., one or more negative and no positive feelings). One percent (1%) expressed neither positive nor negative feelings. A strong majority of forty-three percent (43%) of students reported as having a mix of both positive and negative feelings while engaged in OLEs. Feeling of Uncertain and independent were found to be most frequently reported feeling among participants with mixed-feelings (Table 10).

An analysis of reported feelings in relation to POE produced interesting results. Larger numbers of participants with POE reported more positive feelings and participants with no POE reported more negative feelings as shown in Figs. 1 and 2.

As an example, a higher percentage of participants with POE reported feeling independent and confident than did those who did not have POE. Analysis also shows a larger portion of participants without POE reported feeling stressed and uncertain about their capabilities to succeed when compared to those with POE.

4.2.1 Differences in Feelings based on Gender

Analysis of positive and negative feelings based on gender also yielded interesting results. All negative feelings (except isolation) were more prevalent among females compared to males. However, Chi Square test of independence showed that these gender differences were statistically significant (at $p < 0.05$) for only four feelings (i.e., scared, anxious, depressed, and stressed). Isolation was the only negative feeling reported by a slightly higher number of males compared to females, although the difference was not statistically significant. Similar to this trend found in the analysis of negative feelings is a trend found in the positive feelings for males. It was found that all positive feelings (except "supported") were more prevalent among males when compared to their female counterpart. However, Chi Square analysis showed that the differences in positive feelings based on gender were statistically significant (at $p < 0.05$) only for three of the positive feelings (i.e., confident, comfortable, and supported).

4.2.2 Differences in Feelings based on Prior Online Experience (POE)

Frequency analysis showed that more students without POE reported negative feelings compared to those students with POE. Chi Square analysis showed that differences in negative feelings based on POE were significant (at $p < 0.05$) for five negative feelings (i.e., uncertain, scared, anxious, depressed, and stressed). On the other hand, positive feelings were reported to be more prevalent among students with POE than those without prior exposure. Differences in all positive feelings (except safe) based on POE were statistically significant at $p < 0.05$.

4.2.3 Differences in Feelings based on CGPA

Although there were a few anomalies due to a lower number of participants in the low achieving (i.e., low CPGA) groups, frequency analysis showed that negative feelings were found to be more prevalent among students with lower CGPAs compared to high achievers. On the other hand, positive feelings were found more among high achievers.

Due to violation of assumptions of Chi Square test of independence (i.e., there should be no less than a 5 count in any cells), *Fisher's exact test* was applied to check the significance of associations
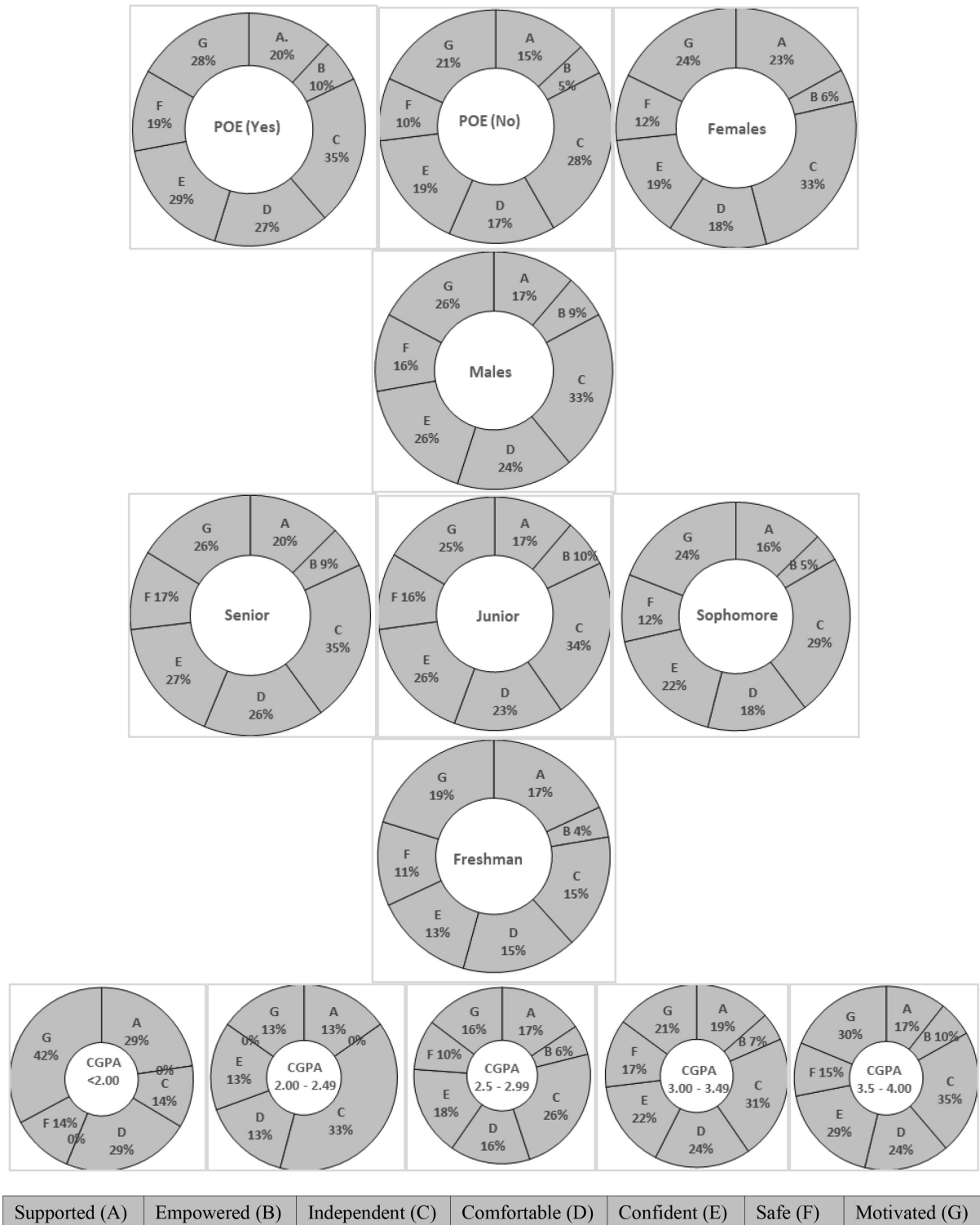
| Supported (A) | Empowered (B) | Independent (C) | Comfortable (D) | Confident (E) | Safe (F) | Motivated (G) |

Fig. 1. Participants' Reporting of Positive Feelings.

between CGPA and prevalence of various (positive and negative feelings). *Fisher's exact test* results showed that only the differences in uncertain, scared, anxious, depressed and stressed (among negative) feelings with respect to CGPA were significant at $p < 0.05$. Differences in positive feelings

with respect to CGPA were found to be significant only for motivated and confident feelings.

4.2.4 Differences in Feelings based on Current Academic Status

Frequency analysis showed an increased prevalence

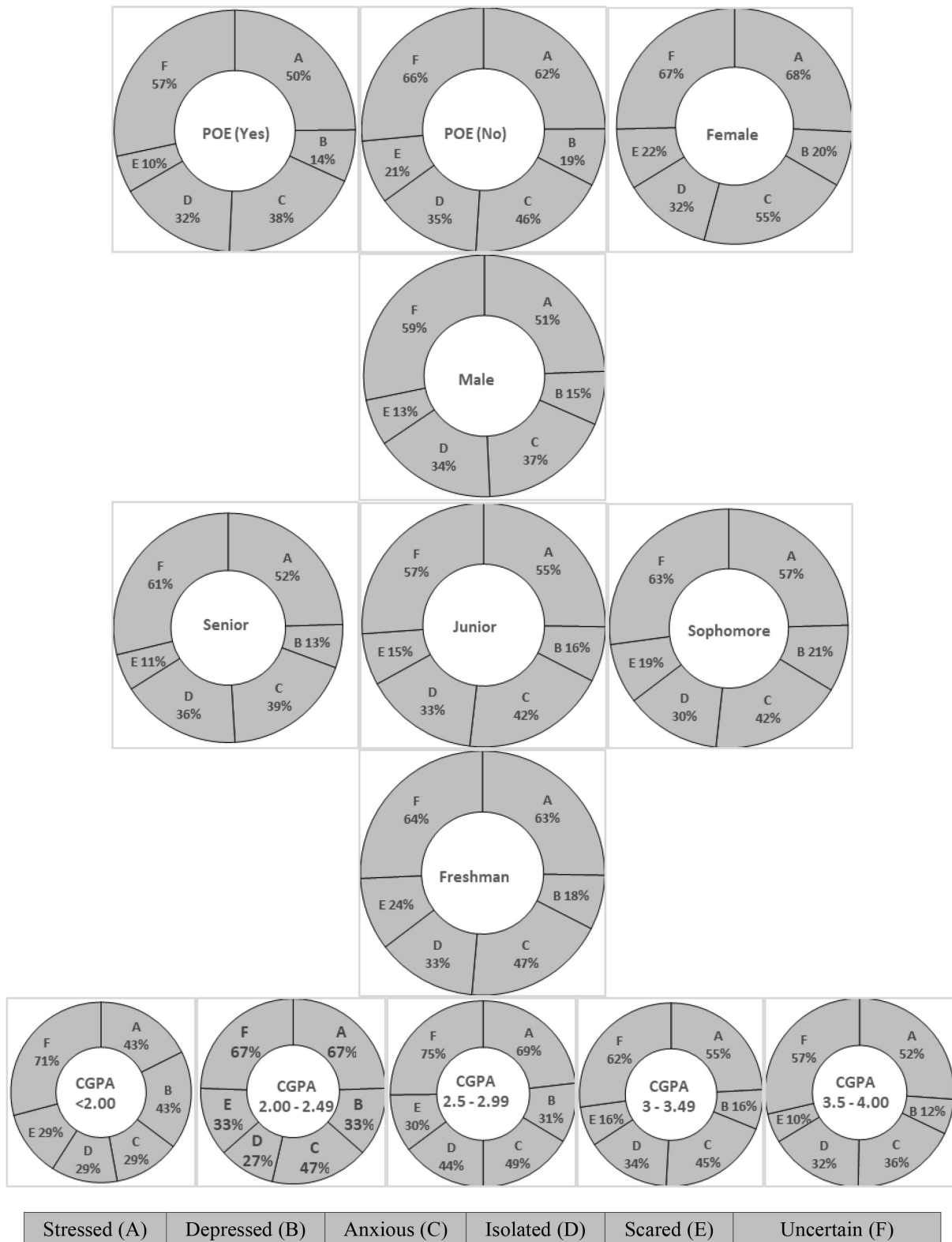| Stressed (A) | Depressed (B) | Anxious (C) | Isolated (D) | Scared (E) | Uncertain (F) |

Fig. 2. Participants' Reporting of Negative Feelings.

of positive feelings of motivated, safety, confidence, comfort, and independence with increasing academic level (i.e., from freshman towards senior). However, in the cases of supported and empowered, more freshman than sophomores reported feeling supported, while more juniors than seniors felt empowered. Chi-Square analysis found that differences in feeling confident, comfortable, inde-
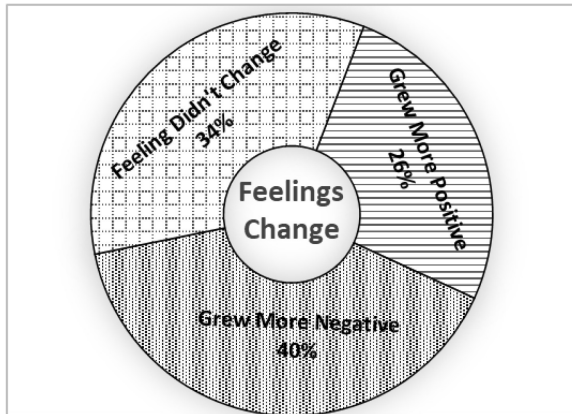
Fig. 3. Changes on students' feeling toward OLE.

pendent and empowered are statistically significant at $p < 0.05$. In the case of negative feelings, frequency analysis showed a clear decreasing trend in prevalence of feeling scared, anxious, and stressed with increasing academic level (i.e., from freshman towards senior), while there are some deviations in case of uncertain, isolated, and depressed feelings. Chi-Square analysis shows the statistical significance (at $p < 0.05$) of differences in feeling scared and depressed based on current academic status.

4.3 Change in Students' Feelings during the Online Course (Research Question #3)

As the semester progressed, we found that participants' feelings towards online learning changed. Sixty-six percent (66%) of the student participants

reported a change in their feelings. As shown in Fig. 3, twenty-six percent of these reported that their feelings grew more positive during the online learning; forty percent reported that their feelings grew more negative.

In the following sections, we describe how these feeling changed based upon participants' POE, gender, and academic status.

4.3.1 Feeling Changes Based Upon Students' POE

An analysis of the self-reported differential growth of positive and negative feelings reported by participants with respect to POE yielded interesting results. Within-group analysis of both student groups showed that growth of negative feelings during the online experience was more prevalent, compared to positive feelings and neutral feelings, irrespective of whether participants had prior POE or not. For example, 43% of all students without prior exposure to OLE and 37% of all students who had prior exposure to OLE reported that their feelings grew more negative during the online experience compared to 23% and 28% of students reporting growth of positive feelings among the two groups respectively. However, intergroup comparison shows that the growth of positive feelings was more prevalent among students with POE and that the growth of negative feelings was more prevalent among students without POE. Using these results, it might be inferred that POE helps to reduce the growth of negative feelings during online learning experience. However, none of the changes in feelings in relation to POE were statistically significant.
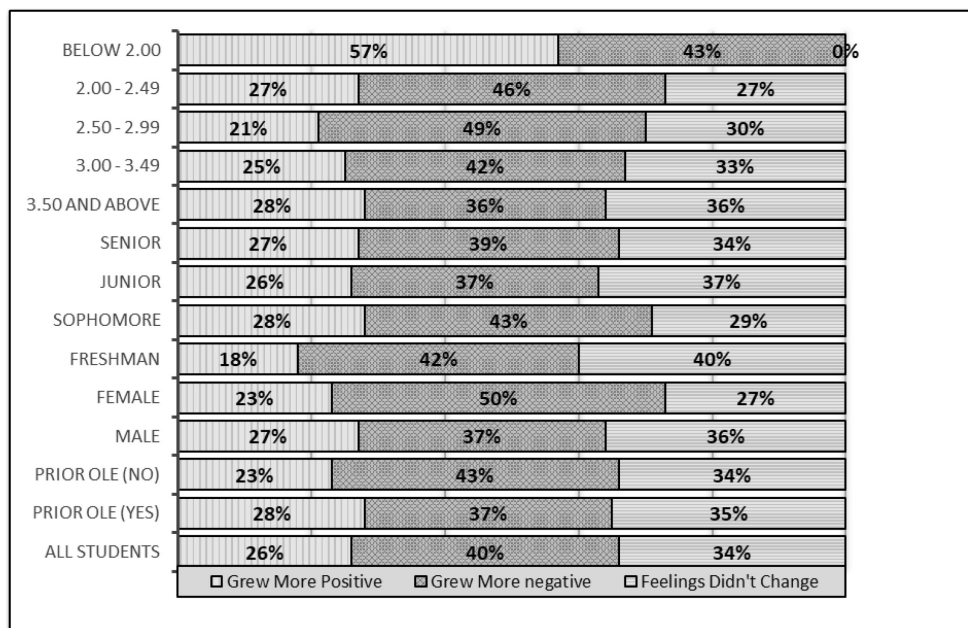

Fig. 4. Feeling changes due to various demographic background.

4.3.2 Feeling Changes Based Upon Students' Gender

A frequency analysis of changes in participants' feelings revealed that among all participants (irrespective of gender), the growth of negative feelings was more prevalent than growth of positive feelings. However, a gender-based comparison did show that more females (50%) reported to develop more negative feelings than males (37%). On the other hand, more males (27%) reported developing more positive feelings during online learning experience than females (23%). Chi-square analysis showed that all of these changes in feelings in relation to gender were statistically significant ($\chi^2(2) \geq 13.433$, $p = 0.001$).

4.3.3 Feeling Changes Based Upon Students' Academic Status and CGPA

Despite a larger number of participants who reported developing more negative feelings as the semester progressed, we found participants with higher CGPA or who were more senior in their academic status were likely to grow positive feelings and lessen their negative feelings than their fellow students with lower CGPA or at early stage in the academic progression. Anomalies in the growth of positive feelings towards online learning were found among two student groups with CGPA lower than 2.50, which might be attributed to the very low counts of students falling in these two groups (7 students with CGPA < 2.00 and 15 students with CGPA 2.00 – 2.49). However, all of these changes in feelings were not statistically significant ($p > 0.05$).

5. Discussion

The unexpected transition to online delivery in spring 2020 seemed to have caught some instructors and students unprepared. This is understandable, since there was limited time for the instructors to make the transition from their traditional face-to-face classes to online classes. Our analyses found electronic homework submissions, recorded video lectures, and online exams to be the 3 most widely available features that students were exposed to. Students also reported that video lectures, homework electronics submission, and downloadable documents or files were the top three features that had positive contribution to their learning. Poor internet performance, online exams, and projects were found to be the top three features that were reported to have contributed negatively to students' learning. These findings suggest that learning assessments would need to be carefully developed when they are being administered online. Poor internet performance may add extra stress to students' online work. Internet performance is of particular importance while taking online exams or submitting assignments, especially when the submission deadline is approaching. Establishing a clear guideline, when unexpected events occur during online exams and submissions, may reduce the unnecessary stress on students. A more flexible policy or procedure for completing tasks may need to be considered.

Teacher-student interaction is different in online environments [22]. Online interaction emphasizes the instructor's role as the facilitator between students and materials [23] or the mediator between students and technology [24]. The learning features that are provided in online courses may potentially facilitate knowledge-generation, which helps students to organize their ideas from multiple perspectives and integrate them with personal knowledge. Therefore, the instructor must be cognizant of the increased diversity of learners, and then accordingly determine appropriate test formats, measurement practices, and assessment strategies [25]. Doing so may persuade and motivate students to accept the e-learning environment [26].

Participants of the study reported three positive feelings of being independent, motivated, and confident to be the most prevalent during the online learning despite the unexpected transition from face-to-face traditional classes. Participants also reported feelings of uncertainty, stress, and being anxious as the most frequent negative feelings they experienced while engaged in online learning. Furthermore, results show that POE impacted both positive and negative feelings while engaging in online courses. These feelings may be caused by multiple reasons. There is a need to empower students through personalized support, prevent struggling students from feeling overwhelmed, and direct students to specific services and resources based on their unique needs. Moreover, more of the younger and less experienced students (i.e., freshmen, sophomore) reported that online help (e.g., virtual office hours, virtual tutoring, and live synchronous chat) contributed positively to their learning success compared to their more senior fellow students. This may be indicative of increased maturity as they become self-reliant learners [27, 28].

It was apparent that the changes in feelings reported by participants were related to their POE. Students having POE showed indications that their feelings grew more positively towards online learning than their fellow students without POE. This finding suggests that having students gain experience with some level of online learning in an online learning environment during their tradi-

tional face-to-face learning may help students become more prepared when another unexpected and unplanned switch to online learning occurs. Also, more female students seemed to grow negative feelings than their male counterparts during online learning. Like students, instructors often feel anxious and isolated, teaching in an online environment with concerns regarding the workload, quality of instruction, technology skills, and accessibility [29]. Yet, there is little research to date that explores students' emotions and the strategies that may help online learning feel more satisfying.

6. Conclusions

As a result of the unexpected transition to online delivery in spring semester of 2020, students were required to adapt and adjust to new learning environments. Poor internet performance, online exams, and group projects were the top three features that students reported as negatively affecting their learning. This work found a complex mix of positive (i.e., independent, motivated, and confident) and negative feeling responses (i.e., uncertainty, stress, and being anxious) that were reported by the participants. More female students seemed to grow negative feelings than their male counterparts during emergency remote learning (ERL). Furthermore, the work discovered that students' prior exposure to online learning environment affects both their positive and negative feelings they have during their engagement in ERL. Students who had initial prior online learning experience (POE) showed indications that their feelings grew even more positive towards online learning than their fellow students without initial POE.

7. Limitations and Future Study

There are two known limitations to this study. The results of the study presented in this paper are situated from an unplanned and unexpected move from traditional face-to-face learning to online learning because of the health crisis of COVID-19 pandemic. Instructors may not have had a robust online learning curriculum or online learning management system developed before being forced to move. They more than likely, did not have time to build a learning system that could accommodate many differences in their students learning preferences. Thus, the results presented herein may not represent a situation when the online learning was as thoughtfully designed and delivered as most online educational literature would recommend. It may be worthwhile to replicate this study during a full-semester of online learning to understand how this nuance in the learning environment may influence students' feelings presented herein.

Second, the duration of the of the online learning experience we investigated in this study is relatively short and does not represent a full semester course. This was due to the timing of the start of the pandemic. Considering that, students' feelings might have been unsteady or volatile as they rapidly adjusted to the new OLE, especially for those who had no POE, there is a chance those feelings carried through much of this study's time duration. Further study to explore specific POE that positively and negatively impacts students' feelings and success may also need to be conducted.

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