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Perceived Task Value of Engineering Undergraduates During COVID-19 Pandemic*

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The Corona Virus-19 globally disrupted education severely in March 2020 and has continued through 2023. It has had far reaching impacts on engineering education and yet it provides an opportunity for researchers to understand this type of event's impact so that we can be well equipped for potential future disruptive events. This paper describes a novel study that used an online learning value and self-efficacy scale survey to collect data on perceived task value and student self-efficacy during a forced transition to online learning in a western university's sophomore level engineering mechanics course and a junior level hydraulic engineering course. This was an initial study that was investigating these constructs using the Online Learning Value and Self-Efficacy Scale. Data was additionally collected a year later with new participants in the same classes now taught in a traditional face-to-face fashion. Comparative results indicate that students who started in face-to-face classes preferred and felt they could do better in the face-to-face components more so than the online components, and that students who were earlier in their academic career were more likely to have higher ratings of self-efficacy in a forced online learning environment than students enduring the transition later in their academic career.

Keywords: task-value; online learning value; pandemic; Covid-19; OLVSES; engineering

1. Introduction

The Covid outbreak of March 2020 forced many Higher Education Institutions (HEIs) to immediately transition from classroom-based learning to online learning. Its impact spans 200 countries and more than 1.6 billion learners [1]. The size and breadth of this online movement is astounding when one considers how many teachers, students, and schools where involved [2]. Literature has begun to coin this movement as an Emergency Transition to Remote Experiences (ERT) [3–10]. The term references the speed and immediacy of the required transition. In fact, the efforts of all entities involved should be considered as monumental. This transition has been shown to be difficult for both students and teachers. Holme has reflected on this transition and noted that an amazing feat was accomplished [11]. Work conducted on multiple fronts during the ERT has allowed the academy to develop knowledge about impacts and practices for students and teachers engaged in such a pivot [10, 12]. Our contribution seeks to add to that body of knowledge by focusing on two specific and formative engineering courses and their corresponding instructional approaches, and has a goal of developing an understanding of the impacts of this ERT event on student self-efficacy and online learning value. The work uses the Online Learning Value and Self-Efficacy Scale (OLVSES) developed by Artino and McCoach to collect its data [13]. It is believed this is the only work that has used this scale to assess self-efficacy and online learning value during the ERT.

The ERT involved typical distance education delivery mechanisms, such as learning management systems, video conferencing software, and online discussion groups, but it likely did not always involve solid foundational distance education practices. With recognition of the extenuating circumstances imposed, one cannot be too critical of implemented learning structures because educators were reacting rapidly to keep our educational systems running through online methods. Accommodations were commonly implemented without teacher training on the learning management systems adopted/used, on the vetted online education practices and techniques typical for good online education, or with knowledge of the existing research concerning the differences between traditional and online curriculum development. In short, many instructors were caught unprepared and even unaware [14].

Literature shows that traditional distance education methods are not the same as those recommended for online instruction [15–17]. It also shows that many faculty are untrained in skillsets/techniques found to help the online learner, resorting to similar practices from their face to face classes to aid students [18–20]. The rapid immersion of instructors and students to the ERT was unplanned and unexpected, thus placing students into an

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environment that was in stark contrast to the more typical deliberate and "well-planned" face-to-face model they were experiencing [9, 21–24]. These factors certainly had an impact on student education, and it behooves the academia to develop an understanding of how students reacted in this ERT [7, 14, 25].

1.1 Task Value

This work uses an instrument that measures Online learning Value and Self-Efficacy. Online learning is assessed through a construct of task value. Lawanto, et al., defines task value as referring to a student's evaluation of how important, useful, and interesting a task is [26]. This work focused on these three components of task value: importance, utility, and interest. Task Value is also discussed by Eccles and Wigfield, and they advocate a focus on four components: attainment value (importance), intrinsic value (interest), utility value (usefulness) and cost [27]. Attainment value is defined as the importance of doing well on a task while intrinsic value is the inherent pleasure or enjoyment from engaging in an activity or their subjective interest in the task's content. Utility value is defined as usefulness of a task to the individual in terms of their short- and long-term goals, and cost is defined as the negative aspects of participation in the task or the amount of effort to succeed at it versus the lost opportunities' resultant to that engagement [13]. Task value has been extensively researched in connection with students' motivation and learning achievement, and a strong predictor of mastery goal orientation and deep learning [28].

1.2 OLVSES Instrument

Self-efficacy for learning and perceived task value are two attributes that are specifically assessed with the Online Learning Value and Self-Efficacy Scale (OLVSES) instrument, a seven point Likert scale instrument [13]. This instrument has been chosen and adapted in this work to collect data around self-efficacy and perceived task value. The research team in this work is focusing only on task value in this phase of the study and has classified the questions according to the importance, utility, and interest factors used to categorize task value. While this instrument was developed initially for self-paced online training, its application to courses that where subject to ERT is highly relevant. As mentioned by the instrument's authors, investigations of this type are important because perceived task value and self-efficacy are demonstrated as significant predictors of both student's academic achievement and their use of self-regulated learning strategies in traditional learning [29]. Additionally, many experts suggest these motivational constructs may have even greater import in online education [30–34]. It is likely that aspects of these motivational constructs are equally relevant in an ERT.

The original OLVSES instrument was initiated with a literature review with initial items for each subscale being developed using a process where conceptual definitions where written. Close to 10 items per construct where created, and items were compared to similar scales in the literature. Six content experts reviewed the items by identifying the construct area where each item fit. They then indicated the certainty and relevance they felt for each items placement in the category and rated their opinion of how favorably the item was with respect to the chosen construct [13]. Results yielded a 28-item instrument that was considered valid with regards to content. 475 participants were invited to complete the survey with 204 finishing it in its entirety. For this first stage in the analysis, a principal axis factor (PAF) analysis was performed on results to reduce the questions to only those that were significant. A reliability analysis was then run on these items and for a second study some questions were omitted because they correlated highly with other items. This allowed a shorter survey to be provided to students while still gaining the same information. This second study involved 780 invited participants of which 646 participated fully. Analysis was conducted on this second study and findings presented herein are derived from that work. Six task value items and five self-efficacy items were selected to be retained in the instrument thus focusing the scale on two areas. The Cronbach alpha values for the Task Value items were reported as 0.85 and for the self-efficacy items it was reported at 0.87. Respective means for task value (TV) and self-efficacy (SE) where 5.25 (TV) and 0.99 (SE) and standard deviations where 5.16 (TV) and 1.04 (SE). Subscale correlation was 0.289, $n = 638$, and $p < 0.01$. A newer version of the scale was developed with these eleven (11) items and then tested with an additional 481 participants for a look at criterion related validity. Additionally, a 50 item (1–7 Likert Scale) survey was used targeting four subscales: boredom, frustration, elaboration, and metacognitive self-regulation. The two former subscales were adapted from Pekrun, Goetz, and Perry work and the latter subscales where from Pintrich's Motivated Strategies for Learning Questionnaire (MSLQ) [35, 36]. Correlation results and regression analysis results can be found in the original publication [13].

The work developing this OLVSES instrument provided a measurement tool that was used in our study to look at the impact of this ERT event on student self-efficacy and online learning value (task value). Our specific research questions are:

1. How do students who in an engineering course who suffer disruption evaluate the three categories of task value: importance, utility, and interest?
2. What attributes within students result in higher ratings of task value (importance, utility, and interest) after a disruption has occurred?

2. Methods

2.1 Participants

One-hundred four (104) students from an undergraduate Engineering Statics class and fifty-three (53) students from an upperclassmen level Hydraulics class were asked to participate in a survey related to their experience with the sudden impact of Covid-19, which changed their experience in class from a traditional face-to-face class into an online class during the spring semester of 2020. All students in the class were invited to participate in an anonymous survey. Once the survey data was collected, the surveys were checked for consistency, with all incomplete surveys and surveys consisting of repeated use of the same answer (all 7's, all 1's, and all 4's) were removed from the data set. This reduced the total number of participants to one-hundred forty-four (144), with ninety-two (92) students left in the Statics class and fifty-two (52) students left in the Hydraulics class. These students were primarily traditional college students at a western university in traditional undergraduate engineering programs.

2.1.1 Context

Utah State University is a land-grant, public research university in Logan, Utah, focusing on science, engineering, agriculture, domestic arts, military science, and mechanic arts [37]. It has 20,000 students living on or near campus. The College of Engineering at Utah State University includes six undergraduate programs and seven graduate programs. Both courses used in this study come from this university and results from the work are possibly limited in its generalizability to similar institutions.

2.1.2 Statics

Statics is the study of forces acting on bodies at rest or moving with a constant velocity. It is one of the first engineering courses taken by students in Mechanical, Aerospace, Civil, Environmental, and Biological Engineering. This course is usually taken in the fall by students in the first semester of their sophomore year although many may also take it in the spring or summer. The class has a calculus and calculus-based physics prerequisite and students are often concurrently enrolled in another math course (second or third calculus course or linear algebra/differential equations) while engaging in this class. The class precedes a student's enrollment in Strengths or Dynamics which are courses usually delivered after a student has taken Statics. Course content spans subjects such as vectors, forces, moments, equivalent force systems, distributed loading, 2 and 3D equilibrium, rigid body constraints, truss analysis, frame and machines, shear and bending moments, friction, center of gravity and centroids, composite bodies, fluid pressure, moments of inertia for area, products of inertia for area, and mass moments of inertia. The class spans 14 weeks and has multiple formative and summative assessment opportunities. The class provides basic foundational material for a student's progression to future mechanics-based coursework.

2.1.3 Hydraulic Engineering

The term "Hydraulic Engineering' is often coined as hydraulics, which refers to water in motion and its application to water infrastructure and the environment. This course, Hydraulics in Civil and Environmental Engineering, is the second of a two-part series taken junior year where students are first instructed in the basic physics of water movement (fluid mechanics) followed by the application of such principles to engineering projects and problem solving. This mimics industry, as hydraulic engineers use fluid mechanics principles to solve societies' water challenges and are concerned with a variety of complex topics such as floods, rivers, sediment transport, water storage, water diversion, navigation, hydropower, water quality, aquatic ecosystems, potable water systems, and sewage treatment.

In this course, students should learn how to apply the laws and principles of fluid motion (e.g., conservation of mass, energy, and momentum) to solve hydraulic engineering problems including flow measurement, pipeline flow, open channel flow, culverts, weirs, spillways and other hydraulic structures, and pumps and turbines. Problem solving should be done through the lens of sustainability, which requires consideration of many external factors. The instructional method for this course is somewhat unique in that each instruction module is patterned after actual engineering projects with deliverables mimicking typical submittals by hydraulic engineers. Virtual field trips detailing the role of hydraulics in civil engineering projects are common for contextual teaching. Furthermore, although many hydraulic courses include a laboratory portion, in this course creativity and communication are prioritized as, for example, students are prepared to design and carry out as a team their own laboratory experiment of a topic of their choosing, formulating their instrumentation plans, data analyses, and conclusions and submitting their deliverable with cover letter and self-assessment. It is important to note that the structure of this course and instructional methods leveraged in-person teaching and working as teams on projects and in a laboratory that were not necessarily easily transferred to online instruction.

2.2 Instrumentation

The survey was delivered to the participants through Qualtrics, a survey-building software. This survey was modified from the Online Learning Value and Self-Efficacy Scale (OLVSES) survey [13]. The original survey was intended to function as a "quantitative self-report measure of perceived task value and self-efficacy for learning within the context of self-paced, online training" [13]. The survey questions can be found in Table 1. Due to the desire to adequately understand the impact of the Covid-19 disruption, the questions from the OLVSES regarding Self-Efficacy were duplicated, and one question was modified to include Self-Efficacy of the face-to-face modality of the class. The full survey is provided, but this phase of the work focuses only on the results of question 7.

2.3 Data Collection

As mentioned previously, students were invited to participate in this survey over the course of a week near the end of the semester (4 month instructional period). This occurred after the Covid-19 pandemic forced the school to convert all classes into online classes and after instructors rapidly adapted their effective in-person teaching strategies to online teaching platforms. A portion of questions asked students to recall what the course was like prior to the disruption.

2.4 Data Analysis

Because the data consisted of Likert-scale, ordinal quantitative results, the data was analyzed using statistical means. Although, often, ordinal scales lack the same strict distances as interval data would, it is acceptable to use similar methods with ordinal data [38]. In particular, RStudio was used to evaluate and analyze the data. To form the groups (Table 2), the research team used questions 1 through 6. A final group (Class, seen in the last row of Table 2) was form based on which class each student was in.

Once the groups had been identified, the means and standard deviations of the results related to Task Value were calculated. Following this, the research team checked between the groups on each survey question looking for those that might be statistically significant. First, graphs of the medians and standard deviation of the data were

Table 1. Survey Questions

Question Number	Question
1	To which gender do you most identify?
2	How many months of online coursework have you completed before this class went online?
3	What is your current academic status (earned credit hours)
4	What is your GPA?
5	What is your age?
6	What is your employment status as you attend school this semester?
7	Task Value questions (7 level Likert-scale questions)
7-1	It was personally important for me to perform well in this class.
7-2	This course provided a great deal of practical information.
7-3	I was very interested in the content of this course.
7-4	Completing this course moved me closer to attaining my career goals.
7-5	It was important for me to learn the material in this course.
7-6	The knowledge I gained by taking this course can be applied in many different situations.
8	Self-Efficacy questions in face-to-face classes (7 level Likert-scale questions)
8-1	Even in the face of technical difficulties, I am certain I was learning the material presented in my face-to-face class fine.
8-2	I am confident I can learn in the presence of an instructor to assist me.
8-3	I am confident I can do an outstanding job on the activities in a traditional face to face class.
8-4	I am certain I can understand the most difficult material presented in a face-to-face class.
8-5	Even with distractions, I am confident I can learn material presented in a face-to-face class.
9	Self-Efficacy questions in online classes (7 level Likert-scale questions)
9-1	Even in the face of technical difficulties, I am certain I can learn the material presented in an online course.
9-2	I am confident I can learn without the presence of an instructor to assist me.
9-3	I am confident I can do an outstanding job on the activities in an online course.
9-4	I am certain I can understand the most difficult material presented in an online course.
9-5	Even with distractions, I am confident I can learn material presented online.

Table 2. Demographic Categorization

Demographic Information	Grouping
Gender	Male Female
Months of prior online experience	None 0 to 2 months 2 to 4 months 4 to 6 months 6 to 12 months 12 to 24 months More than 24 months
Academic Standing (Year in College)	Underclassmen (Freshmen/Sophomore) Upperclassmen (Junior/Senior) Grade Point Average (GPA) Greater than 3.5 3–3.49 2.5–2.99 2–2.49 Less than 2
Age	Younger Traditional (18–21) Older Traditional (22–24) Nontraditional (25+)
Employment	Fulltime Part-time Not working
Class	Hydraulics Statics

Table 3. Means and Standard Deviations on the Task Value question of the OLVSES Survey

Survey Question	n	M	SD
It was personally important for me to perform well in the class (7-1)	144	6.0	1.1
This course provided a great deal of practical information (7-2)	144	6.1	0.9
I was very interested in the content of this course (7-3)	144	5.7	1.1
Completing this course moved me closer to attaining my career goals (7-4)	144	5.8	1.2
It was important for me to learn the material in this course (7-5)	144	5.9	1.1
The knowledge I gained by taking this course can be applied in many different situations (7-6)	144	5.9	1.0

Table 4. Means and Standard Deviations on Task Value based on category

Survey Question	n	M	SD
Important to student (7-1, 7-4, 7-5)	144	5.9	1.0
Useful to student (7-2, 7-6)	144	6.0	0.8
Interesting to student (7-3)	144	5.7	1.1

generated to determine if we could identify groupings that might be significant. Once those groupings which showed promise were identified, one-way Analysis of Variances (ANOVAs) were performed to confirm if there was a significant difference between the groups. Tukey's Honestly Significant Difference (HSD) tests were then performed to identify which groups were significant. The results of this analysis will be presented in the next section.

3. Results

3.1 Task Value

The means and standard deviations of all participants replying to the Task Value questions in the OLVSES survey are shown in Table 3. The means of all six questions hover around 6 on the 7-point Likert scale, with a standard deviation hovering around 1. This indicates that most students who took part of the survey had high values of Task Value related to the course they were taking. The research team identified that the OLVSES instruments original questions 7–1, 7–4, and 7–5 measure the importance of the class to the student, while 7–2 and 7–6 measures the usefulness to the student, and 7–3 measures the interest of the class to the student's Task Value. These results are shown in Table 3.

The following tables show the results for these three attributes by separating the students into groups based on gender and online experience (Table 5); academic standing, GPA, and age (Table 6); and employment status and course (Table 7).

The most telling results are how similar the groups appear to be with each other, although there are some potential differences. To determine which groups might be significant, graphs were generated for each category of task value and each grouping, and those graphs indicated possible differences were analyzed using one-way ANOVAs. The results of these one-way ANOVAS are shown in Table 8. Although significance is usually limited to the $p < 0.05$ level or lower, looking at the ANOVAs that came in at the $p < 0.1$ level can often shed light on the results and can guide future

Table 5. Means and Standard Deviations on the Task Value categories of the OLVSES Survey based on Gender and Experience in Online Classes

Survey Question	Gender M (SD)		Experience in online classes M (SD)						
	Female	Male	Not Specified	0 to 2 months	2 to 4 months	4 to 6 months	6 to 12 months	12 to 24 months	More than 24 months
	n = 27	n = 116	n = 39	n = 19	n = 43	n = 20	n = 14	n = 5	n = 4
Important	6.0 (0.8)	5.9 (1.0)	6.0 (1.2)	5.8 (0.8)	6.1 (0.9)	5.7 (1.4)	5.9 (0.9)	6.0 (0.6)	5.4 (0.5)
Useful	6.0 (0.8)	6.0 (0.9)	6.0 (0.9)	6.1 (0.7)	6.1 (0.7)	5.8 (1.1)	5.9 (0.9)	5.9 (0.4)	6.1 (0.8)
Interesting	5.4 (0.8)	5.8 (1.0)	5.8 (1.3)	5.7 (0.8)	5.8 (0.9)	5.6 (1.2)	5.5 (0.9)	6.0 (1.2)	5.5 (0.6)

Table 6. Means and Standard Deviations on the Task Value categories of the OLVSES Survey based on Academic Standing, GPA, and Age

Survey Question	Academic Standing M (SD)		GPA M (SD)				Age M (SD)		
	Under Classmen	**Upper Classmen**	**3.5+**	**3–3.49**	**2.5–2.99**	**2–2.49**	**Younger Traditional**	**Older Traditional**	**Non-traditional**
	n = 41	**n = 103**	**n = 64**	**n = 68**	**n = 11**	**n = 1**	**n = 41**	**n = 74**	**n = 29**
Important	6.4 (0.7)	5.7 (1.1)	6.0 (1.0)	5.8 (1.1)	6.0 (0.8)	4.3 (NA)	5.9 (1.0)	5.9 (1.0)	5.9 (1.2)
Useful	6.3 (0.7)	5.9 (0.9)	6.1 (0.8)	6.0 (0.9)	5.9 (0.9)	6.0 (NA)	6.0 (1.0)	6.0 (0.8)	6.0 (0.9)
Interesting	5.9 (0.9)	5.7 (1.1)	5.8 (1.1)	5.7 (1.1)	6.0 (0.8)	6.0 (NA)	5.6 (1.1)	5.8 (1.0)	5.8 (1.1)

Table 7. Means and Standard Deviations on the Task Value categories of the OLVSES Survey based on Employment and Class

Survey Question	Employment M (SD)			Class M (SD)	
	Fulltime	**Part-time**	**Not Employed**	**Statics**	**Hydraulics**
	n = 20	**n = 86**	**n = 38**	**n = 92**	**n = 52**
Important	5.7 (1.0)	6.0 (0.9)	5.9 (1.2)	6.0 (1.0)	5.7 (1.0)
Useful	5.8 (0.8)	6.1 (0.8)	6.1 (1.1)	6.1 (0.9)	6.0 (0.8)
Interesting	5.7 (1.2)	5.8 (0.9)	5.6 (1.3)	5.7 (1.1)	5.7 (1.0)

Table 8. Results of One-Way ANOVA for OLVSES Survey Questions

Task Value Category	Group	*df*	F	η	*p*
Interest	Gender	1,141	3.21	0.022	0.075*
Important	Experience Online	6,137	0.59	0.025	0.739
Useful	Experience Online	6,137	0.74	0.018	0.858
Important	Academic Standing	1,142	13.44	0.086	<0.001**
Useful	Academic Standing	1,142	6.87	0.046	0.010**
Important	Class	1,142	2.46	0.017	0.119
Useful	Class	1,142	0.48	0.003	0.488
Important	Employment	2,141	0.54	0.008	0.581
Important	GPA	3,140	1.17	0.024	0.323

* Significant at the $p < 0.1$ level; ** Significant at the $p < 0.01$ level.

research. Each ANOVA that showed $p < 0.1$ was analyzed using Tukey HSD to identify which, if any, of the groups was statistically different.

Gender had one significant difference related to the students finding the course interesting. The Tukey HSD test indicated that the mean score for females (M = 5.4, SD = 0.8) was significantly different than for males (M = 5.8, SD = 1.0).

Academic standing had two different categories which were statistically significant. First, Tukey HSD tests indicated that underclassmen (M = 6.4, SD = 0.7) found the courses more important than the upperclassmen (M = 5.7, SD = 1.1). The underclassmen (M = 6.3, SD = 0.7) also found the courses more useful than the upperclassmen (M = 5.9, SD = 0.9). It is interesting to note that these same results are not found with regards to the class that the students are in, although far more students are underclassmen in the statics class than in the hydraulics class.

Because academic standing was grouped into upper- and underclassmen, the research team also performed an ANOVA comparing the importance (and usefulness of the courses based on the specific year the students were in. The ANOVAs showed that there were experience levels that found higher importance ($F(3, 140) = 2.86$, $p = 0.005$) and usefulness ($F(3,140) = 2.86$, $p = 0.039$). Post hoc tests confirmed that sophomores (M = 6.4, SD = 0.7) found the class more important than both juniors (M = 5.8, SD = 0.9) and seniors (M = 5.7, SD = 1.2) and that sophomores (M = 6.3, SD = 0.6) found the class more useful than juniors (M = 5.8, SD = 0.9).

No other comparisons were found to have significant differences.

4. Discussion

It should be recognized that all participants in this study had originally registered for a face-to-face class and, due to the impact of Covid-19, were thrust into an online modality. In addition, as mentioned under instrumentation above, there was not a pre-survey/post-survey provided because of the nature of the Covid event and its immediacy.

Instead, each student rated their task value after the ERT had occurred.

Our first research question was:

> How do students who suffer disruption during a course evaluate their task value?

As shown in Table 4, students rate the importance, usefulness, and interest in their courses fairly high even with a disruption to the course. This is telling because the statics course is one of the first engineering courses that engineering students take. The fact that the mean for importance (M = 5.9), usefulness (M = 6.0), and interest (M = 5.7) are all close to 6, the second highest rating on the scale, suggests that students are willing to engage in the class even with the disruption. This is an important fact to recognize, as it emphasizes the importance of continuing a course even with a large disruption in higher education.

Our second research question was:

> Are there students who have higher task value ratings during a disruption in their education than others?

The results related to task value show that the biggest differences between demographics occurred between underclassmen and upperclassmen. Underclassmen found the class to be more important and more useful than upperclassmen did. This suggests that students earlier in their career were finding the material to be more applicable. Upon further investigation, it was found that the sophomores, in particular, found the class more important than all their upperclassmen did, while they also found the class more useful than their junior classmates did. It is possible this may be due to their introductory experience in engineering courses at their sophomore level. Statics is one of the first engineering courses engineering students take and that is usually in their fall sophomore semester. Often sophomore students are learning many skills to help them succeed in an engineering class that lie beyond the simple mastery of the courses content. Things such as organizations skills, communications skills, and grit. In addition, the results from the hydraulics class did not yield this same difference, further suggesting that it is something about the year of the student that impacts this. This finding is important because the statics class tends to have more sophomores while the hydraulics class tends to have more juniors and seniors. In addition, age was not found to be significant, which suggests that it is credit hours the students have earned that influences their rating rather than their age or the course they are taking, with students with less credit hours finding the class to be more important and useful to them.

Although the significance was not significant at the $p < 0.05$ level, there was one additional ANOVA that provided some insight. Students found their interest level different based on self-identified gender, with males being more interested in their course than females. This is not particularly surprising, as engineering degrees are still vastly over-represented by males than females.

The fact that previous online experience was not found to have any significant differences is slightly surprising, as the research team expected previous experience to be a factor in students' ability to adjust to the new class modality. While the researchers would like to expand the study to a larger more diverse population to investigate this finding further, these results do indicate that a group may be able to adjust to a ERT irresponsive of previous online experience. In addition, GPA, age, employment, and class were not found to have any significant impact on task value. Age and the course they are enrolled in have been addressed above in regards to its separation from academic standing. In fact, with an investigation of the graphs of task value based on age, there didn't appear to be enough differences to warrant the further investigation by an ANOVA. Finally, it is important to note that GPA and employment appear to have played no role in students' rating of their task value.

5. Conclusion and Future Work

This work is the first phase of research on the topic of student task value and self-efficacy during an ERT. This research has found that there are significant differences in students' feeling that a course was important, useful, and interesting, primarily based on their academic standing. Underclassmen specifically rated significantly higher than upperclassmen on finding their course useful and important, while males rated their interest significantly higher than females.

Knowing that students, particularly underclassmen, still find the course important and useful after a major disruption argues that faculty members should do what they can to keep the class going even in the face of the disruption. Sometimes this will not be feasible, but where possible, students should be allowed to finish the course.

Future disruptions don't necessarily need to be at the level of a global pandemic. So long as the disruption does not interfere with communication systems, it is possible for students to continue engaging in their schoolwork, even when they cannot meet in person. For example, there may be a community displacement taking place because of a local disaster, or a potential threat of terrorism may result in group instruction being canceled to reduce targeting. Any time there is a need to reduce the physical size of the population on campus, faculty can potentially count on their students' task value keeping them involved in their engineering courses, thus allowing students to finish their class despite the disruption.

When a disruption has occurred, faculty can best support students by reiterating the important aspects of Task Value to students: that their performance matters in the class, that completing the course will help with their career goals, and that it is important for them to learn the material in the course. By showing how this can be done in an online environment through either discussion, readings, or demonstrations, the faculty member can help the students' transition to their online learning through the disruption. Faculty can also help students recognize how the class is useful to the students, showing them the practical information in the course and helping them apply it to other situations. Being more deliberate in communicating this information to students should also help the transition. Where possible, faculty should also help students maintain their interest in the course through discussion.

Further phases of the research, on simultaneous collected data, will compare the students' self-efficacy in the face of the disruption, comparing their expected face-to-face instruction with their realized online experience, and how new students in these same classes are impacted a year after the pandemic, to see if the same basic findings from this study still exist a year later. Further research could investigate why the underclassmen rated higher than the upperclassmen.

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