



Using a Novel Research Methodology to Study and Respond to Faculty and Student Experiences with COVID-19 in Real Time

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ABSTRACT

This paper describes the use of a novel research platform called SenseMaker® to collect and analyze real-time data in the form of participants' qualitative accounts of COVID-19 along with online learning experiences and participants' own quantitative assessments of those experiences. Participants were faculty, students, and staff in the College of Engineering at the University of Georgia during Spring 2020. Results from two waves of data collection informed real-time recommendations to College faculty and administration to address COVID-19-related challenges. Results also facilitated faculty development programming to build instructor communities of learning and support in response to the University's transition to online learning.

Key words: Organizational change, Mixed methods research, Distance learning, COVID-19

INTRODUCTION

The COVID-19 pandemic and the higher education sector's subsequent shift from in-person to online learning took faculty, staff, and students alike by storm. While prior research has explored online learning environments and established best practices (e.g., Alexander 2017, Bailey and Card 2009, Keengwe and Kidd 2010), COVID-19 introduced variables absent from most traditional online learning settings, including a rapid, involuntary, wholesale, and yet likely temporary transition away from in-person teaching; challenges associated with working from home (e.g., childcare and internet access); lack of access to

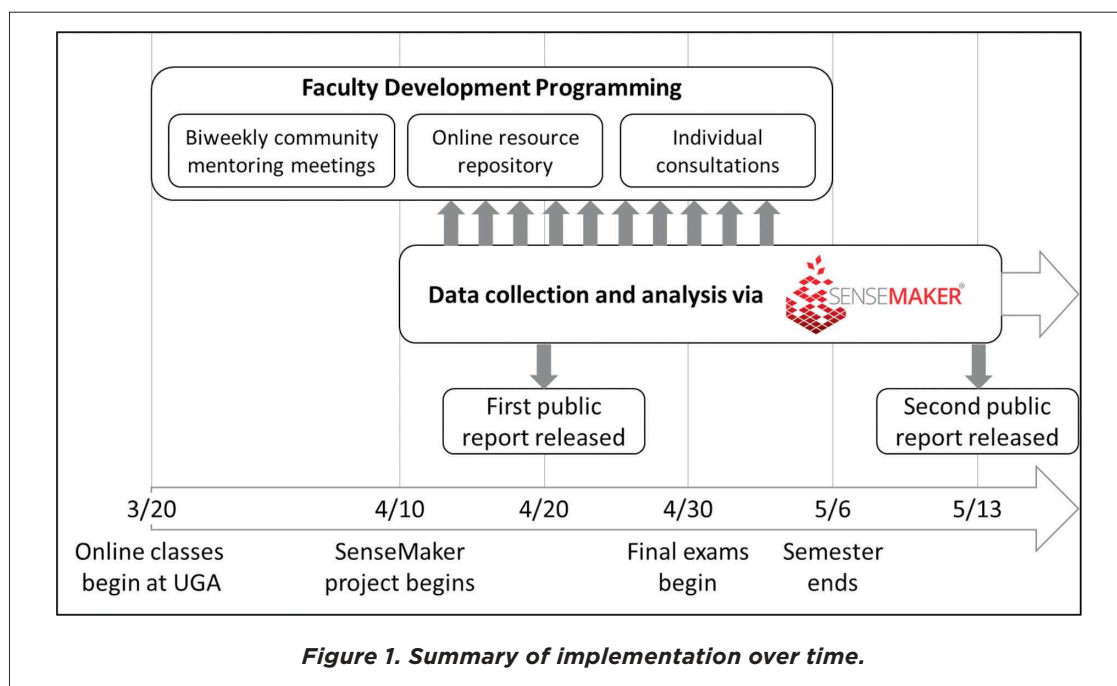


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on-campus utilities; and the backdrop of a global health crisis with the potential for significant impacts on faculty and students. The combination of these variables presented both a long-term research opportunity and a short-term practical challenge, namely: to investigate dramatically different approaches to teaching and learning that might inform novel approaches to higher education post COVID-19, and to better understand faculty, student, and staff experiences to inform immediate, local actions. To these ends, this paper describes the use of a novel research platform called SenseMaker® (Cognitive Edge 2020), which we used to collect and analyze real-time data from College of Engineering (CENGR) faculty, staff, and students. These data took the form of participants' qualitative accounts of COVID-19-related and online learning experiences as well as participants' own quantitative assessments of those experiences.

METHODS

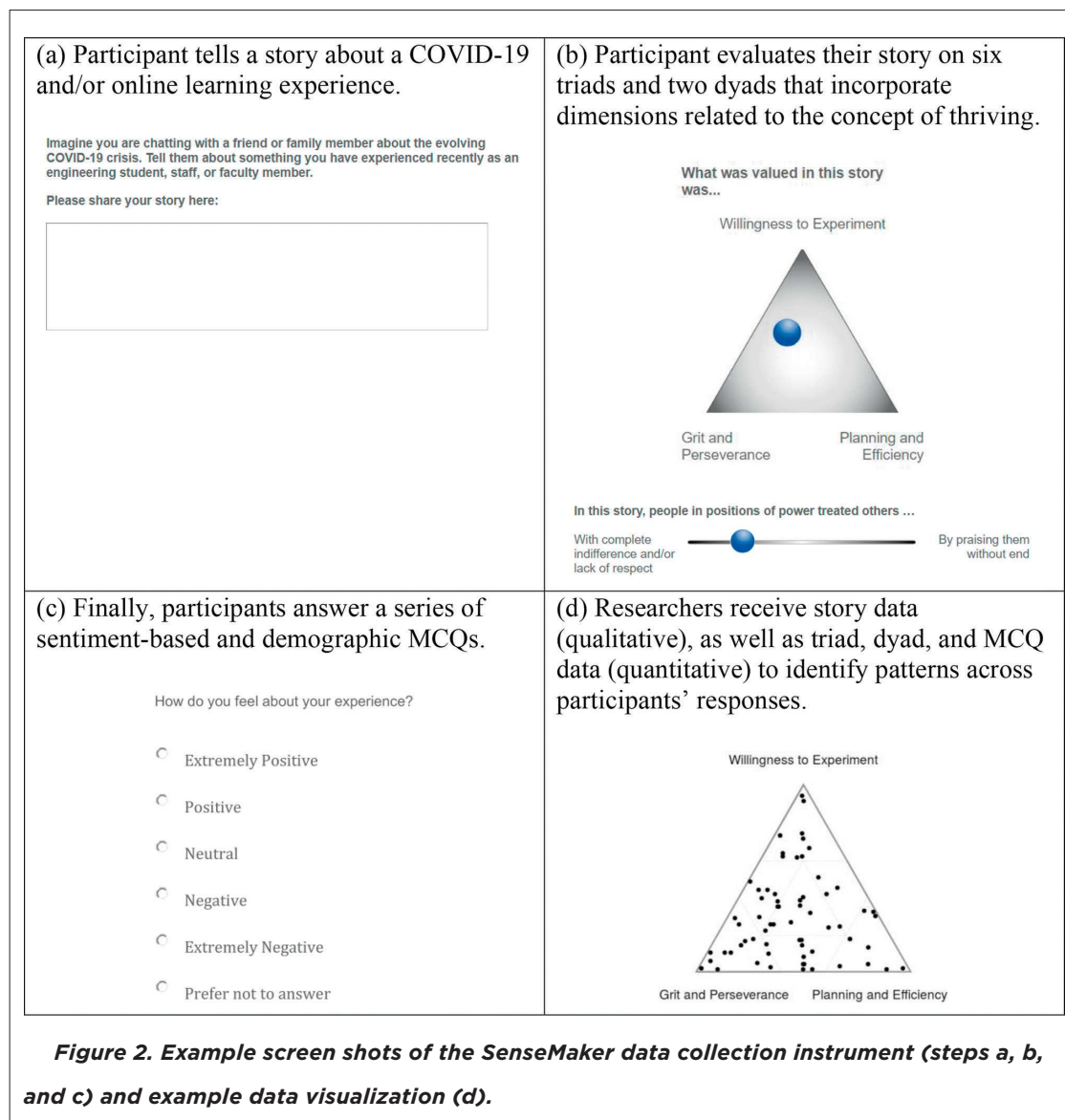
This study was conducted by four faculty members and four undergraduate students in the Engineering Education Transformations Institute (EETI) at the University of Georgia. Our implementation involved three major components: (1) data collection and analysis via SenseMaker (all faculty, staff, and students in CENGR were sent an email containing a link to the survey); (2) community-oriented faculty development programming; and (3) release of public reports on major findings and recommendations. Figure 1 summarizes how these components fit together over time.





Data Collection and Analysis

Research via SenseMaker involves mixed methods data collection and analysis in four steps, illustrated in Figure 2. First, participants were asked to write a short story describing a recent experience related to either COVID-19 or the transition to online learning. They then answered a series of quantitative questions asking them to evaluate their story according to six triads and two dyads (Van der Merwe et al. 2019; see Figure 2), which the researchers designed as part of prior work (Youngblood et al. 2018, Sochacka et al. 2020) to probe different aspects of the concept of thriving (Carver 1998, Schreiner 2013, Spreitzer et al. 2005, Tobias 2004). See Appendix A for a





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list of these aspects and their mapping to each triad and dyad. Participants were then asked two sentiment-based and five demographic multiple-choice questions (MCQs). The triads, dyads, and sentiment-based MCQs were designed to empower participants to interpret their own experiences within the bounds of an *a priori* framework. Finally, SenseMaker provided researchers with visualizations of participants' interpretations along with the underlying raw data to conduct analyses across participants and generate system-wide recommendations. Acknowledging SenseMaker's commitment to empowering participants in the analysis process, the researchers limited their analysis of stories to the identification of patterns across participants; i.e., they did not deeply analyze individual stories. Appendix B exemplifies how we analyzed dyads and triads to produce the conclusions in this manuscript. The SenseMaker tool was left open to responses for the duration of the spring 2020 semester following the transition to online learning, and we regularly sent invitations to all faculty, students, and staff in CENGR to participate. Appendix A includes our entire SenseMaker instrument.

Faculty Development Programming

EETI is an engineering education unit that focuses on integrating applied educational research with the cultivation of communities of faculty and staff that are passionate about instructional innovation (Morelock, Sochacka, and Walther 2020, Sochacka et al. 2019, Morelock, Walther, and Sochacka 2019). During COVID-19, EETI facilitated biweekly community mentoring meetings to allow faculty to bring up and resolve challenges, the development of an online learning resource repository in response to faculty needs (Engineering Education Transformations Institute 2020c), and individual consultations where needed. EETI leadership spearheaded these initiatives and used SenseMaker data to inform real-time recommendations based on faculty and student experiences.

Public Reporting

In addition to using data to inform our faculty development efforts, we also analyzed the data for indications of future educational trends. We disseminated major findings from both strands of analysis in two interim reports: one released near the end of the spring semester based on data from the first half of the online instructional period (Engineering Education Transformations Institute 2020a), and the second after the semester ended based on data from the second half of the online instructional period (Engineering Education Transformations Institute 2020b). These reports allowed all actors in CENGR to understand the breadth of faculty, staff, and student experiences and provided recommendations for immediate and future actions, both in the summer and beyond COVID-19, to improve teaching and learning.



PRELIMINARY RESULTS

In total, we received 70 stories from CENGR faculty, staff, and students, with Table 1 showing a breakdown of respondents.

Table 1. SenseMaker responses by report and role. Because responses were anonymous and participants were encouraged to submit multiple stories, accurate response rates are unavailable.

	Faculty	Undergrad Students	Graduate Students	Staff	Total
Report 1	11	8	2	2	23
Report 2	13	12	5	0	30
Post-Report 2	1	11	5	0	17
Total	25	31	12	2	70

Our reports are available online (Engineering Education Transformations Institute 2020a, b). We generated three recommendations in each report. The first report offered preliminary insight into the challenges faculty and students faced, while the second report provided more detailed responses to those challenges. Table 2 summarizes these recommendations.

Table 2. Recommendations offered across our two public reports.

Report	SenseMaker Study Outcomes	Resultant Recommendation
1	Students and instructors struggled to recover a sense of connectedness in an online environment.	Avoid purely asynchronous courses; incorporate more interactive, synchronous components in courses.
	Most faculty responses were positive. Most student responses were negative. These experiences were linked to the different degrees of agency both groups had in how they responded to the crisis.	Provide students with choices in how they can achieve online learning objectives. Become familiar with resources to help students manage their lives during the COVID-19 crisis.
	Students did not feel sufficiently prepared to succeed in an online learning environment.	Adjust courses to reduce student stress during the transition. Shift focus from rigor to compassion.
2	Faculty and students lamented the loss of in-person affordances like body language & process-oriented feedback, e.g., partial exam grades.	Reflect on what was lost in the transition and how these outcomes might be achieved through other means.
	Students expressed frustration with traditional teaching approaches that did not easily translate to online.	Leverage experiences of stress and frustration to question status quo practices in higher education instruction (e.g., timed final exams.)
	Students and faculty faced a range of COVID-19-related challenges within and outside of academia.	Be as flexible and accommodating as possible in course design, policy enforcement, and interactions.



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The insights and recommendations from our reporting directly informed our COVID-19-focused faculty development programming and provided interesting directions for future research and faculty development efforts. Table 3 shows the reach of our programming during the spring semester. In total, we interfaced directly with more than a third of our College's 90 faculty members and provided resources that were accessed on hundreds of occasions.

Table 3. Online learning faculty development impact metrics.

Metric	Community mentoring participants	Faculty served via consultations	Visits to online resource repository*
Result	21	14	1,192

*Cumulative total as of July 28, 2020

Communications with instructors yielded several examples of instructional adaptation related to our SenseMaker findings. For example, one instructor implemented oral examinations to re-establish a sense of connectedness with students and offer process-oriented feedback. Another instructor implemented remote laboratory software that would allow students to continue collaborating in teams over video-conferencing software. The SenseMaker data also showed evidence of faculty changing the status quo and providing students with more agency in their learning. For example, one faculty member changed a timed final exam to a choice of three written assignments. Our data and conversations with students also indicated that our reports had immediate impact on students by helping them understand and empathize with the challenges their professors were facing. All four of these examples point to promising future directions for educational research and practice in higher education beyond COVID-19.

NEXT STEPS

Our preliminary results indicate that SenseMaker is an effective platform for real-time, participatory research to inform system-wide recommendations and instructional support programming in times of uncertainty. In addition to informing our faculty development programming during spring 2020, our analyses also yielded recommendations applicable to higher education post-COVID-19 and to teaching and learning as universities transition back to in-person and/or hybrid approaches:

1. In-person and online learning have different affordances, and trying to replicate one in the other's medium is minimally effective. In the case of hybrid learning, this means that instructional approaches attempting to offer "equal" experiences to in-person and online student audiences may struggle to capitalize on the unique opportunities of either medium.



2. As COVID-19 continues to impact student lives, instructors will need to strike a balance between flexible, accommodating course design and finding means to connect with students synchronously. Students are particularly critical of online learning approaches that are entirely synchronous or asynchronous.
3. Learning in online and hybrid environments requires metacognitive skills with which few students have had much practice. As instructors, we can help students understand what they need to do to succeed by balancing course rigor with compassion.

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This research was approved by University of Georgia's IRB under protocol ID PROJECT00002157. The author team is not affiliated with Cognitive Edge beyond the use and study of its research platform, SenseMaker. Furthermore, the author team has no financial or proprietary interest in SenseMaker that would result in an actual or perceived conflict of interest.

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AUTHORS



John R. Morelock is the Associate Director for Educational Innovation and Impact at UGA's Engineering Education Transformations Institute (EETI), where he coordinates faculty and graduate student professional development opportunities, including EETI's monthly engineering education Forum, annual travel grant program, and the College of Engineering's graduate TA pedagogy course. He received his doctoral degree in Engineering Education at Virginia Tech, where he was a recipient of the NSF Graduate Research Fellowship. His dissertation studied the teaching practices of engineering instructors during game-based learning activities, and how these practices affected student motivation. His research interests include engineering faculty development, institutional change, student motivation, game-based teaching and learning, gamified classrooms, and engineering faculty collaborations around the scholarship of teaching and learning.



Nicola W. Sochacka is a research scientist and the Associate Director for Research Initiation and Enablement in the Engineering Education Transformations Institute (EETI) at UGA. Her multi-pronged research program is underpinned by a deep appreciation for diverse perspectives. She works closely with faculty and students within and outside of engineering to design cutting edge qualitative studies that embody a focus on in-process research ethics and bridging the research to practice gap. Her current interests include scaling her and her colleagues' pedagogical developments on fostering empathy in engineering to other instructional settings; increasing the capacity of technical faculty in her college to engage with and conduct engineering education research; and piloting a novel methodological approach called SenseMaker® to investigate and improve faculty, staff, and student experiences in engineering at UGA.



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Joachim Walther is the Founding Director of the Engineering Education Transformations Institute (EETI) and an Associate Professor of engineering education research. In his role as Institute Director, Dr. Walther is committed to creating a collaborative, welcoming, and inclusive environment as the basis for a vibrant engineering education ecosystem in the College of Engineering. His interdisciplinary research program spans research quality across interpretive methodologies, the role of empathy in engineering formation, and student development in interdisciplinary and interprofessional spaces. Dr. Walther is the recipient of the Presidential Early Career Award for Scientists and Engineers (PECASE). He serves as the Associate Editor for Studies in Engineering Education (SEE), a peer reviewed journal that provides a venue for high-quality research conducted in all settings and contexts relevant to engineering education.



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Christian M. Culloty is pursuing a Bachelor of Science in Mechanical Engineering at The University of Georgia. He currently works under Dr. Sochacka on “The Engineering Experience Project,” a mixed-methods study that explores the opportunities and challenges presented to undergraduate engineering students using a novel data collection system called SenseMaker.



Jacob S. Hopkins is an undergraduate mechanical engineering student and researcher at the University of Georgia. He has been a researcher with the Engineering Experience Project since September, 2019. The team’s focus has been on improving engineering education through the gathering of qualitative and quantitative data, with the implementation of the SenseMaker tool.



Shweta Vedanarayanan Shweta Vedanarayanan is a third-year Electrical Engineering student at the University of Georgia. Before she entered college, she was a member of her high school’s robotics team and taught programming classes at a local elementary school. Since entering college, she found that she could combine her passions for engineering and education by becoming an undergraduate research assistant at EETI. Shweta is currently a co-op student at Jordan & Skala Engineers.



Chukwuemeka K. Ofunne is a mechanical engineering major at the University of Georgia. He currently works under Dr. Sochacka on “The Engineering Experience Project,” a mixed-methods study that explores the opportunities and challenges presented to undergraduate engineering student using a novel data collection system called SenseMaker. He has supported the team with two papers so far.



APPENDIX A: SENSEMAKER INSTRUMENT

Story Prompt

Imagine you are chatting with a friend or family member about the evolving COVID-19 crisis. Tell them about something you have experienced recently as an engineering student, staff, or faculty member.

This could be something you have experienced related to academics (teaching or learning), or maybe something at home, or even in your community. Your account can be as short or as long as you want it to be. Try to focus on just one experience at a time (not an overall evaluation). If you want to share more than one experience, you can choose to tell another story at the end of the survey.

Triads

Thriving Concept(s) (derived from Tobias 2004)	Prompt	Triad
Thriving (overarching concept) + Accountability (sub-feature)	This story was about...	Struggle, Opportunity, Progress
Investment/ Discipline	What was valued in this story was...	Willingness to experiment, Grit and perseverance, Planning and efficiency
Autonomy	Actions were in the story were motivated by...	Expectations of others, Self-care, Rational decision-making
Openness/ Reflectiveness	The decisions that were made in this story were influenced by...	Intuition, Self-reflection, Feedback from others
Internal alignment/ Alignment with others	The experience I shared influenced impacted my (or the person in the story's) sense of...	Confidence, Purpose, Belonging
Flexibility	Thinking about the future, this story makes me want encourages me to...	Embrace risk, Be willing to adapt, Have a "can do" attitude.

Dyads

Thriving Concept(s) (grounded in Schreiner 2013)	Prompt	Dyad
Sense of community – interdependence, shared goals	In this story I (or the person in my story) decided...	To put myself first - my interests are most important ↔ To put others first - my own interests aren't important
Sense of community – voice and contribution, mattering to the institution	In this story, people in positions of power treated others ...	With complete indifference and/or lack of respect ↔ By praising them without end



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Multiple Choice Questions (MCQs)

Question Type	Prompt	Format	Options
Sentiment-Based	How do you feel about your experience?	Select one	(1) Extremely Positive, (2) Positive, (3) Neutral, (4) Negative, (5) Extremely Negative, (6) Prefer not to answer
Sentiment-Based	How often will you think about this story a year from now?	Select one	(1) Never, (2) Once in a while, (3) Often, (4) Very Often, (5) All the time, (6) Prefer not to answer
Demographic	I am a...	Select one	(1) Undergraduate Student, (2) Graduate Student, (3) Staff member, (4) Faculty member, (5) Prefer not to answer
Demographic	I identify as...	Select one	(1) Female, (2) Male, (3) Other, (4) Prefer not to answer
Demographic	Major	Select one	(1–8) A list of CENGR's eight majors, (9) N/A
Demographic	If I am a student, my club affiliation is...	Select all that apply	(1–16) A list of 16 CENGR student organizations, (17) N/A
Demographic	I identify as...	Select all that apply	(1) Black/African American, (2) American Indian/Alaskan Native, (3) Asian, (4) Native Hawaiian/ Other Pacific Islander, (5) White, (6) Hispanic/Latino, (7) Prefer not to answer, (8) Other

APPENDIX B: EXAMPLE OF OUR SENSE-MAKING PROCESS

We used SenseMaker's online data analysis platform to explore patterns in the data collaboratively and iteratively. This platform allows for triad and dyad data to be filtered using the MCQs (see *Figure 3*). There is also a select tool, which enables researchers to read clusters of participants' stories (see the red box in *Figure 4* below). In our first pass of the data analysis, we observed that the majority of faculty stories were positive and the majority of student stories were negative.

Next, we sought to find explanations for these differences. For example, in *Figure 3*, we show the second of the six triads in our survey, filtered for extremely positive and positive faculty stories.

In *Figure 4*, we illustrate the same triad, this time filtered for extremely negative and negative student stories. This time, instead of the filters, we show three story titles and part of one of the students' stories.

We then examined clusters of stories, such as positive faculty responses close to the Willingness to Experiment top corner of the triad and the negative student stories near the Grit and Perseverance corner. These clusters indicated that while faculty members were engaged in finding solutions to the online learning challenges, students felt they had limited agency in the transition. These observations were discussed in team meetings and compared to patterns on other triads and dyads. For example, the above-discussed pattern also seemed to be reflected in faculty and student responses to the second dyad, which asked how participants in the system felt they were being treated by people in positions of power (see *Figure 5*).

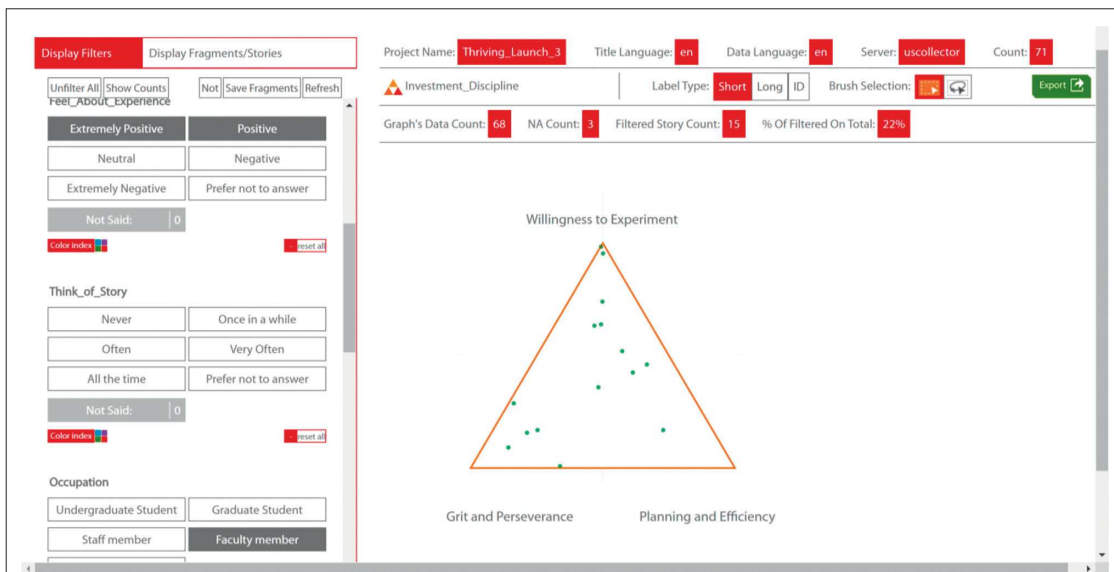


Figure 3. Screenshot from SenseMaker analyst platform that shows the second triad – “What was valued most in this story was...” – filtered for extremely positive and positive faculty stories. Filters are shown on the left of the figure.

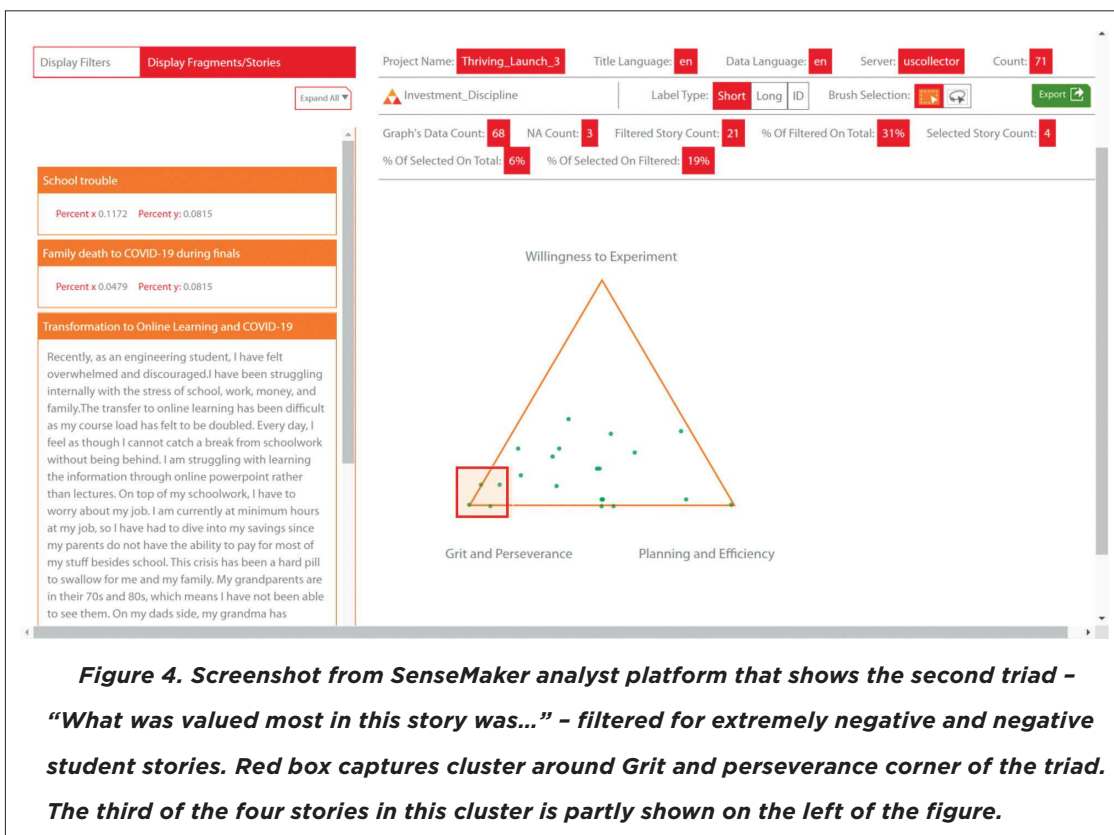
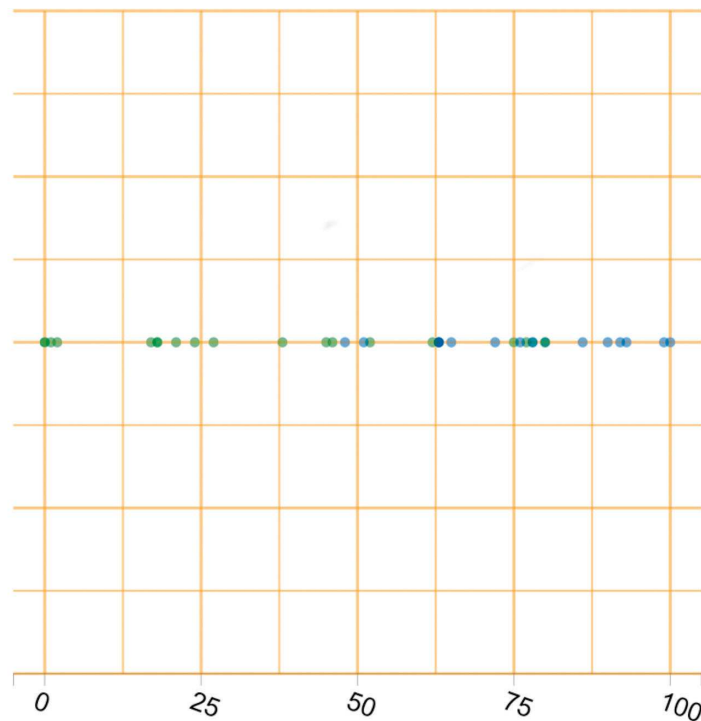


Figure 4. Screenshot from SenseMaker analyst platform that shows the second triad – “What was valued most in this story was...” – filtered for extremely negative and negative student stories. Red box captures cluster around Grit and perseverance corner of the triad. The third of the four stories in this cluster is partly shown on the left of the figure.



With complete
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end

Figure 5. Results from the second dyad – “In this story, people in positions of power treated others ...” – filtered for faculty stories (blue dots to right of figure) and student stories (green dots to the left of the figure).

The research team discussed these findings with an additional five educational researchers from the College of Engineering and the College of Education at UGA. In these meetings, we collaboratively brainstormed and developed recommendations, such as the need to provide students with choices in how they can achieve online learning objectives. A complete list of the recommendations for the first two reports is presented in *Table 2* in the main body of the manuscript.