


Lessons Learned from Clinical and Translational Science Faculty and Student Survey as COVID-19 Pandemic Continues to Shift Education Online

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ABSTRACT

INTRODUCTION: As the pandemic continues with new variants emerging, faculty and students require support with education's rapid shift to the virtual space. The Mayo Clinic Center for Clinical and Translational Science curriculum team works closely with faculty to support a smooth transition to offering graduate courses in a virtual learning environment. The aim of the present project was to explore faculty and student perceptions of these remote learning strategies to gain an understanding of the innovations required to improve future educational offerings.

METHODS: All faculty and learners involved in nine Clinical and Translational Science courses in spring 2020 were invited to participate in a web-based questionnaire. Quantitative analysis was performed on closed-ended items, including 5-point Likert-scale questions used to assess the range of views. Qualitative free-text responses were independently analyzed for repetitive themes and summarized. Additionally, comparisons of faculty and course evaluations and student grade point averages (GPAs) from the in-person courses and their subsequent virtual course offerings were considered.

RESULTS: Survey results indicated several positive impacts with moving courses into the virtual environment, including increased accessibility as well as more student-centered education. Learners joining from sites outside of the originating campus were especially grateful for the virtual classroom because they felt newly integrated within classes. Faculty and course evaluations, as well as student GPAs, remained consistent.

CONCLUSION: New COVID-19 variants continue to shift education online, and innovative ideas are required to further improve future virtual course offerings. Increased engagement is warranted, both from faculty to incorporate activities designed specifically for a virtual classroom, and from students to increase participation by activating their microphones and webcams. Greater opportunities for global involvement and connectedness arise. Finally, this project advocates for adequate eLearning staffing to support quality online education as the need for pedagogical and technical provision continues.

KEYWORDS: COVID-19, pandemic, online education, faculty development, survey, virtual classroom, remote learning

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Introduction

As the pandemic continues with new variants of the novel coronavirus disease 2019 (COVID-19) emerging, faculty and students require support with education's rapid shift to the virtual space. The Mayo Clinic Center for Clinical and Translational Science (CCaTS) curriculum team works closely with faculty to support a smooth transition to offering graduate courses in a virtual learning environment. Instructional design specialists and education coordinators meet with faculty individually prior to each course launch and continue to provide aid throughout the course run (Table 1). Although logistic adaptations are necessary as courses move online, the rigour of each course should remain the same as innovation and creativity are incorporated. This project explores faculty and student perceptions of the transition to virtual learning and offers a broadening of strategies to inform future educational offerings.

Numerous challenges are presented with shifts from in-person learning to a virtual learning environment. From the faculty standpoint, virtual learning can be perplexing due to lack of personal experience with online learning, inadequacies with technical knowledge, and increased workload.^{1–4} Additionally, faculty may face “identity dissonance” having to teach in new ways different from the pedagogical or teaching identity they have formed.⁵ Fortunately, studies have shown improvements in faculty acceptance of online learning with practice and training in this environment, support from permanent eLearning staff, and increased understanding of the usefulness of online education.^{3,6,7} Faculty who are able to manage negative emotions and demonstrate a positive attitude toward online education are perceived to have an approachable presence within the course, which is a key factor in student satisfaction.^{8–10} Research has pointed to other important



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further permission provided the original work is attributed as specified on the SAGE and Open Access page (<https://us.sagepub.com/en-us/nam/open-access-at-sage>).

Table 1. Training and support provided.

<i>Steps Taken to Prepare Faculty and Students for Online Course Offerings</i>
<ol style="list-style-type: none"> 1. Reviewed and updated each course syllabus to adapt learning activities and assignments with in-person elements to the virtual environment 2. Took inventory of faculty access to supplies and purchased and mailed equipment to faculty 3. Provided a unique virtual classroom for each course by creating individual uniform resource locators (URLs) 4. Distributed the URL for each virtual classroom through multiple communications 5. Met one-on-one with the faculty and teaching assistants of each course for training within the virtual classroom platform, including an introduction to the basic control panels as well as more advanced features such as screen sharing, the virtual whiteboard, polling, and using breakout rooms for small groups; faculty were then given time to practice with these tools
<i>Support Provided during Virtual Course Sessions</i>
<ol style="list-style-type: none"> 1. Assigned a staff member to attend each live class session 2. Video recorded each session to distribute to students who experienced connection issues 3. Provided technical support, such as pulling students aside into a private virtual chat to diagnose and resolve access issues 4. Assisted faculty in facilitating virtual learning activities, such as moving students to breakout rooms and launching poll questions, which allowed faculty to focus solely on content presentation 5. Monitored student interactions in the chat in order to provide real-time responses and alert faculty to unanswered questions

factors that help determine the success of a virtual course, including that the format requires a more student-centered, active learning environment.¹¹ Student-centered approaches are often defined by learner autonomy and independence, in contrast to traditional instructional approaches characterized by greater teacher direction.¹² Efficacious faculty focus on designing collaborative learning experiences, such as incorporating group work and facilitating discussions.¹³ It is critical to implement strategies that keep students engaged in the virtual educational experience.

Several innovative strategies were endeavoured by CCaTS with the transition to the virtual classroom. Many faculty opted to prerecord lecture content so that the sessions could be flipped to allow more time for discussion of key concepts. This was especially effective for courses heavy with guest lectures. Students would submit questions on the material in advance of each live session for the visiting lecturer to address. A more challenging course to move online was a molecular mechanisms of human disease course because, prior to the pandemic, the course included in-person dissections in a cadaver lab. Curriculum staff worked with course content experts to identify specific clinical anatomy videos that could be programmed to start and stop at specific time frames most appropriate for students to view within each module of the course. For another course in clinical research proposal development, a great deal of restructuring within the learning management system was required. Prior to the pandemic when the course ran in-person, faculty and students used email to exchange materials and assignments. In the transition, students began utilizing the discussion board as a drop box. The large class was broken down into small groups, each overseen by a different tutor, with separate discussion boards created for each group. Students submitted their proposals to the applicable board for peer review and then met synchronously in the

virtual classroom for presentation and discussion of their submissions. Thus, moving the course online streamlined the homework submission and review processes for students and reduced administrative burden for faculty and support staff.

While many written exams moved from in-person to online offerings using a virtual proctoring software, the summative assessment given in one population health science course was altered altogether for a learner-centric approach. The final was redesigned as an interactive oral exam with students engaged throughout the entire process. Students developed a pool of exam questions, from which eight were selected, and were asked to prepare to discuss their response to each prompt for ten minutes. A rubric was used to measure the student's overall understanding of the topic, including arguments used, evidence provided, and implications of the response, as well as the overall structure of the response and the degree to which prompting was required by the instructor. On the day of the exam, the instructor randomized which of the eight questions was chosen for each individual oral exam, and the participating scholar had the option to "reroll" the randomization one time for a new question.

In addition to intentional design of the presentation and assessment of course content, community-building was also made a priority in the virtual environment. Some faculty focused the beginning of each course session to this purpose—creating a learning environment that invited participation. For example, targeted questions related to what was happening in the world were used as "icebreakers" to draw in students for the session. Another faculty member used the chat feature to drop a link to a short podcast for students to listen to individually before returning together and using the whiteboard to respond to several prompts based on the message.

The aim of the present project was to explore faculty and student perceptions of these remote learning strategies to gain

an understanding of the innovations required to improve future educational offerings. The questions that guided this project were: 1) How effective was faculty training at building confidence in using available eLearning tools, and how could this be improved? 2) How effective was in-class support at meeting the needs of faculty and learners, and how could this be improved? 3) And finally, how did offering courses in the online environment affect the overall educational experience of faculty and learners, and how could eLearning be improved to increase success in the future? Faculty and student surveys were conducted to address these questions. Additionally, comparisons of faculty and course evaluations and student GPAs from the in-person and virtual course offerings were considered.

Methods

A survey research design was used to collect faculty and student reactions to the virtual learning experience and gauge perceived success. The surveys were reviewed by the curriculum team and adapted based on feedback. Two original item-based questionnaires were created in Qualtrics; one to gather faculty responses and the other to gather student responses. The faculty questionnaire contained a total of nine items—six closed-ended and three free-text—grouped into three main areas. Faculty were asked to provide feedback on their: 1) level of training received, comfort with the virtual classroom platform, and eLearning tools utilized; 2) level of in-class support received, and 3) overall experience and its perceived effect on education. The student questionnaire contained a total of eleven items—seven closed-ended and four free-text. Questions were grouped into three similar areas: 1) experience and comfort with the features of the virtual classroom platform, 2) level of in-class support received to alleviate technical issues, and 3) overall experience and its perceived effect on education.

The faculty survey was sent to all instructors and teaching assistants (TAs) involved in teaching a course within the Clinical and Translational Science track of the Mayo Clinic Graduate School of Biomedical Sciences during the spring 2020 quarter. The total population was twenty-three individuals across nine courses. The student survey was sent to all students who completed a CCaTS course during the spring 2020 quarter. The total population was eighty-three unique learners.

The questionnaires were delivered directly from the Qualtrics platform to faculty and students by email at the end of the term using a closed link which allowed each individual to access the survey only one time. Completion of the survey was optional. Respondents could move back and forth between questions freely to edit answers; however, a response to most questions was required for submission. Two reminders to any unfinished respondents followed, each one week apart, before all surveys were closed to further reply. Quantitative analysis was performed on closed-ended items, including 5-point Likert-scale questions used to assess the range of faculty and student views. Qualitative free-text responses were

independently analyzed by the authors for repetitive themes and then summarized.

In supplement to the faculty and student surveys, several additional data points were collected and used in the analysis. Student grades were considered by averaging and comparing grade point averages (GPAs) across the in-person spring 2019 and virtual spring 2020 quarters. In addition to the average GPA of the overall population, GPA averages of students identifying as female, students identifying as male, white students, and students of color were likened. Faculty and course grades were also averaged and compared across the in-person spring 2019 and virtual spring 2020 quarters. Post-course evaluations, which are completed at the conclusion of each course run, ask students to assign a grade for each instructor, as well as the course itself, according to the following scale: A (4.0), B (3.0), C (2.0), D (1.0) and F (0). Comparing data from all courses that ran in spring 2019 to all courses that ran in spring 2020 is not an exact measurement due to courses that run every other year, course cancellations, and new courses being developed and launched. For this reason, data were also compared across matched courses—courses with the same number and title—that ran both in spring 2019 and again in spring 2020. Quantitative data are presented as mean \pm standard deviation. Statistical testing for non-parametric data was conducted with the Mann-Whitney test using Prism software (GraphPad Software, La Jolla, CA). Statistical significance was defined as $p < 0.05$.

Results

Eighteen of the twenty-three faculty and TAs surveyed responded to the questionnaire, for a 78% response rate. The student survey yielded a 42% response rate, with thirty-five of the eighty-three solicited completing the survey.

Faculty Perceptions of Preparedness

The first theme addressed in the faculty survey was how satisfied instructors felt with their level of training and preparation for moving the formerly in-person courses to the virtual environment, including comfort-level with the features of the virtual classroom platform. When asked to evaluate the one-hour platform training session that was held individually with the faculty member(s) and TA(s) of each course one week prior to the first day of class according to a 5-point Likert scale, all respondents felt the training session to be “adequate” (8; 44%) or “very adequate” (10; 56%). Faculty were also asked to provide written feedback on their training experience, including suggestions to improve the session. Seventy-eight percent (14) felt no changes were necessary, as the session provided an overview of the appropriate breadth and depth and an opportunity to test out the tools in a practice space. Those who offered suggestions expressed a desire for more—a more advanced session to follow the basic training, a written user’s manual covering the

platform's features for later reference, more resources on effective strategies for virtual teaching and learning not specific to the platform, and further class-specific suggestions for adapting particular content, assessments, and learning activities to the virtual environment. One respondent noted, "There are really only 3 to 4 total tools available within [the platform], which can get repetitive unless you get creative with other combinations." Another faculty voiced a similar desire for "suggestions for how to use other virtual resources in conjunction with [the platform], eg padlet."

A 5-point Likert scale question ranging from very uncomfortable to very comfortable was also used to assess participants' level of comfort with the virtual classroom platform, and faculty compared their comfort levels on the first class session to how they felt on the last class session (Figure 1). At the beginning of the quarter as faculty adjusted to their new environment, responses ranged the full spectrum, with 22% (4) expressing discomfort and only one respondent indicating feeling "very comfortable" (5.5%). But by the end of the term, all faculty were comfortable, and the majority responded in full confidence with the maximum level of "very comfortable" (13; 72%). Furthermore, the platform training sessions proved helpful in that across all of the courses, all features presented to faculty were used throughout the term, including raising and lowering virtual hands, updating statuses, chatting, breakout groups, polling, the virtual whiteboard, and file/screen sharing (Figure 2). The most popular features were chat (17; 94%), faculty screen share (14; 78%), and raising/lowering virtual hands (14; 78%). While all platform features were used collectively across the faculty, improvement opportunities exist for frequency of use of some of the tools. Only half of the faculty utilized breakout groups in their course (9; 50%) and less than half asked students to be involved in file/screen sharing (8; 44%).

Student Perceptions of the Virtual Classroom Platform

The student survey confirmed faculty use of the platform's various tools throughout the term. Responses aligned on the most and least used features within the platform (Figure 2). In addition to reporting on what had occurred in the current term, students were asked which tools they would like to see used more and less frequently in future course offerings. Two answers emerged as the most recurring response for which feature students would encourage faculty to use more often: breakout groups (6; 17%) and polling (6; 17%). The value students placed on breakout groups was discussed both in terms of requiring more active learning and in building more meaningful connections. One student stated this feature "optimized learning, especially because it involves more interactions between students [and] faculty, leading to a more active participation from the student" and another echoed, "I felt that [breakout groups] allowed for an opportunity to connect more closely."

In addition to the features specific to the virtual classroom platform, students also suggested broader best practices for engagement. Students expressed a desire to see their peers get more involved, such as by raising hands more often and opting to use a microphone instead of the chat to contribute. And they asked faculty to intentionally "cold call" for more student participation.

The most common answer for which feature students would encourage faculty to use less often was "none" (7; 20%). Outside of those who felt no changes were necessary, qualitative responses varied greatly. Students discussed how to better utilize the available tools rather than promoting their use be discontinued. For instance, students specifically suggested that faculty use polling to review material and check for understanding, as opposed to merely serving as an icebreaker or opinion poll. Students also appreciated being moved into breakout rooms rather than having to perform this action themselves. And students appreciated faculty screen sharing, but suggested materials be provided in advance of the class session as well.

Faculty and Student Perceptions of Live Support

For the second major theme addressed by the surveys, faculty and students were asked to provide feedback on the level of support they received during their live virtual class sessions throughout the quarter. As with the platform training session scheduled prior to classes beginning, all faculty also felt that their in-class support was either "adequate" (3; 17%) or "very adequate" (15; 83%). While the majority of the qualitative feedback received did not propose changes (12; 67%), some struggles with the platform were expressed, including periods of spotty connectivity, having to monitor questions and comments placed in the chat while presenting, inability to gather non-verbal cues from students who did not participate with webcam and microphone, and redundancy of using the same few features available within the platform for engagement. The overarching message that most recurred throughout the faculty feedback in this section was to keep live support in the virtual classroom moving forward. Faculty appreciated the availability and aid of technical support personnel, especially in that it allowed them to focus on presentation and interactions with students.

The same level of support was needed on the student end as well. Although (6) 17% of students reported no technical issues, and the majority (19; 54%) experienced only one to two occurrences throughout the quarter, for three students, difficulties were frequent. Fortunately, 84% were able to be helped to an "adequate" or "very adequate" level by the technical support person assisting with the live class session. In addition to assisting with basic connectivity issues, technical support personnel helped students use the features within the virtual classroom platform. One student reported, "I had trouble sharing my screen and slides but received great help from one of the folks

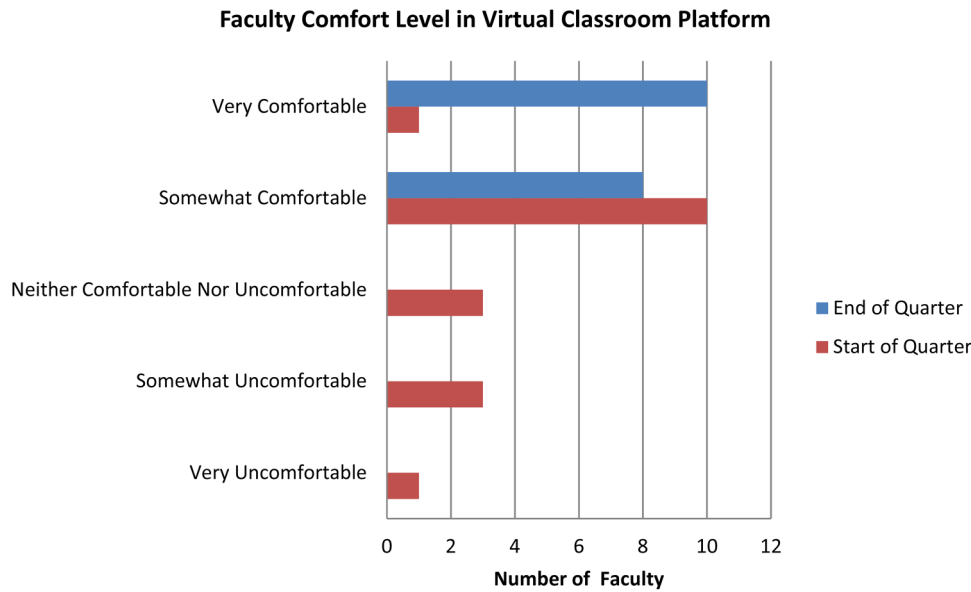


Figure 1. Faculty comfort level in virtual classroom platform.

assigned to be present to help with the experience, but I couldn't figure it out on my own."

Faculty and Student Perceptions of Effect on Education

The final goal of the faculty survey was to gauge the overall experience of our faculty with virtual education and to understand how they felt this new environment impacted the education of the students enrolled in their courses. These data were then compared with responses to the student survey regarding how students perceived the overall experience and its effect on their education. A quantitative measure showed that no faculty member felt the experience of offering the course in the virtual environment to be negative (Figure 3). The lowest scoring was a "neutral" experience (1; 6%), indicating the in-person and virtual classrooms both to be sufficient, with the majority ranking a "very positive" experience (10; 56%). Greater range was recorded across student perceptions (Figure 3), with (4) 11% expressing a negative reflection; yet, for (8) 23% the experience was comparable with a face-to-face offering, and the majority of students (23; 66%) reported positive reflections.

When asked how the new environment changed engagement with students, faculty feedback varied. Some felt communication increased in the virtual classroom, whereas others found interactivity to be more difficult. For those of the former perspective, the amount of communication was felt to increase in that there was no longer a need to wait one's turn as a learner—everyone could answer at the same time and the moderator would then filter and select responses to draw out—and faculty noticed an increased willingness of students to participate in answering questions. For those in the latter

category, the students' lack of use of webcams during interactions was a major factor.

Mixed results were received on the impact of this new format on levels of engagement from the student perspective as well. For a quantitative measurement, a 5-point Likert scale question was used to ask students to rank how experiencing the course in the virtual classroom affected their level of engagement compared to a traditional face-to-face classroom (1 - less engaged virtually; 5 - more engaged virtually). An equal number of respondents fell at both poles (3; 8.5%); however, the majority (11; 31%) fell in the middle, indicating the virtual and face-to-face classrooms to be the same, with neither affecting their engagement in learning more or less than the other (Figure 4). Contrasting perspectives were also expressed in the qualitative data. Some fell into the opinion narrated by one student, "The discussions were great and participation levels seemed higher than they may have been during an in-person session," whereas others commented on the increased distractions in the virtual environment, making it harder to pay attention and at times requiring more energy to engage. Several who expressed collaboration was better in the face-to-face environment cited issues such as inability to pick up on social cues and lack of eye contact during presentations, which as one respondent worded it, "can be corrected by asking all participants to turn their cameras on."

Perspective on the greatest advantages and the greatest areas for improvement in this new format were gleaned from the student survey results. Overwhelmingly, flexibility and accessibility were cited as positive impacts of moving courses online. Students discussed the convenience of not having to travel to class, making it easier to attend classes more regularly. In addition to making schedules more efficient for all, the learning was

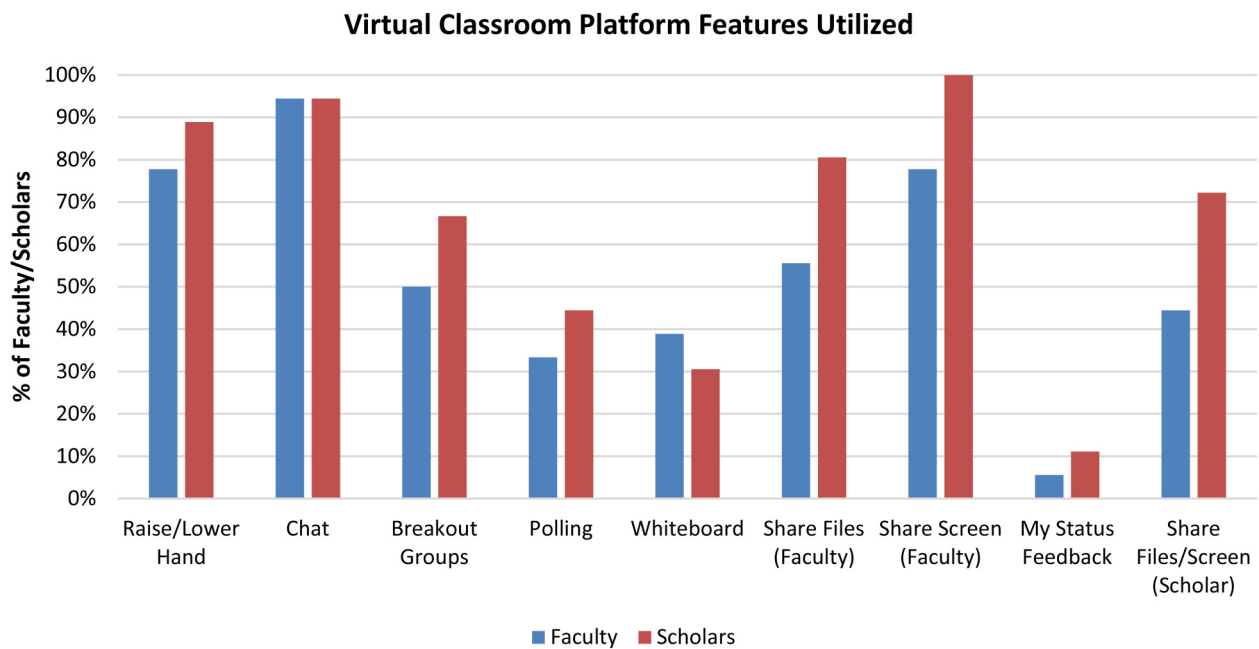


Figure 2. Virtual classroom platform features utilized.

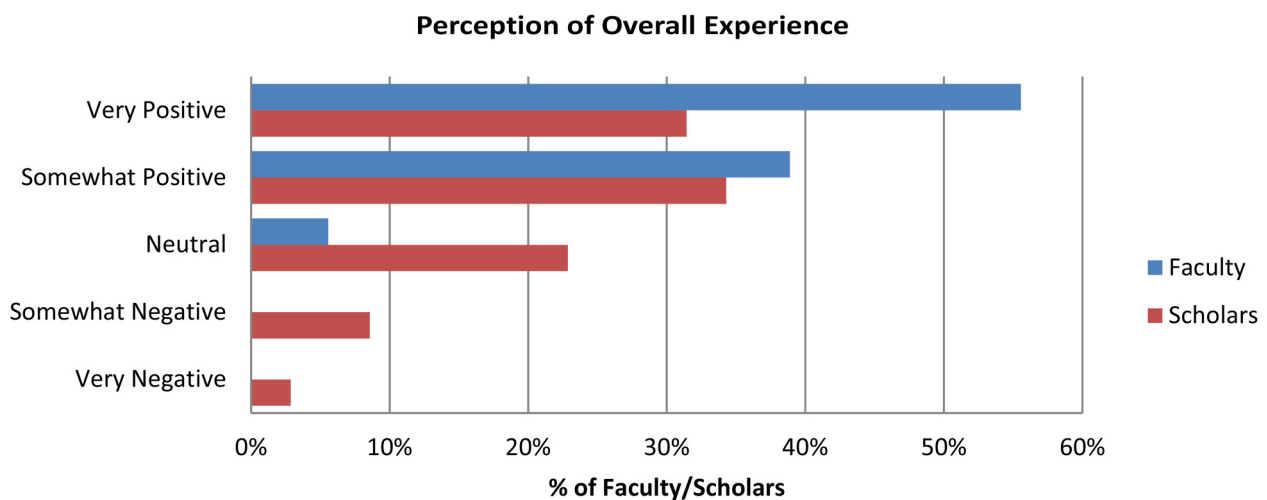


Figure 3. Perception of overall experience.

also made more equitable for distance learners. One student reported,

As a learner from Florida, I greatly appreciated everyone in the course having to experience the course virtually (ie not being the “main group” with just satellite groups videoconferencing in). My experience was actually better than during other quarters because I didn’t feel like I was overlooked or that the course wasn’t taught with me in mind as someone that takes most courses virtually from my campus. I thought the instruction was better at integrating everyone, regardless of location.

Faculty also noticed this improvement, as evidenced by one respondent’s quote, “It was specifically advantageous because students on all campuses could get the same content.” Along

with these advantages, the new format offers opportunities for improvement. Moving into future offerings, students want to see increased engagement and suggested building in more interactive exercises, slimming down lectures, asking more questions, increasing student-to-student interactions, and even adding quizzes during the session itself to break up lecture slides.

A final theme that emerged from both faculty and students’ open-text responses to the question of how offering the course in the virtual classroom changed the learning experience was that the education became more student-centered. Students used phrases such as: more productive, learning more, better resources, and more self-directed. The onus was placed on

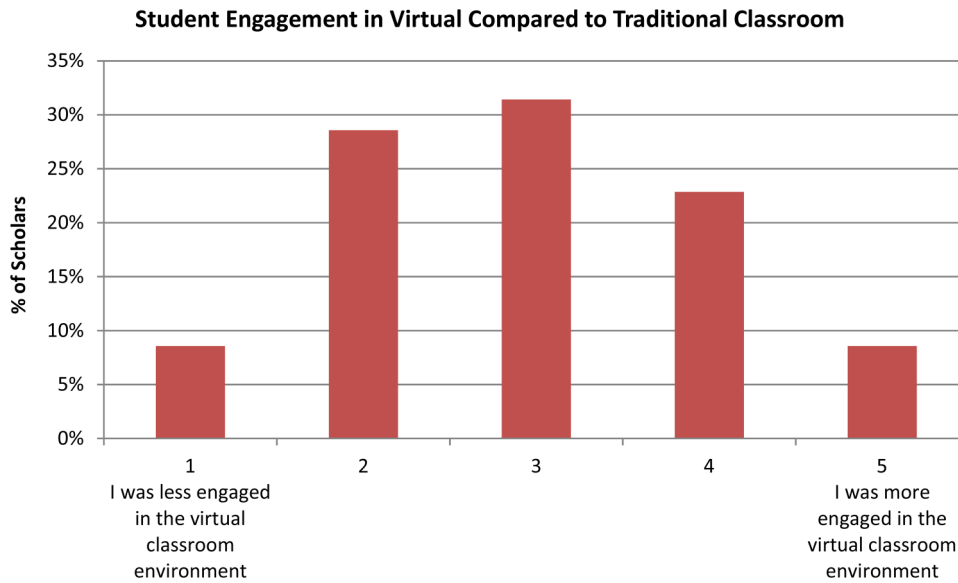


Figure 4. Student engagement in virtual compared to traditional classroom.

the student to stay active in the course. Faculty expressed a perceived push to get more creative in their lesson planning. One instructor reported this new environment “required more interactive and innovative ways of presenting the information,” and another echoed, “I had to do a lot of thinking outside the box.”

Additional Data Points Considered

Enrollment remained consistent during the pandemic. One hundred and twenty total grades were received by students across eight CCaTS courses in spring of 2020 compared to 127 grades across 11 courses in spring of 2019. In narrowing the numbers to only the five matched courses that ran both years, 83 grades were received in spring of 2020 compared to only 70 in spring of 2019. The GPA average of the overall population was stable from spring 2019 (mean GPA = 3.61 +/- 0.55) to spring 2020 (mean GPA = 3.66 +/- 0.45) across all courses that ran, and this was similar when comparing across just the five matched spring courses that ran in 2019 (mean GPA = 3.54 +/- 0.47) and again in 2020 (mean GPA = 3.59 +/- 0.46). There were no statistically significant changes when comparing gender or race across the 2019 and 2020 course offerings. Evaluations of the courses and the faculty who taught them remained steady, with a slight upwards trend. The overall grade given to the courses by students trended upward 0.38 from 3.22 +/- 0.94 in spring 2019 to 3.60 +/- 0.59 in spring 2020 across all courses that ran and up 0.24 from 3.36 +/- 0.90 in spring 2019 to 3.60 +/- 0.50 in spring 2020 across the five matched courses. Similarly, the average faculty grade went from 3.54 +/- 0.77 in spring 2019 to 3.72 +/- 0.72 in spring 2020 across all courses that ran, and individual faculty (n = 6) who taught in

both years saw a trend for improvements in their grade from 2019 (3.55 +/- 0.71) to 2020 (3.86 +/- 0.37).

Discussion

With only a brief interlude to prepare for the move of all spring 2020 courses online, faculty and students were equipped with training and support from the Mayo Clinic Center for Clinical and Translational Science (CCaTS) curriculum team. The quarter proved successful, but as we move further into the pandemic and continue to have the need to shift more courses online, valuable insights can be gleaned to improve this process for future terms.

Training and support of faculty is key because faculty do not often have sufficient experience to succeed without this provision.¹⁻⁴ Although training in virtual meeting software was the most important initial faculty need caused by the pandemic, these new mediums of modern technology provide an opportunity to further improve teaching and learning.^{14,15} Learning objectives should not change when translating a face-to-face course into an online course; however, how these outcomes are achieved must differ.¹⁶ Many instructors attempt to use the same learning activities in both environments rather than adapting the experience to the new setting. Creativity is also required to deliver effective virtual education.¹⁷

In the present project, many students used the survey opportunity to thank faculty for their extra efforts. One student charged, “I think if professors can be open to it and try to take some chances with the features they use, they’ll be pleasantly surprised.” Faculty also expressed an awareness of this opportunity to “do more” to involve learners and enhance education. While the basic training provided faculty with a tool belt to begin their exploration, this is only the beginning. Training in resources beyond the platform, as well as new ideas for how

to use the same platform features in new ways, is warranted. To meet faculty desire to improve their teaching methods within this new environment, more support is needed, including encouraging best practices for virtual learning to further enhance student engagement.^{14,18}

Student feedback confirms literature findings on what students respond well to in the virtual environment. More interaction and active learning components are suitable to the virtual classroom,¹¹ and students desire quality connections with their instructors and peers.^{9,10,16} In response to students' over-reliance on the use of the chat functionality to participate in classes, the expectation to secure a microphone or use the call-in by phone feature has been added to course syllabi. Additionally, faculty are being trained to express their expectations of course participants and draw out student responses with prompting, such as, "That is an interesting thought; would you use your microphone to elaborate?"

Faculty frustration with students' lack of use of webcams is also congruent with the literature. Chertoff et al¹⁴ found in their research on the pandemic's effect on radiology training programmes that maintaining meaningful interaction during virtual conferences required participants to turn on webcams so that faces were shown. This also allowed presenters to call on participants more easily. Asking participants to disconnect from virtual private network (VPN) access can increase bandwidth and allow for broader webcam use.

The need to provide live virtual classroom technical support to faculty and students continues. To make this task sustainable across the seventy-six courses that are offered by CCaTS each year, this role will be moving to student TAs in future quarters. As faculty become more accustomed to the virtual classroom, the support person is utilized less frequently, and often only in response to a particular technical issue. The curriculum team will group-train student TAs to assist with such needs, alleviating hours of required classroom time and allowing staff to focus on broader course design and implementation strategies. TAs are receptive to the additional income these supplemental work hours bring, and many find the opportunity to audit course content without having to complete the assessments especially attractive.

Perhaps the biggest benefit that arose from this time of crisis was "leveling the playing field" so that distance learners could experience the same benefits as local students. While the majority of the Mayo Clinic Graduate School of Biomedical Sciences courses are taught by faculty from the Rochester, Minnesota campus, the school serves students at each of Mayo's main tri-sites, including campuses in Arizona and Florida, as well as learners across the Mayo Clinic Health System in communities across Iowa, Minnesota, and Wisconsin. Prior to this transition, faculty were perceived to favor those joining the in-person classroom. Many faculty had to be reminded to turn and face the camera a few times throughout the session to directly solicit questions and comments from off-campus learners. Small group

activities also favored the local campus, and often distance learners were merely left to observe their classmates during the session. Now, all students join the virtual classroom as equals, each filling a same-sized square on the gallery screen, each participating in breakout groups filled with a mix of learners. For off-campus learners, this change was significant. The Office of Faculty Development (OFD) at Texas Tech University Health Sciences Center El Paso reports similar findings.¹⁹ Despite efforts to provide resources and engage faculty in the benefits of eLearning, in the pre-pandemic timeline, it was merely the early adopters who experimented with these services. Mulla et al¹⁹ accounts, "What the OFD could not accomplish earlier, the novel coronavirus changed overnight." Through the crisis, educators realized firsthand the advantages, and gained skill in overcoming the limitations, of eLearning solutions. In conclusion, the authors¹⁹ state, "eLearning implies distance, but at the same time, and in the global world, it implies connectivity." Similarly, all our learners, across our market, are now more connected than ever.

Although the survey response rate was strong, the project is limited by a low total population. Slight upward leanings in student GPAs and faculty and course evaluations were not statistically significant but show a trend towards improvement in GPA for courses offered in the virtual environment. This is encouraging, and the field will benefit from future studies tracking these trends across wider populations into the coming years. Faculty and student perceptions of the effects of virtual education on learning and engagement captured in this project are reflective of an immediate need to move to a virtual classroom platform with little time for preparation; as students become more accustomed to engagement through microphones and webcams and faculty are offered more advanced training in virtual pedagogy, the authors expect to capitalize on the resulting benefits of virtual education even further into the future.

Conclusion

New COVID-19 variants continue to shift education online, and innovative ideas are required to further improve future virtual course offerings. Increased engagement is warranted, both from faculty to incorporate activities designed specifically for a virtual classroom, and from students to increase participation by activating their microphones and webcams. Greater opportunities for global involvement and connectedness arise. Finally, this project advocates for adequate eLearning staffing to support quality online education as the need for pedagogical and technical provision continues.

Author Note

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authors and do not necessarily represent the official views of the NIH.

Ethical Approval

Not applicable, because this article does not contain any studies with human or animal subjects.


Informed Consent

Not applicable, because this article does not contain any studies with human or animal subjects.

Trial Registration

Not applicable, because this article does not contain any clinical trials.

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REFERENCES

- Bennett S, Santy J. A window on our teaching practice: enhancing individual online teaching quality through online peer observation and support. A UK case study. *Nurse Educ Pract.* 2020;9(6):403-406. <https://doi.org/10.1016/j.nepr.2009.01.019>
- Youm J, Corral J. Technological pedagogical content knowledge among medical educators: what is our readiness to teach with technology? *Acad Med.* 2019;94(11S):S69-S72. <https://doi.org/10.1097/ACM.0000000000002912>
- Back DA, Behringer F, Harms T, Plener J, Sostmann K, Peters H. Survey of e-learning implementation and faculty support strategies in a cluster of mid-european medical schools. *BMC Med Educ.* 2015;15:145. <https://doi.org/10.1186/s12909-015-0420-4>
- Shea P. Bridges and barriers to teaching online college courses: a study of experienced online faculty in thirty-six colleges. *Journal of Asynchronous Learn Network.* 2007;11(2):73-128.
- Maggio LA, Daley BJ, Pratt DD, Torre DM. Honoring thyself in the transition to online teaching. *Acad Med.* 2018;93(8):1129-1134. <https://doi.org/10.1097/ACM.0000000000002285>
- Cherry SJ, Flora BH. Radiography faculty engaged in online education: perceptions of effectiveness, satisfaction, and technological self-efficacy. *Radiol Technol.* 2017;88(3):249-262. Retrieved from <http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=med14&NEWS=N&AN=28298576>.
- Richter S, Idleman L. Online teaching efficacy: a product of professional development and ongoing support. *Int J Nurs Educ Scholarsh.* 2017;14(1). <https://doi.org/10.1515/ijnes-2016-0033>
- Regan K, Evmenova A, Baker P, et al. Experiences of instructors in online learning environments: identifying and regulating emotions. *Internet Higher Educ.* 2012;15(3):204-212. <https://doi.org/10.1016/j.iheduc.2011.12.001>
- Dixson MD. Creating effective student engagement in online courses: what do students find engaging? *J Scholarship Teach Learn.* 2010;10(2):1-13.
- Willing PA, Johnson SD. Factors that influence students' decision to drop out of online courses. *J Asynchronous Learn Networks.* 2009;13(3):115-127.
- Rovai AP, Downey JR. Why some distance education programs fail while others succeed in a global environment. *Internet Higher Educ.* 2010;13(3):141-147. <https://doi.org/10.1016/j.iheduc.2009.07.001>
- Pedersen S, Liu M. Teachers' beliefs about issues in the implementation of a student-centered learning environment. *Educ Technol Res Dev.* 2003;51(2):57-76. <https://doi.org/10.1007/BF02504526>
- Hannafin MJ, Hannafin KM. Chapter 2: cognition and student-centered, web-based learning: issues and implications for research and theory. In: Spector JM, Ifenthaler D, Isaías P, Kinshuk, Sampson D, eds. *Learning and Instruction in the Digital Age.* Springer; 2010:11-23.
- Chertoff JD, Zarzour JG, Morgan DE, Lewis PJ, Canon CL, Harvey JA. The early influence and effects of the coronavirus disease 2019 (COVID-19) pandemic on resident education and adaptations. *J Am Coll Radiol.* 2020;17(10):1322-1328. <https://doi.org/10.1016/j.jacr.2020.07.022>
- Price DW, Campbell CM. Rapid retooling, acquiring new skills, and competencies in the pandemic era: implications and expectations for physician continued professional development. *J Continuing Educ Health Prof.* 2020;40(2):74-75. <https://doi.org/10.1097/CEH.0000000000000297>
- Kenzig MJ. Lost in translation: adapting a face-to-face course into an online learning experience. *Health Promot Pract.* 2015;16(5):625-628. <https://doi.org/10.1177/1524839915588295>
- Hagler D. Developing educators with, from, and about the technology. *J Contin Educ Nurs.* 2016;47(2):47-48. <https://doi.org/10.3928/00220124-20160120-01>
- Gray AC, Steel A, Adams J. Attitudes to and uptake of learning technologies in complementary medicine education: results of an international faculty survey. *J Altern Complementary Med.* 2020;26(4):335-345. <https://doi.org/10.1089/acm.2019.0319>
- Mulla ZD, Osland-Paton V, Rodriguez MA, Vazquez E, Kupescic Plavsic S. Novel coronavirus, novel faculty development programs: rapid transition to eLearning during the pandemic. *J Perinat Med.* 2020;48(5):446-449. <https://doi.org/10.1515/jpm-2020-0197>