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The Importance of Ending Well: A Virtual Last Class Workshop for Course Evaluation and Evolution

ABSTRACT

The last class session of the academic term represents an excellent opportunity to solicit meaningful feedback from students who have just completed the course. To capitalize on the students' first-hand knowledge of their own experiences with our course and maximize the impact of the last class for our Canadian graduate-level genetics course, we have used and optimized a workshop first described by Bleicher (2011) as a means of obtaining real-time, in-person course evaluations, and driving course evolution. Presented as an empowering opportunity for student activism, students are asked to contribute collaboratively to improving future iterations of the course. This approach stimulates thoughtful discussions, generates honest and useful feedback, and requires only nominal preparative work on the part of the instructor, whose primary role during the workshop is as a facilitator. In light of the COVID-19 pandemic, we've assessed student perceptions of two virtual models for the Last Class Workshop—one using Google Docs, a free web-based word processor, and another using Miro, a collaborative whiteboard platform—to identify whether or not the Last Class Workshop can be effectively translated for a synchronous online learning environment. Student responses to the virtual workshops have been highly positive, and participants overwhelmingly preferred the Miro adaptation. We suggest that this is an effective way to access the expert knowledge of our students to develop innovative adaptations, updates, and evolutionary change at the end of a course, and conclude with a proposal for maintaining this virtual tool after in-person learning resumes.

KEYWORDS

student voice, participatory design, metacognition, online learning, pandemic pedagogy

INTRODUCTION

The cognitive importance of ending an experience deliberately and on a high note has been well documented. In particular, the Peak-End rule suggests that an individual's overall recollection of an experience depends primarily on the emotional peak, and on the culmination of the experience (Kahneman et al. 1993). This can be directly applied to the student experience of completing an academic term or course—if the end of a course is meaningful and impactful, this can have major benefits including increased satisfaction with the course (Hoogerheide and Paas 2012), better evaluations (Woloschuk et al. 2011), and maybe most importantly, useful feedback for instructors as they prepare for future offerings of the course (Lutsky 2015).

Despite these obvious benefits, there is limited practical evidence that instructors in higher education are taking steps to deliberately part ways with their classes; Eggleston and Smith (2002) have identified that only 42% of instructors take the time to say goodbye to their class, and 90% of students

suggested that they would appreciate a more deliberate ending to their coursework. Whether this is due to time constraints, a lack of awareness about useful end-of-term techniques, or a general discomfort with saying goodbye, this represents a missed opportunity for valuable academic and emotional closure for both students and instructors at the end of a challenging term. Further, in the wake of the COVID-19 pandemic, providing students with a learning community, a sense of belonging, and support for their emotional wellbeing is more important than ever, although supporting remote learners has increased in complexity (Harper and Neubauer 2021; Shay and Pohan 2021).

THE LAST CLASS WORKSHOP

Ending a course well can take many forms (Stone, Powell, and McGuire 2020) but we posit that the most valuable ways to close an academic term will 1) cement the content of the course for the students and bring together key conceptual elements; 2) enhance metacognition and learning transfer as students move forward in their academic journey; and 3) provide closure for students and instructors (Bleicher 2011; Maier and Panitz 1996; Uhl 2005). We present here a model for adapting a workshop first developed by Elizabeth Bleicher entitled, fittingly, "The Last Class" workshop, to fulfill these major end-of-term goals while working exclusively in a virtual learning environment. This workshop is designed around a single foundational yet often overlooked concept—students, having just completed a course, are experts on the topic of the student experience of the course. It would be a short-sighted waste not to access that knowledge to get feedback on the current course and improve the class for future offerings. As Dennis White (2010) aptly put it, "Asking students to talk about their education is so simple that [...] we inevitably forget to do it" (xi). Bleicher's (2011) workshop goes directly to the source to ask for insights about what worked and what did not work in the current iteration of the course, and for specific notes from the class about how it might be improved.

The virtual pivot for the workshop, which was originally created to suit an emergency switch to remote learning—what Roy Schwartzman (2020) has termed "pandemic pedagogy" —has radically altered the ways in which we part ways with our students, many elements of which we will carry forward as we return to in-person teaching and learning. We recognize that our current students are experts not only in their student experience of the course in question, but also in the online student experience. As we move into an educational environment that is dominated by virtual teaching and learning experiences, we are asking our students to operate in an educational environment in which we ourselves have had limited experiences in— our students have now cumulatively participated in more online coursework than we have, either as students or as instructors. What began as a straightforward attempt to assess two different models of a virtual parting ways workshop has unearthed some meaningful data surrounding what it means to students when we engage them fully in their own learning and clearly articulate their value as informants and co-developers of their curriculum.

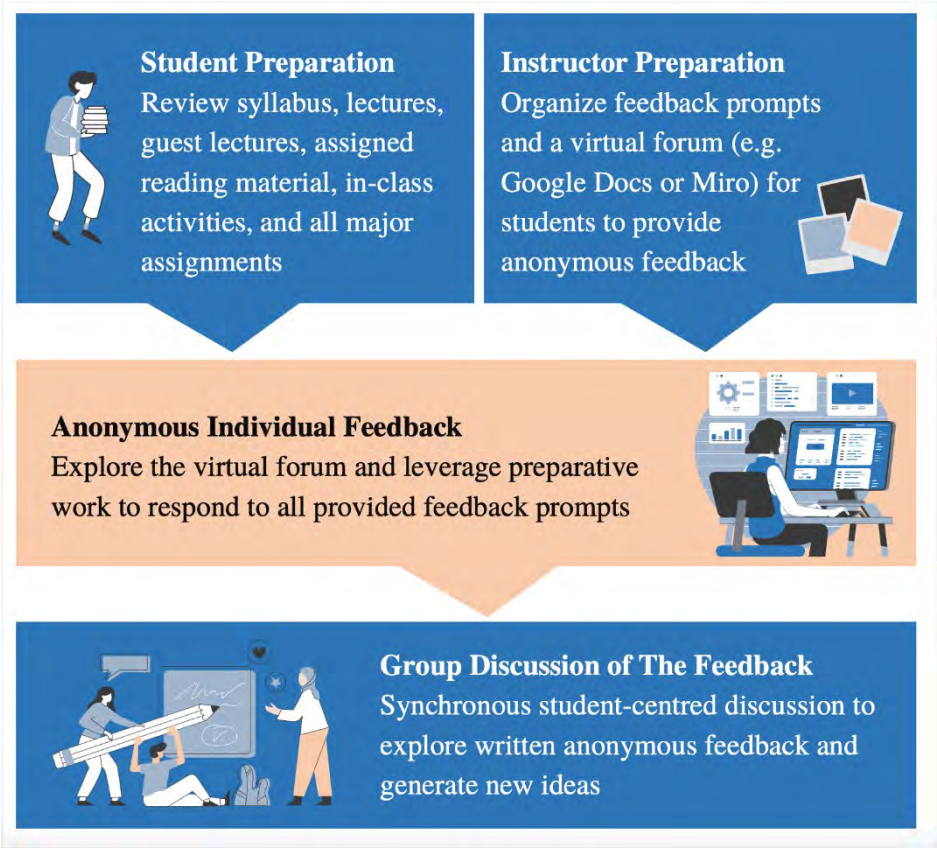
STRUCTURE OF THE WORKSHOP

Having facilitated Bleicher's (2011) model of the Last Class Workshop many times in person, it has become a staple in the curriculum of our graduate-level Advanced Human Genetics course, targeted to first-year students in a two-year professional master's program at the University of Toronto in Canada. Given its usefulness in person, we elected to rework the workshop for the all-online environment mandated by the COVID-19 pandemic. Here we describe a workshop that is adapted to a synchronous virtual learning environment and oriented towards a relatively small group of students—

between 15 and 50. We believe the workshop to be highly transferrable, and can be implemented at any level of course, across disciplines, and in most types of classes.

Using a constructivist model for teaching and learning, this workshop represents a sharp departure from the content-driven learning prioritized by much of the course towards a metacognitive experience of the class that asks students to focus on learning outcomes (Oliver and Omari 1999). Metacognitive activities are well known to improve and support students' learning and overall performance (Stanton, Sebesta, and Dunlosky 2021). In this workshop, students must think critically and reflectively about their process of learning relative to the coursework and evaluate their progress using the learning tools and curriculum provided to them. This student-centred self-monitoring asks the students to lead the way and nudges them towards being self-directed learners (Jonassen, Mayes, and McAleese 1993; Laurillard 2002; McAlpine et al. 2016). When students are aware that their feedback will be used to make meaningful change, this empowers them to be active contributors to their learning experience and gives them a voice in the classroom and in pedagogical planning (Cook-Sather 2006). The workshop itself is organized around three major elements, the central components of which are unaltered from Bleicher's original workshop (2011; Figure 1).

Figure 1. Structure of the virtual Last Class Workshop



While the two versions of the virtual Last Class Workshop presented here were facilitated by different instructors within the same course and with the same student group (one at the midpoint, the other at the end of the course), every effort was made to keep the delivery consistent in all regards other than those related to the specific study question, associated with the anonymous individual feedback component of the workshop.

Preparation

Prior to the last class, students are given instructions describing the preparative work they should do in advance of the last class of the term (described in full in Appendix A). Experience has indicated that correctly framing this session for the students in advance directly impacts its success. We are soliciting honest feedback from the class—the good, the bad, and the ugly—and presenting this workshop as an opportunity for student activism during which they can enact real, lasting change in the curriculum. This creates a sense of anticipation and ensures that the class is invested in the objectives of the workshop (Bleicher 2011).

This preparative exercise, which was unchanged in the switch from in-person to virtual learning, asks the students to engage in learning by problem solving—a key aspect to the constructivist learning environment (Reeves and Okey 1996). The class is required to not only reflect on what elements of the class were most and least successful, but also to begin designing potential solutions for the parts of the class that were not well received. The preparation activities define an open-ended series of problems (i.e., that the course has any number of flaws), and give the students a shared goal—to "tear apart the course" and rebuild it better than before. Perhaps most importantly, the instructors forfeit much of their power through participatory design—with radical collegiality, we pass the baton to the students, acknowledge them as owners of the space and experts in the content at hand, and note that our role will be minor (Bovill, Cook-Sather, and Felten 2011).

Counter to this time- and energy-intensive student preparation, the preparative work for the instructors is nominal and limited to setting up the virtual environment in which the second stage of the workshop will take place. While an in-person workshop would rely on use of physical poster sheets, each with a written prompt at the top, the virtual workshop can do no such thing. With new online teaching and collaborative tools surfacing almost daily, we opted to offer the workshop twice over the duration of a year-long class—once at the midpoint (end of September–December term), and once at the conclusion (end of January–April term)—using two different delivery models; Version 1 relying on shared documents in Google Docs' online word processor environment, and Version 2 leveraging a new collaborative whiteboard platform called Miro. Importantly, both platforms are free for instructors and students—Google Docs does not require an existing account to access, and Miro offers a free account for educators into which students can be invited without their own accounts. The platforms were selected based on general familiarity for both students and instructors (Google Docs), and an overall assessment of intuitiveness, ease of use, and effectiveness (Miro).

In each case, a set of virtual "posters" was created, each with a single feedback prompt at the top. In the Google Docs environment, these prompts were provided in individual documents, while in the Miro environment, all posters were arranged in a single virtual space. The prompts were based on those developed by Bleicher (2011) and were adapted for the course in question (Appendix A).

Anonymous individual feedback

The first synchronous component of the workshop asks the students in the class to explore each poster and to anonymously provide their feedback on each board. For the purpose of this study, the Anonymous Individual Feedback stage of the workshop represents the only significant difference in delivery between the two different versions of the virtual Last Class Workshop. Links to the virtual poster location(s) are shared with the class, and students are given half of the duration of the class time (30–60 minutes) to leave their anonymous feedback. They are encouraged to respond to each other's notes and comments and to revisit boards that they have already commented on to see if any of their peers have replied to their feedback. They are instructed not to discuss their feedback out loud at this stage, to ensure that all of their collective feedback is documented on the posters. This portion of the workshop is reminiscent of a gallery walk model for team-based learning—students can examine all areas of the course at a high level, move between posters freely, and work actively and collectively on the curriculum (Rodenbaugh 2015).

Prior to launching the session, students are reminded to be candid and respectful, but above all, to be honest—we assure the class that we want their notes, that this feedback will not impact their grade in the course, and that any critiques they provide are in service to our collective goal of improving the class. This requires trust; instructors must trust the class to deliver appropriate feedback and to then believe that feedback, and students must trust instructors enough to know that their candour during the workshop will not have negative ramifications. Open dialogue increases students' motivation and is important for the involvement of students as course co-creators (Bovill, Cook-Sather, and Felten 2011). The requirement for bidirectional trust is the reason why the context provided by the preparative instructions is so important—this early stage of the process solicits student buy-in for the workshop's major goals of both course evaluation and evolution. It also heads off another potential discomfort—that of soliciting completely anonymous feedback which may seem alarming to some instructors. How might one ensure that students will provide comments that are honest but not inappropriate? In our collective experience this has not been an issue—when students are able to view themselves as co-creators of an updated curriculum, they have a vested interest in participating fully, candidly, and respectfully. Empowering students by emphasizing that they have important perspectives and information to share supports a collegial relationship between instructors and students and leads to students having a greater sense of responsibility for their learning (Bovill, Cook-Sather, and Felten 2011). In our experience, knowing that after the anonymous feedback is delivered, the class will reconvene to discuss that feedback generally provides enough of a sense of ownership and responsibility—both to the rest of their class and to future students—to prevent any mean-spirited comments that may occasionally surface in the type of anonymous feedback provided via other evaluative forums (e.g. standardized course evaluations).

Group discussion of the feedback

The final element of the Last Class Workshop brings the entire group back together (e.g., on Zoom) to work through the provided anonymous feedback for the remainder of the class (a further 30–60 minutes). Each poster is assigned to a small group of students, who are then responsible for sharing the major themes and comments, highlighting any areas of contention or disagreement and leading the large group discussion on the poster's topic. Primarily as students work through the feedback as a class, the discussion focuses on the following major questions:

1. Does the class generally agree with each comment? Why or why not?
2. Are there elements of certain comments that need to be elaborated on?
3. Does the group have any additional feedback as a result of our discussion so far?

While it might be faster and more streamlined to have the instructor collect and read the comments on the posters, there is an important rationale behind having students act as caretakers of the class feedback at this stage of the workshop. Firstly, it keeps the onus on the students, rather than the instructor, to move the conversation forward. Secondly, it gives each poster comment some space in the discussion without mandating that the student(s) who authored it has to identify themselves—allowing some space for residual anonymity can make it easier for students to participate in the conversation, especially if the comments in question are critical of the course or suggestive of a major change. Finally, it keeps the class talking—the anonymous writing phase was quiet for a reason, but at this stage we want noise, discussion, and debate in order to really get to the root of why certain elements of the course worked or did not work and to create an atmosphere in which new ideas can be proposed and developed.

The role of the instructor is purely as a facilitator of this discussion, which is most fruitful if the instructor is firmly in the backseat. The instructor asks clarifying questions, confirms new ideas, summarizes, and takes notes. They do not drive the discussion or defend aspects of the existing curriculum—this stifles the student-led discussion and disrupts the trust and cohesion of the community of remote learners. Students were—and in some cases continue to be—isolated from each other and their normal learning environment and are coping with an unfamiliar and a generally unwanted mode of learning as a result of the COVID-19 pandemic (Blankstein, Frederick, and Wolff-Eisenberg 2020). The role of the facilitator in this session is to bring everyone together and promote a sense of community by focusing on the equality between faculty and student voices and the value of the students' individual and collective contributions to the improvement of the course.

The open discussion session is based on Kolb's (2014) contemporary experiential learning model, which suggests that a meaningful reflective experience is guided by the three fundamental questions—what?, so what?, and now what? During this final portion of the Last Class Workshop, we work with our students to not only acknowledge the feedback that was provided anonymously on the poster boards (what?), but also to clearly articulate the implications of these notes on the curriculum and content of the course (so what?), and to generate new ideas that might address these issues (now what?). Here we encourage students to relocate from the passive periphery of the virtual classroom learning community into the centre. Focused on addressing the authentic curricular issues identified by the students, this discussion opens the learning, reflecting, and rebuilding process very quickly (Johnson 2001; Wegerif 1998).

We ask the class to work collaboratively to synthesize and propose solutions to collective curricular issues through this process of constructivist participatory design (DiSalvo et al. 2017; Martens et al. 2019). Ideating as a group about custom innovations to the curriculum that will improve the student experience both acknowledges and validates that experience and fosters the students' sense of community.

EXAMINING STUDENT PERCEPTIONS OF THE VIRTUAL LAST CLASS WORKSHOP

We found a great deal of meaningful evidence to support the utility and effectiveness of these online workshop pivots through student discussion during the workshops themselves. That having been

said, here we focus on the data collected through an anonymous survey distributed on the last day of class and a subsequent focus group, which allows us to draw some conclusions about the overall efficacy of the virtual workshops, and directly compare the two different delivery methods described above. All students in our course were given the option to participate in this study and 95% of the class consented to have the data from their survey included in the current analysis (n=19). Survey results from the consenting students were anonymized by an outside collaborator who was unknown to the students prior to data analysis. The survey focused on student perceptions of the Last Class Workshop as a model for course evolution and evaluation, as well as on a specific comparison between the two delivery models of the workshop (Appendix B). Of the study group, 53% consented to participate in a follow-up instructor-led, recorded focus group (n=10), during which seven students were present. The focus group was organized as a semi-structured interview using pre-prepared questions (Appendix D), with allowances for the discussion to evolve and to specifically interrogate ambiguous elements from the survey.

General assessment of the Last Class Workshop

To assess the student perceptions of the Last Class Workshop as a tool for course evaluation and evolution, Section I of the Virtual Last Class Survey, a General Assessment of The Last Class Workshop (Appendix B), used a five-point scale (1 = strongly agree, 5 = strongly disagree) across 10 survey questions. This was coupled with two contextualizing questions surrounding the amount of the requested preparative work the participants had elected to complete and the relative novelty of the workshop style, based on the participants' previous academic experiences. A majority of the class indicated that they had done some or all of the required preparative work in advance of the workshop (Figure 2a; 95%, n=19), and a remarkable 95% of the participants noted that they had never done anything like this workshop in a formal classroom setting at any other point during their academic career (Figure 2b; n=19). It is worth noting that the single respondent who indicated a similar experience elsewhere elaborated on their answer later in the survey, detailing a highly dissimilar experience. The study participants overwhelmingly indicated that this workshop is an enjoyable experience, an excellent way to provide feedback in a judgement-free environment, a good way to provide evaluations for the current form of a course, an empowering way for students to impact the curriculum, and a useful way to generate new ideas for the class. Furthermore, the group overwhelmingly agreed that the workshop is a useful curriculum assessment and development tool at the graduate level, and that it should be a permanent fixture in the course in question (Figure 2c).

Interestingly, a number of participants noted that this workshop helped them make new connections between concepts in the course that they may not have otherwise identified (39%; n=7; Figure 2c). When explored further during the focus group, participants suggested that the discussion component of the workshop allowed them to identify the overarching goals of the class and to more easily connect course learning outcomes with the challenging work required of them during the course. As an example, one focus group participant reflected on a particularly difficult assignment in light of the context provided by the virtual Last Class Workshop, noting "It was eye-opening, I did view that task [...] in a completely different light; I did appreciate it more, I wouldn't have made that connection without the discussion." Another participant echoed this, suggesting:

> As people gave their opinions about certain aspects of the course [...], you got to understand the learning outcomes a little bit more. It kind of contextualizes what we do, why we do it, and things you might not have reflected on by yourself.

This might suggest that these connections should be more clearly articulated throughout the class and in the syllabus, but we posit that this effort may be in vain—it is the act of directly participating in the course learning and then metacognitively reflecting on the experience of learning that drives these connections home.

Survey participants were also offered a free-text box in which to provide additional notes on their overall experience with the workshop. The responses here were overwhelmingly positive, and a few major themes emerged (Appendix C; Supplementary Figure 1)—it is clear that students felt a sense of responsibility to future cohorts to improve the course, and that this responsibility underpinned the desire to provide high quality feedback (58%; n=11). Further, they understood that their input during the Last Class Workshop would be both heard and integrated—the workshop gave them a feeling of being valued, which seems to have much to do with the radical collegiality practiced by instructors during the session (63%; n=12).

Interestingly, students noted that the proof is in the curriculum—the class highlighted a number of elements in the current iteration of the syllabus that they viewed as highly successful, which had in fact been suggested by previous cohorts of students and subsequently integrated into the course. This suggests that this session is likely to become more robust, meaningful, and valuable to students as it ages within a course.

In addition to providing a well-rounded structure for parting ways with the class, this would appear to address another major and almost universally agreed upon issue instructors face at the end of the term—standard course evaluations. Many comparisons were drawn between the virtual Last Class Workshop and generic end-of-term course evaluations that are often provided at the course, departmental, or institutional level, with all references to such surveys indicating that the Last Class Workshop was more engaging, and a better model for soliciting formative feedback (26%; n=5). This is evidenced by the following two excerpts from student responses:

> Overall, I think this is a useful tool for course evaluation. My prior experience with course evaluations generally consisted of filling out a generic survey asking standard questions about the course material and instruction on a scale of 1–5, followed by an option to write any specific comments about the course. I enjoyed that The Last Class Workshop took more of a "free-form" approach, where we were prompted to give our thoughts on specific aspects of the course, rather than simply stating if we agreed or disagreed with a predetermined statement. With this format, it is easier to pinpoint exactly what is working in the course and what is not.

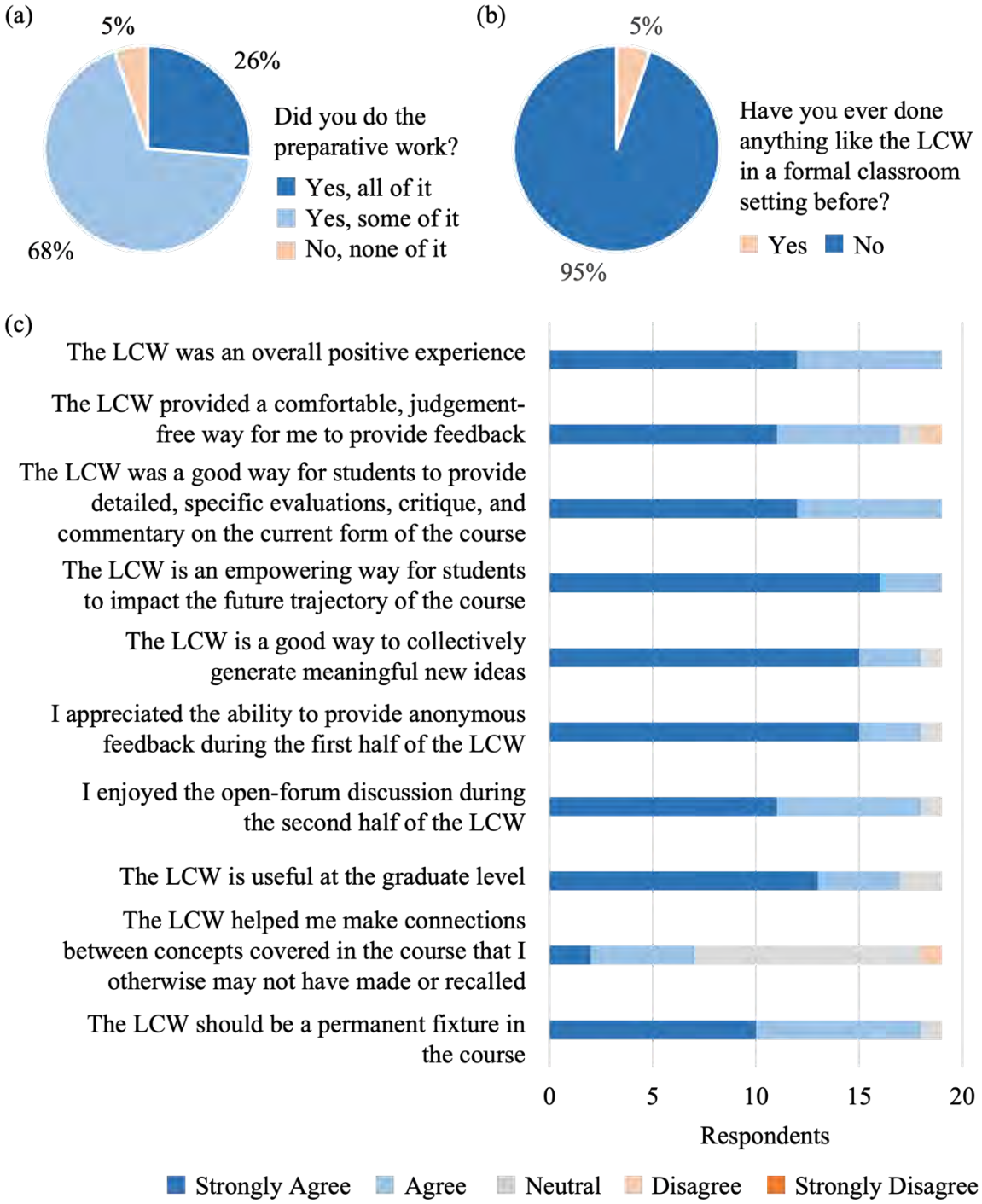
> I really enjoyed that this class incorporates feedback from students. This format really makes me feel like you take our feedback seriously and it's much more conducive for creating discussion. In the past my undergrad courses would have standardized feedback forms at the end of the last class and I never took them seriously because they didn't allow for discussion, they provided a very short amount of time to fill it out, and it generally didn't feel like anyone would pay attention to the feedback given.

Whether offered in-person or online, the generic Likert scale course evaluations are a static, vague, and decontextualized form of feedback, wherein course development and overall educational quality take a back-seat to student satisfaction. There is no shortage of literature on the many issues with standard teaching assessments (Borch, Sandvoll, and Risør 2020; Edström 2008; Oermann 2017), and we suggest that the problems surrounding the lack of formative, specific feedback in these evaluations can be circumvented by asking students directly about their experience with and ideas for the course in an end-of-term workshop like the one described here. However, despite their issues, course evaluations serve a number of purposes in higher education, and it would not do to integrate a workshop that would dissuade students from completing them. While Bleicher (2011) suggests that this type of workshop allows students to provide more meaningful feedback on standard evaluations, when this issue was touched on during the focus group, participants were divided on the impact of the Last Class Workshop on course evaluation submission and overall quality. Of seven participants, three indicated that they would be less likely to complete standard course evaluations while four indicated that they would be more likely to complete them. Participants who suggested that they would be more likely noted that it would be easier to provide constructive feedback after the Last Class Workshop, because their opinions about the course had been examined and refined, and that they may even provide different types of feedback after the Last Class discussion. Those who noted that they would be less likely to complete the course evaluations cited redundancy and having already provided the best version of their feedback as the major reasons for opting out. When we explored this question more deeply, it was suggested that contextualizing standard course evaluations for the students to highlight major differences in intended purpose between the Last Class Workshop and course evaluations (we would argue this to be soliciting meaningful feedback, as opposed to standardized teaching assessment metrics) may go a long way towards encouraging students to complete their evaluations.

Many participants noted that this virtual workshop gave them the opportunity to deliver constructive or critical feedback that may have been otherwise difficult to provide (79%; n=15), as suggested by the following quote:

> The Last Class Workshop is an excellent way to improve the course for future cohorts and an amazing opportunity for all of the present students to provide our constructive critiques in a healthy classroom environment. I enjoyed the last class workshop in both the semesters of [the course]. It is an effective way of putting out the feedback that otherwise would have been difficult to express.

Figure 2. General assessment of the Last Class Workshop



Note. (a) Assessment of student preparedness for the Last Class Workshop (LCW). (b) Assessment of student perceptions of curricular novelty of the LCW. (c) Likert-scale survey of student perceptions of use and utility of the LCW; n=19 respondents.

Notably, the study participants were unanimous that overall, the Last Class Workshop was an excellent way to solicit student feedback and to work towards improving the curriculum and the course as a whole (100%; n=19; Figure 2c), supported by the following excerpt:

> I do feel that the "Last Class Workshop" serves as a useful tool for course evolution by providing us, as students, the opportunity to have a sense of agency and take on an active role as stakeholders in our own learning process. Further, by voicing our experiences and suggestions for improvement, this process has allowed us to help shape and optimize the experiences of future cohorts. The collaborative atmosphere encouraged deep reflection, which I believe ultimately led the class to generate ideas much more thoughtful than would have been put forward in a traditional individual written course evaluation.

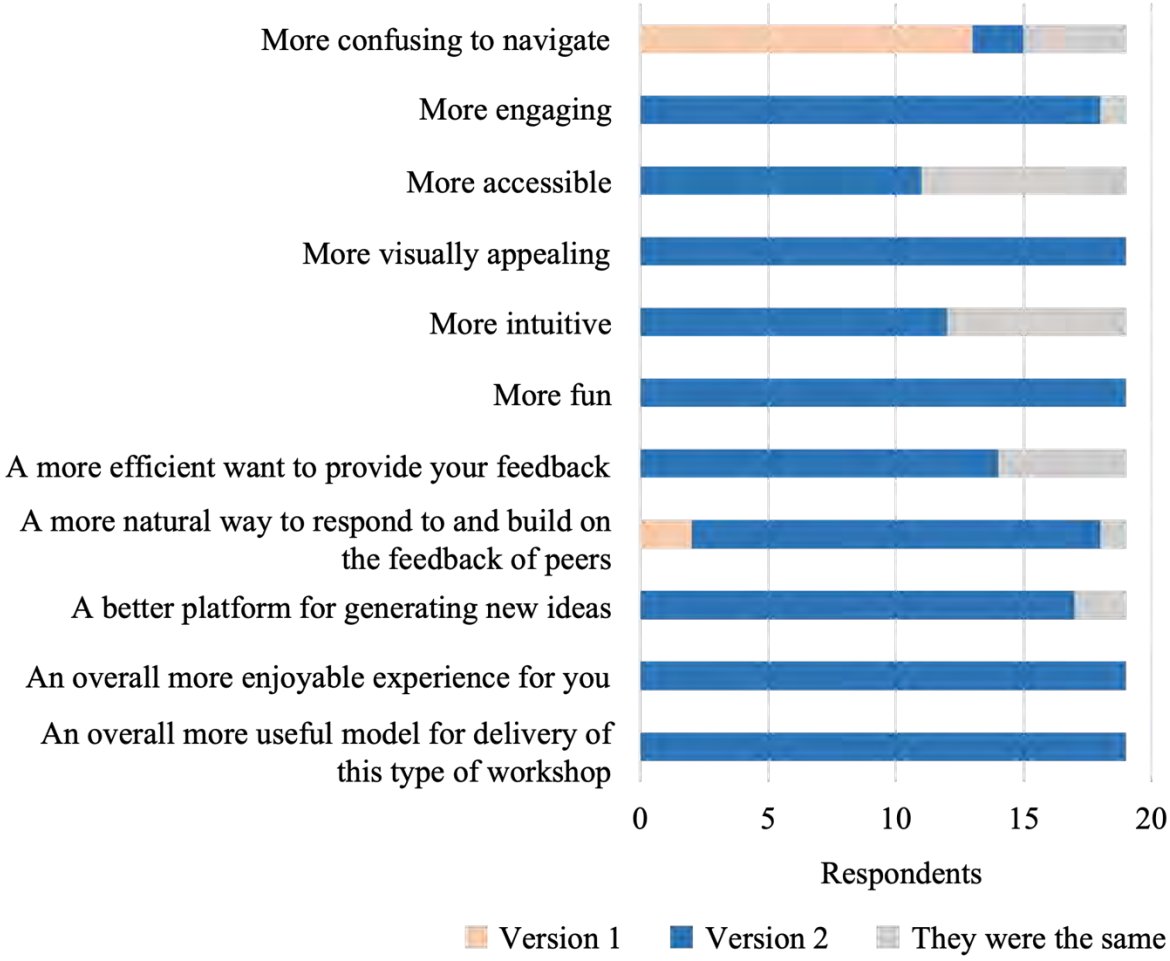
A number of respondents noted the fact that the workshop thrives on the breadth of different student perceptions of the course and that this inherent disagreement allowed for more thoughtful and constructive idea generation (36%; n=6). The act of disagreeing, either anonymously or during the group discussion, certainly allowed for feedback to be thoroughly explored, although not all students appreciated this. In a free-form response box in the survey, there were a small number of respondents who indicated that the group discussion favours extroverted students who are confident sharing their feedback out loud (n=2). We propose that the two complementary synchronous elements of the workshop already address this concern for most students. This is not to say that the anonymous and discussion elements of the workshop are intended to be redundant; rather, these two elements build on one another and have different motivations. The anonymous feedback tends to be dominated by comments about specific aspects of the course, while the group discussion focused more on collaborative problem solving. This is supported by participant perceptions of the two workshop elements—both of which the majority of the group found to be important and enjoyable (Figure 2c). When interrogated during the focus group, one participant elaborated on this suggesting:

> I appreciate that we had the space to […] elaborate on our opinions, and […] hear from the other students in the class and then maybe change our opinions or modify them or […] listen and learn and hear what others thought about it so we could kind of contextualize our opinion… […] I love that we were able to have that discussion.

Offering a chance to provide feedback in writing after the group discussion might allow students who are not comfortable verbalizing feedback to retroactively participate in the discussion via their written responses and could offset this issue. That said, we propose that this option should not be offered until the end of the workshop, lest it discourage students from actively participating in the discussion.

The focus group confirmed another anticipated benefit of the group discussion—working through the feedback systematically cemented the students' feeling of being "heard," and ensured the group that their feedback was not only valuable, but valued. In the words of one participant, "[It] made me feel that […] you were really serious about asking us for feedback and that you really want to do something constructive with it, so you know, the effort from our side feels worthwhile."

Figure 3. Two methods for asynchronous feedback in the virtual Last Class Workshop



Note. Version-specific survey of student perceptions of the relative ranking of Version 1 of the virtual LCW (Google Docs) as compared to Version 2 (Miro); n=19 respondents.

Comparing and contrasting two methods for soliciting anonymous feedback

We specifically queried our study participants regarding the two tools for soliciting anonymous feedback described above, using either Google Docs (Version 1) or Miro (Version 2) in Section II of the Virtual Last Class Survey (Appendix B). Study participants responded overwhelmingly in favour of Miro, noting that it was superior to Google Docs in almost all categories assessed (Figure 3). In particular, participants were unanimous in their assessment that Version 2 was more visually appealing, more fun, a more enjoyable experience, and an overall more useful model for delivery of this type of workshop (100%, n=19). The overwhelming majority of the group cited Version 2 as more engaging and more efficient way to provide feedback, a more natural way to respond to and build on the feedback of peers, and a better platform for generating new ideas (95%, 74%, 84%, and 89%, respectively; n=19). A majority of the group found Version 1 more confusing to navigate (68%, n=19). This is evident in the following participant comment:

> The shared document format (Version 1) was very difficult to connect similar themes / ideas together. The [Miro] format was much more intuitive and interactive—the use of emojis is a simple way to agree / disagree with a comment.

The focus group elaborated on some of these results, identifying that the ability to have threaded conversations and visually identify comments authored by different students made Miro an easier platform for the debates that are inherent to curricular analysis. The group also suggested that the participants who found Version 2 more confusing were likely speaking to lack of familiarity with Miro's feedback features (e.g. emojis and threaded responses; 11% of participants; n=2 in both cases), which participants were expected to self-identify during the workshop. We propose that adding an introduction to these features to the first virtual poster in the Miro environment would suffice to address this issue. Furthermore, the focus group highlighted an interesting (but not insurmountable) issue with Version 1; all students with an existing Google account were automatically signed into the shared Google Docs, effectively eliminating the "anonymous" aspect of the anonymous feedback. To work around this, students had to sign out of their Google accounts or re-join the workshop in a private browser window, and focus group participants expressed annoyance with this added step. This likely contributed to the overall lower rankings of Version 1 and it was not an issue with Version 2, in which students were invited to participate on Miro as unidentified guests.

The group was slightly more divided when asked which platform was more intuitive; 63% of participants preferred Version 2, while the remaining 37% had no preference between Versions 1 and 2. This is in line with our expectation—Version 1 was selected based on existing familiarity, which likely boosted student perceptions of intuitiveness of use. An assessment of which platform was more accessible was similar; 58% of the group preferred Version 2, while 42% had no preference between versions, indicating an overall preference for Version 2. When this was explored with the focus group, participants identified a few important issues—with remote learners tuning into synchronous sessions from around the globe, the international availability of platforms cannot be overlooked. At the time of implementation of Version 1, Google was not available from mainland China, rendering the anonymous feedback segment of the workshop completely inaccessible to one student (n=1). The group went on to identify that the Google Docs lagged significantly as the number of contributors increased, making the experience of collectively contributing to Version 1 and participating in any type of responsive commentary challenging. An exploration of Google Docs and Miro using a more canonical definition of accessibility suggests that both platforms currently have dedicated accessibility settings and policies (Google 2021; Miro 2021), although there are more obvious areas for accessibility gaps on the Miro platform as compared to the Google Docs platform, simply by virtue of being more recently developed and having more self-authored visual elements.

CONCLUSION

We understand the limitations of the study based on the small class size (n=20) and participant number (n=19), and it is possible that the students' participation in two versions of this workshop within the framework of a single course affected their end experience, but this work nonetheless suggests that the Virtual Last Class Workshop is a fun and engaging way to solicit meaningful course feedback and curricular insights centring the student voice. Furthermore, this work clearly indicates that a workshop

leveraging the Miro platform to solicit anonymous student feedback was perceived as superior to one that relied on Google Docs. Our belief remains that this virtual workshop represents a feedback model for course evaluation and evolution that can be widely applied across disciplines, class types, and levels of study. While the virtual Last Class Workshop pivots were originally developed to suit an emergency transition to online learning during the COVID-19 pandemic, we view the early success of the workshop on the Miro platform as an indicator that this particular delivery method will have staying power beyond the pandemic. There is a growing precedent for using Miro in academia (Brandao et al. 2021; Li et al. 2021; Mitchell 2021; Xu 2020a; 2020b; Zhou, Suraworachet, and Cukurova 2021) and the platform has recently been determined to be the preeminent online collaborative whiteboard platform for higher education teaching based on a number of evaluation criteria (Ahmmad et al. 2021). Indeed, the focus group indicated that they would prefer to provide their anonymous feedback via Miro than to write it on physical poster boards, even if the rest of the workshop was offered in person, citing an opportunity to organize feedback more clearly and legibly, and the option for truer anonymity. This will be a model to test in future iterations of the course, when the global public health situation allows for a return to in-person teaching.

Other outstanding questions remain about the scalability of this workshop, its measurable success in creating positive evolution in a course, and a framework for translating the synchronous workshop to a completely asynchronous learning environment, for courses in which a synchronous component is not possible. Furthermore, this work highlights a tension between the type of feedback that can be accessed during this workshop, which can be formative to course evolution, and the relative likelihood of students completing standard course evaluations, which are widely used to assess teaching and course quality. While the nature and direction of the impact is unclear, it is likely that this type of workshop will impact the quantity and quality of submitted course evaluations. These questions will need to be explored more deeply in future research.

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ETHICS REVIEW

This research was approved by the University of Toronto Review Ethics Board. Participation was voluntary and analysis was carried out using results from students who provided informed consent.

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APPENDIX A

Methodological details associated with the preparation and structure of the Virtual Last Class Workshop are provided below. The workshop was facilitated twice over the duration of one course (at the midpoint and at the end of the course) with the same group of students, but by two different instructors. Every effort was made to keep the delivery consistent.

Student Preparation

Prior to the last class, students are given the following directions:

There will be no lecture during class time today - rather, I ask that in preparation for this session, you A) reread the course syllabus (excluding institutional policies), and B) review the content of this course as a whole. I'll be asking for your feedback, both positive and negative, regarding every item in the following categories:

1. *Lectures*
2. *Guest lecturers*
3. *Assigned reading material*
4. *In-class activities*
5. *Major assignments*

As you can see, this will require significant reviewing, and preparing for the Last Class Workshop will be time-consuming. I expect you to come to class ready to tear apart and rebuild this class, with notes on all of the topics above. I appreciate the work that will go into reviewing all of these items even very briefly; your thoughtful, specific feedback and active critique will provide much needed direction when it comes to honing and revising this class for future cohorts.

You will lead this class, and my role will be primarily as a facilitator of your discussion. I will ask each of you to contribute to improving the experience of this class in the future, so that when the course is better next year, the students will have you to thank!

Instructor Preparation

Feedback prompts used in Versions 1 and 2 of the Virtual Last Class Workshop were the same, with minor alterations to accommodate the midpoint nature of the first workshop (prompts six, eight, and nine were not offered at the midpoint, to avoid redundant questioning):

1. *Readings: Which assigned readings did you enjoy? Which were hard or not enjoyable, but valuable? Which should we "kill"? Do you have suggestions for additional readings / topics / forms of pre-learning (e.g., videos, podcasts) that could be incorporated into the class?*
2. *Content: What content was the most and least successful? Were the units / topics structured in a way that was effective? Can you think of content that would make the course stronger / more valuable? If so, is there content you would scrap to make space for it?*
3. *In-class activities: What were the most and least successful in-class activities? Do you have any ideas for new in-class activities?*

4. *Major assignments: Which of the current major assignments should we keep? Do you have any ideas for new ones? How could the assignments (both the structure & instructions) be improved / revised to make the experiences more valuable?*
5. *Guest lecturers: Which of our guest lecturers should we make sure to bring back? Are there any you would suggest dropping? Do you have any ideas for different guest lecturers we might consider inviting?*
6. *Favourites: What were your favourite things about the course (i.e., what's non-negotiable on your "keep" list)?*
7. *Suggestions: What's your best suggestion for improving our course?*
8. *Advice: What's your best advice for the students who will be coming into this course next year?*
9. *Moving forward: Add your name to this sheet if you would be interested in participating in some way in this course in the future (e.g., workshop host, guest lecturer, panelist, consultant on new content or assignments).*

For the purposes of integration on the new Miro platform, an alternative first poster was created for Version 2, resulting in a total of 10 posters, and featuring the following prompt:

1. *Using the virtual poster board – testing Miro: Use this board to practice!*
    - *In the left-hand menu, click the "sticky note" icon*
    - *Pick your sticky colour, drop it onto the virtual poster, and add your name*
    - *Check out the font and size options, and note that you can resize your sticky to accommodate a longer comment*

APPENDIX B

The survey below was offered to all consenting study participants (n=19) via Microsoft Forms one day after the completion of Version 2 of the Last Class Workshop. Following survey submission, results were deidentified by an external collaborator who was unknown to the participants, and who did not know the participants.

Section 1: General Assessment of The Last Class Workshop

The following questions are pertaining to your experience of The Last Class Workshops in general:

1. Have you ever done something like The Last Class Workshop in a formal classroom setting prior to MMG3001Y?
    - o Yes
    - o No
2. If you answered "Yes" above, please describe

3. Did you do the requested preparative work in advance of the Last Class Workshop?
    - o Yes, all of it
    - o Some of it
    - o None of it
4. The Last Class Workshop was an overall positive experience
    - o Strongly agree
    - o Agree
    - o Neutral
    - o Disagree
    - o Strongly disagree
5. The Last Class Workshop provided a comfortable, judgement-free way for me to provide feedback, both positive and negative
    - o Strongly agree
    - o Agree
    - o Neutral
    - o Disagree
    - o Strongly disagree
6. The Last Class Workshop is a good way for students to provide detailed, specific evaluations, critique, and commentary on the current form of MMG3001Y
    - o Strongly agree
    - o Agree
    - o Neutral

    - Disagree
    - Strongly disagree
7. The Last Class Workshop is an empowering way for individual students to impact the future trajectory of MMG3001Y
    - Strongly agree
    - Agree
    - Neutral
    - Disagree
    - Strongly disagree
8. The Last Class Workshop is a good way to collectively generate meaningful new ideas for course evolution
    - Strongly agree
    - Agree
    - Neutral
    - Disagree
    - Strongly disagree
9. I appreciated the ability to provide anonymous feedback during the first half of the Last Class Workshop
    - Strongly agree
    - Agree
    - Neutral
    - Disagree
    - Strongly disagree
10. I enjoyed the open-forum discussion during the second half of the Last Class Workshop
    - Strongly agree
    - Agree
    - Neutral
    - Disagree
    - Strongly disagree
11. The Last Class Workshop is useful at the graduate level
    - Strongly agree
    - Agree
    - Neutral
    - Disagree
    - Strongly disagree
12. The Last Class Workshop helped me make connections between concepts covered in the course that I otherwise may not have made / recalled
    - Strongly agree
    - Agree
    - Neutral
    - Disagree
    - Strongly disagree
13. The Last Class Workshop should be a permanent fixture in MMG3001Y

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

Section 2: Comparing and Contrasting Versions 1 and 2

The following questions are comparing Version 1 of the Virtual Last Class Workshop (December 2020, using shared Google Docs) with Version 2 of the Virtual Last Class Workshop (April 2021, using Miro). Please select the answer that aligns most closely with your overall impression and experience. In terms of the technology and platforms involved, which version of the Virtual Last Class Workshop was:

14. More confusing to navigate?
    - Version 1
    - Version 2
    - They were the same
15. More engaging?
    - Version 1
    - Version 2
    - They were the same
16. More accessible?
    - Version 1
    - Version 2
    - They were the same
17. More visually appealing?
    - Version 1
    - Version 2
    - They were the same
18. More intuitive?
    - Version 1
    - Version 2
    - They were the same
19. More fun?
    - Version 1
    - Version 2
    - They were the same
20. A more efficient way to provide your feedback?
    - Version 1
    - Version 2
    - They were the same
21. A more natural way to respond to / build on the feedback of peers?
    - Version 1

- Version 2
- They were the same

22. A better platform for generating new ideas?
    - Version 1
    - Version 2
    - They were the same
23. An overall more enjoyable experience for you?
    - Version 1
    - Version 2
    - They were the same
24. An overall more useful model for delivery of this type of workshop?
    - Version 1
    - Version 2
    - They were the same
25. Is there anything else you want me to know about your experiences with / interpretation of the two versions of the Last Class Workshop?

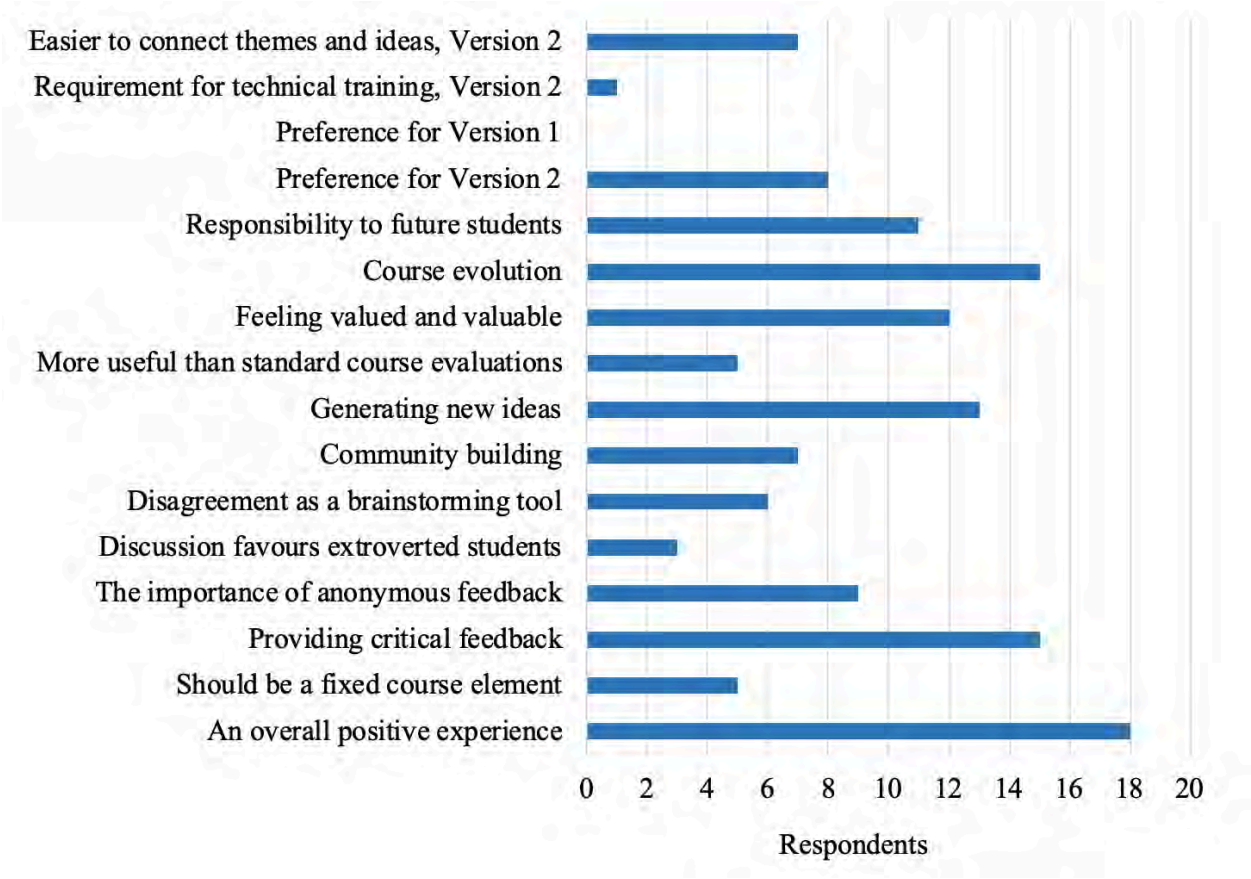
Section 3: Writing Paragraph

What was your overall experience with The Last Class Workshop? Do you think this is a useful tool for course evolution? Why or why not?

APPENDIX C

Qualitative data obtained in Section 3 of the survey (Appendix B) was codified to identify major emerging themes (Supplementary Figure 1).

Supplementary Figure 1. Emerging themes identified from participants' written responses



Note. Qualitative responses from all respondents were codified based on the identification of 16 themes, and the total number of times a theme appeared in the responses is tabulated here; n=19 respondents. Codification was performed by E. Styles.

APPENDIX D

The focus group was noted as optional on the study consent form. All students who indicated a willingness to participate were contacted one month after the completion of Version 2 of the Last Class Workshop. The focus group discussion was facilitated by one of the course instructors. It was organized as a semi-structured interview using the following prepared questions, with allowances for the discussion to evolve, and to specifically interrogate ambiguous elements from the preceding survey. The focus group session was recorded, but was not transcribed.

Version-Specific Questions

1. Based on the anonymous survey, it looks like in general people preferred the Miro Version of the Virtual Last Class Workshop – what are your thoughts on this? Are there other online / virtual platforms that you think might have been equally good or better?
2. Were there any elements of the Google Docs version of the workshop that you preferred, or that you thought worked better?
3. What did you like most about either of the Versions of the Virtual Last Class Workshop that we did this year?
4. What was the most confusing element of either of the Versions of the Virtual Last Class Workshop?
5. What was your overall experience with the different platforms? Did either stress you out? Did you get stuck while trying to participate in either of the workshops?

General Questions

6. Do you think it's important for students to participate in course planning like this? Is this important for life sciences students? Is this more or less important at the graduate level?
7. Do you think that overall this workshop helped you reflect on your learning in this class in a meaningful way? Describe.
8. How does a workshop like this compare to a standard course evaluation form? Do you think this experience impacted the way you completed your course evaluation? How?
9. Do you think there are ways in which this workshop can be improved in the future? Describe.
10. Other comments?