CASE STUDY

Adapting successful online activities for in-person classes - a new challenge

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Abstract

Over the past few years, discussion across the sector has rightly been concentrated on how to provide a valuable and engaging online experience for students. The shift back to in-person classes has left many practitioners considering whether there are any lessons from the necessary shift to online teaching that can be applied to in-person teaching. This article will cover experiences stemming from a welcome but unanticipated dilemma - the live online classes for the module in question were extremely popular with students in 2020/21. How should the lecturer approach the return to in-person sessions?

Activities for live online classes were designed as consolidation "games" which sought to encourage peer learning and discussion. The positive response to these activities encouraged the lecturer to pursue a flipped classroom model for the 2021/22 academic year.

This article will discuss the various considerations when planning the transition to in-person classes for the 2021/22 academic year. In addition to reflections from the lecturer on the experience, this case study will also present preliminary findings from a formal study aiming to determine whether the activities have any positive effects on student confidence. Specifically, the study will investigate student confidence in areas such as working with peers, preparing for a class using online resources, and communicating mathematics in a written format.

Keywords: playful learning, active learning, student engagement, peer learning, polling software.

1. Background

As with most institutions across the sector, the institution in this case study had a phased return to on-campus teaching. The academic year 2021/22 could certainly be characterised as a transition year where all teaching activity was to be hybrid. Under this strategy, all core material was to be delivered via asynchronous online resources. For on-campus interactions, each module had to offer a two-hour, in-person class delivered in active learning mode. No new material was to be delivered in this in-person session, and this was certainly not be a lecture.

With national COVID-related restrictions easing further as the year progressed, in semester two module leaders were offered the option of sticking with the hybrid model or reverting to a more traditional format with three hours of lectures and one tutorial class per week (all in-person). The hybrid model was effectively a flipped approach and this was appealing to some module leaders based on the online experience of 2020/21.

This case study will focus on the adaptation of successful online activities for a Year 1, semester two module (130 students in 2021/22) into an in-person, flipped approach. The module covers elementary number theory and some initial ideas from group theory. This is a theoretical module, and mostly followed a traditional teaching approach pre-pandemic (a mixture of lectures and tutorials). The module is compulsory for all students on the BSc Mathematics and MMath programmes and optional for students on some other degree programmes offered by the

department. For the online sessions in 2020/21, the author developed a playful learning approach centred on three different "rounds" of activity. These were enthusiastically received by students and this left the author in the unexpected position of considering how best to pivot back to in-person classes while retaining the success from the online experience.

The design and success of the three rounds is covered in Russell (2022). The overarching aim of the online live sessions was to consolidate material from the past week, build student confidence, and create an environment where students have ample opportunity to communicate and discuss mathematics with their peers. These activities took inspiration from recreational mathematics (Rowlett et al., 2019 and Sumpter, 2015), learning from errors pedagogy (Tulis et al., 2016 and Metcalfe, 2017), and peer learning (Kuh et al., 2006 and Zepke and Leach, 2010).

2. The in-person flipped approach for 2021/22

For the approach labelled "hybrid", every module in the Department was allocated a two-hour in-person session per week. The playful learning approach for the module in question consisted of three activities (labelled as "rounds") covered in each weekly session. At the beginning of the module, the lecturer explained the approach being taken and the reasoning for this. In particular, it was emphasised that discussing mathematics with peers is beneficial, and making mistakes when learning something new is natural (and expected). At the beginning of each round, the challenge was released on the VLE in PDF format. Students were then encouraged to discuss the particular challenge with their fellow students. Students were given 20 minutes for each of these discussions. After 20 minutes, the whole class came together again and anonymous polling was used to collect thoughts and opinions about the challenges. A summary of the three rounds is given in the table below. The activities themselves were unchanged from those used in the online year 2020/21. Evaluating how these resources work in-person, and reflecting on the additional considerations for this format are the focus of this case study.

Table 1 - breakdown of the three activities in the sessions.

Round	Focus	Format
1	Revision of theoretical ideas and simple examples from asynchronous material for the week	5 or 6 multiple choice questions covering definitions and elementary examples from the weekly material.
2	Presentation of written mathematics related to the weekly material	4 sample answers to typical questions from the weekly material. Each sample answer contains an error. Students are challenged to identify these errors.
3	Consolidation of main ideas from asynchronous material for the week	Students are provided with coordinates in decimal degree format for an attraction in or near to the city. 8 of the digits are missing - students must solve clues relating to the weekly material in order to identify the mystery location. Students must also find out something interesting about the mystery location.

The University in this study uses the Poll Everywhere platform and this was utilised in each of the three rounds to gather student views. This software has many different formats for polls (including multiple choice, open text response, upvoting and clickable image). This range of polling offers the lecturer the opportunity to diversify the methods by which they invite students to engage. The anonymity feature can also encourage student engagement.

There were some issues to consider in the transition to in-person classes and these are outlined below.

Devices for polling

The structure of the sessions is heavily reliant on students using electronic devices for polling. When the live sessions for the module were online in 2020/21, this was taken for granted as students attending were already using such a device. The lecturer made it clear at the beginning of the module that polling using electronic devices was an important part of the activities and so students should ensure that they either have someone close to them who can use such a device (smartphone, tablet, laptop) or that they speak to the admin office to secure a loan. In the end, the structure of the sessions meant that it was not essential for every student to have access to a device as the aim was for the lecturer to get a general sense of any wide-spread issues with the material following on from small-group discussions. Almost all students had a device with them for the sessions and the offer was there for students who wished to use one.

Groups for activities

In the online format, students were assigned to private channels for the activities (which they could choose to go into or not). This gave students a defined set of peers who they could work with, and this was useful. In-person, students naturally chose to sit in their friendship groups. The lecturer gave the class a series of icebreaker activities in the first session to encourage initial discussions and group-forming. The lecturer did not require students to form groups, although the benefits were clearly described. Some students still chose to work alone, and this was also the case when the sessions were online in 2020/21. In future years, the lecturer would probably like to acknowledge and reach out to students in a third category who wish to form a group but don't feel confident reaching out (even after engaging in icebreaker activities). The lecturer could offer a buddy scheme for students to sign up to.

Lecturer intervention

In the online format, the lecturer deliberately left students to discuss the activities in their private channels in an effort to create a safe space (Whitton, 2018) where they could explore the material. The lecturer found that holding back from intervening in discussions was tricky in-person - if students are online in private channels it can be easier to leave them to it while making it clear that they can always reach out for help from their channel. When students are in the room and clearly struggling, it's very difficult for a lecturer to stay away when the natural urge is to support. Students were grateful for these interventions and the lecturer took on a more active role in establishing the "safe space" for the sessions. This was achieved (in part) through a focus on discussion and debate rather than the lecturer only emphasising correct responses. The role of the lecturer in flipped classrooms becomes much more apparent in-person and the responsibility for setting the atmosphere sits firmly with the lecturer (and is essential for success of the flipped model). The lecturer needs to make the class feel comfortable with their presence in the room while students hold their small-group discussions.

3. Evaluation

The in-person sessions for the module were well-attended with an average 60% attendance. For comparison, the average in-person session attendance across all core semester two Year 1 Mathematics modules was under 50%. Students expressed their opinions on the module in two formal surveys (response rate 57%). Students were invited to complete one survey at the beginning of the module before they had engaged in any of the activities (Week 1), and another survey at the end of the module (Week 12). The surveys aimed to establish student confidence in several key areas. The baseline was established with the first survey and any changes in confidence would be observed in the second survey (after students had engaged in the activities). The surveys were a mixture of 5-point Likert scale questions and free-text response questions. For the Likert scale questions, student self-assessed confidence was measured from "1 (not confident)" to "5 (very confident)." The main results are given below.

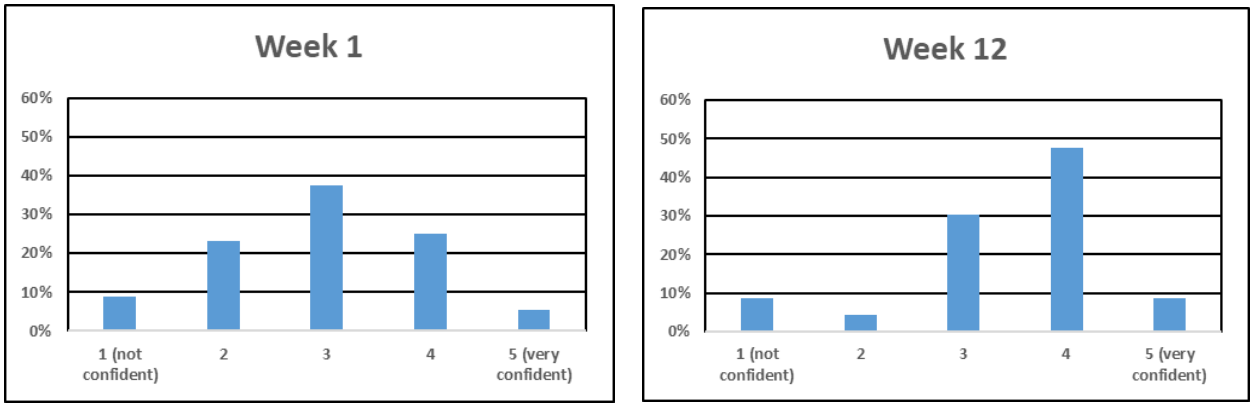

Figure 1. Responses to the question "How confident do you feel tackling a maths problem you have not seen before?" (Week 1 and Week 12)

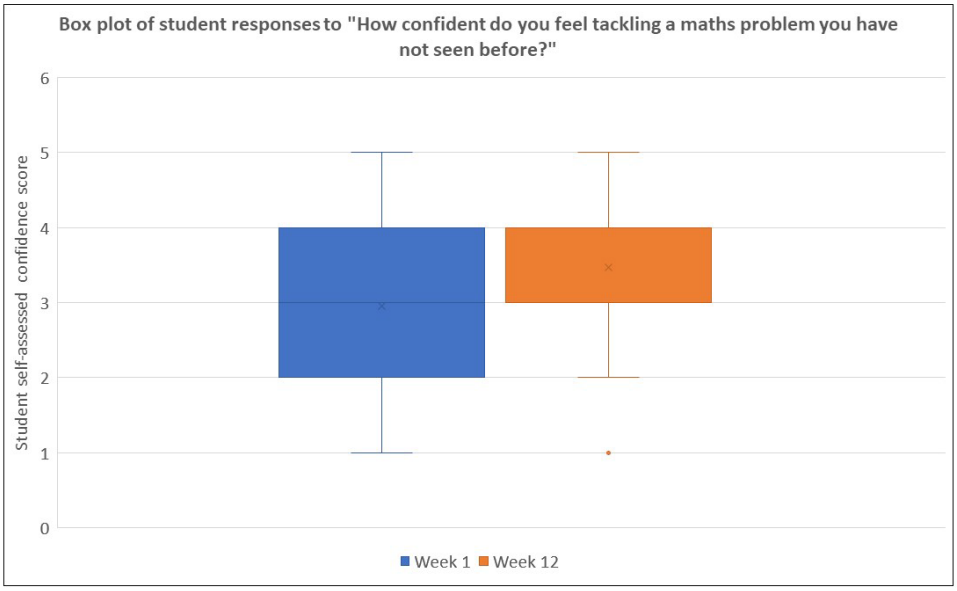

Figure 2. Box plot of student responses to "How confident do you feel tackling a maths problems you have not seen before?" (Week 1 and Week 12).

As can be observed in Figure 1 and Figure 2, there are positive shifts in confidence from Week 1 to Week 12. While over 30% of responses were "1" or "2" (at the lower end of the scale) in Week 1, only 15% responded "1" or "2" in Week 12. The proportion of "4" or "5" responses was 30% in Week 1 and 60% in Week 12. This positive shift is clearly observed in Figure 2. In particular, the first quartile moves from 2 to 3 between Week 1 and Week 12 and the median shifts from 3 to 3.5 over the same period.

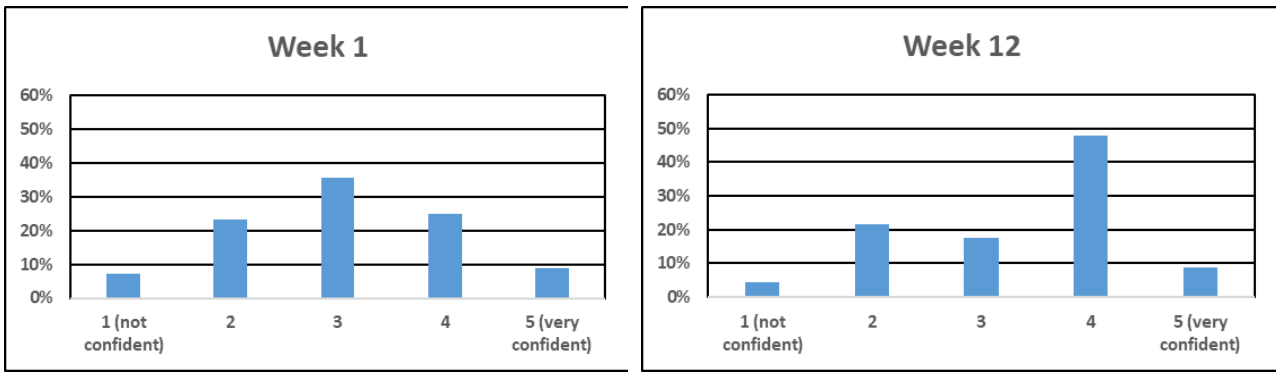

Figure 3. Responses to "How confident do you feel explaining mathematical ideas to others" (Week 1 and Week 12)

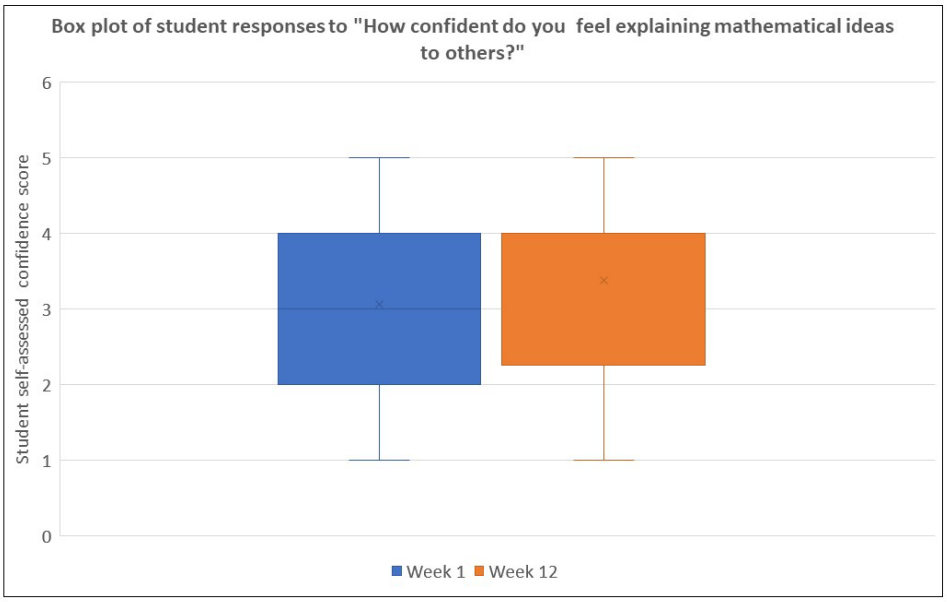

Figure 4. Box plot of student responses to "How confident do you feel explaining mathematical ideas to others?" (Week 1 and Week 12).

Positive shifts are seen in the Figure 3 and Figure 4 responses. - 60% of responses were "4" or "5" (at the higher end of the confidence scale) in Week 12 compared with 35% in Week 1. It should be noted that the responses at "1" or "2" for this question did not seem to move at all (very similar proportions in Week 1 and Week 12). As the format did not require students to engage in group discussions, these responses could be attributed to those working alone in the sessions. Further investigation could confirm this. There could be other experiences outside of this module enhancing

this particular skill. Although no other Year 1 modules offered by the Department had the weekly focus on discussion that this module utilised. The box plot (Figure 4) shows that, despite a clear positive change from Week 1 to Week 12, the shift from Week 1 to Week 12 is not as pronounced for this area of confidence. The first quartile and median both show small increases from Week 1 to Week 12.

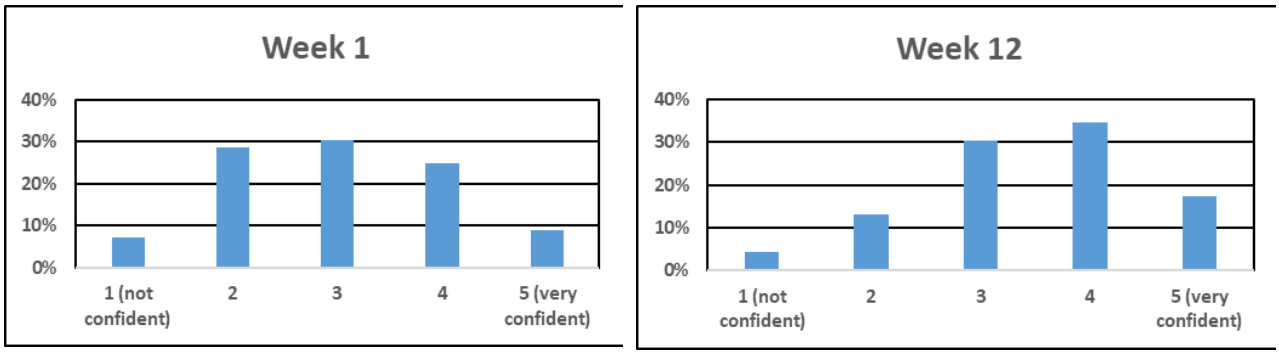

Figure 5. Responses to "How confident do you feel writing out solutions to mathematical problems properly?" (Week 1 and Week 12)

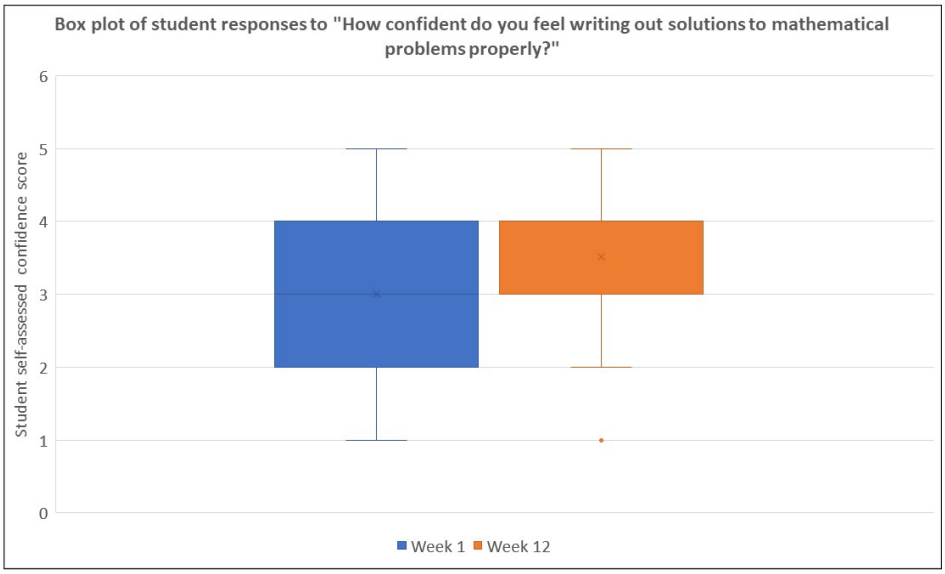

Figure 6. Box plot of student responses to "How confident do you feel writing out solutions to mathematical problems properly?" (Week 1 and Week 12).

Again, some positive changes are observed in Figure 5 and Figure 6 from Week 1 to Week 12. Round 2 had a focus on the presentation of mathematics (identifying errors in mathematical argument or presentation) and so it is pleasing to see that there is some positive change in confidence by Week 12. With this area of confidence, there appears to be movement between Week 1 and Week 12 from the lower confidence end of the scale ("1" and "2") to the higher confidence responses ("4" and "5"). In particular, it should be noted here that the proportion of neutral responses ("3") does not move much between Week 1 and Week 12 so it would seem that there is some shifting here directly from low confidence to high confidence. This is a similar to the results observed in Figure 1 and Figure 2.

In addition, students were asked how much time they spent working with the asynchronous online resources before class each week. The results can be seen in Figure 7.

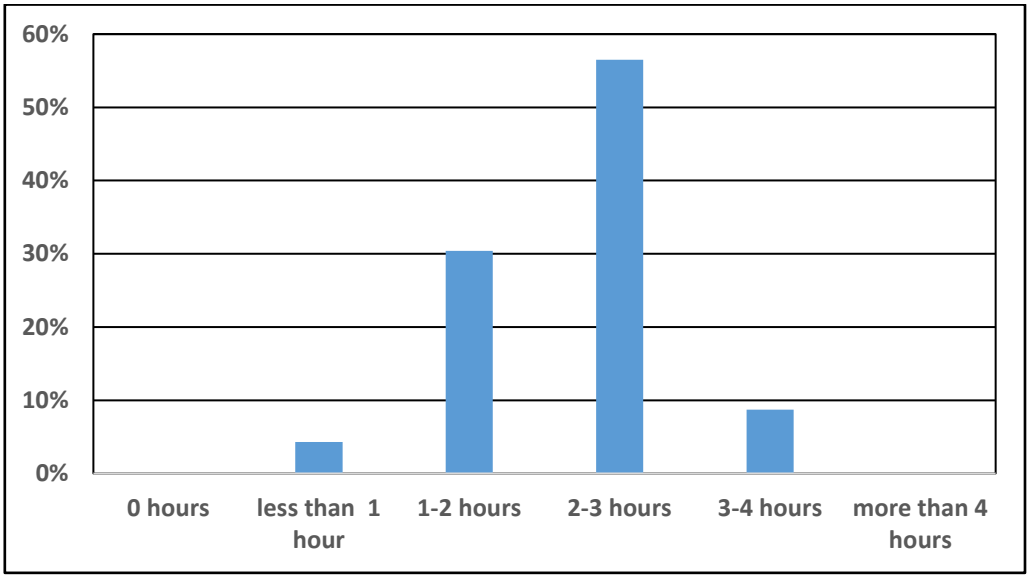

Figure 7. Responses to "How long did you spend studying the online resources before each class (on average)?"

As watching all the video resources alone for a given week takes one hour, it is perhaps concerning, but not necessarily surprising, that very few students (under 10%) acknowledge that they are spending more than three hours studying in advance of the classes.

When it comes to working with others in the sessions, a mixed picture emerged, as can be seen in Figure 8 below.

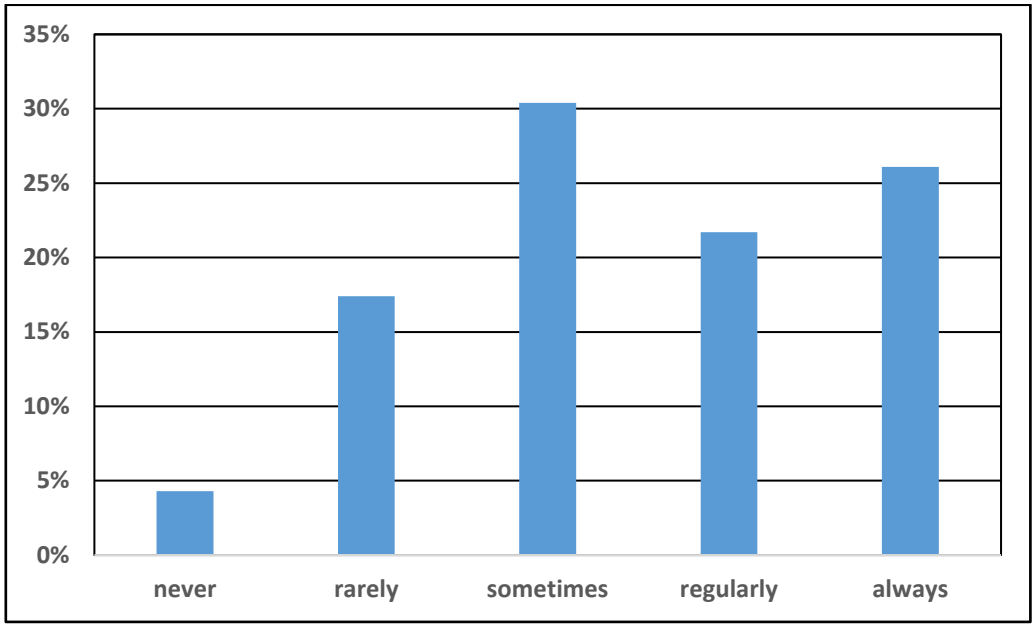

Figure 8. Responses to "I worked with other students in the weekly live sessions..."

With the adopted format on working with others (encouraged but not required), it is unsurprising to see that a mixed picture emerges from the responses in Figure 8. It is interesting to note that the "sometimes" response was given by over 30% of respondents - could this indicate that some students found it useful initially to work with others but then decided to work alone, or vice-versa? Perhaps the students in this category started working with others but their group members stopped attending at some point in the semester and they did not form new groups. It would be interesting to investigate this further.

When asked to consider if they had learned from their peers, the results can be seen in Figure 9 below. Again, a mixed picture was expected from the responses to this question as students were not required to

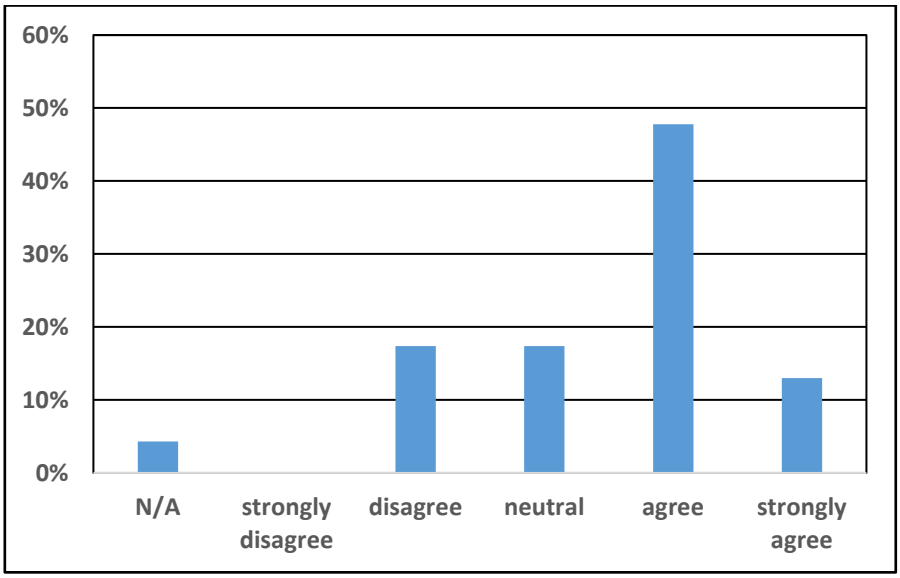

Figure 9. Responses to "I learned from working with other students in the weekly live sessions"

Obviously it is pleasing to see that over 60% of respondents believe that they have learned directly from the experience of working with their peers in the sessions. Given that over 20% of students stated that they did not regularly work with others (Figure 8), this seems like an even more impressive result.

When asked about the activities, students again were very positive (Figure 10). All rounds were popular, with under 10% of respondents believing that any of the three rounds were not very useful. For each round, over 70% of respondents believed that the round was "quite useful" or "very useful".

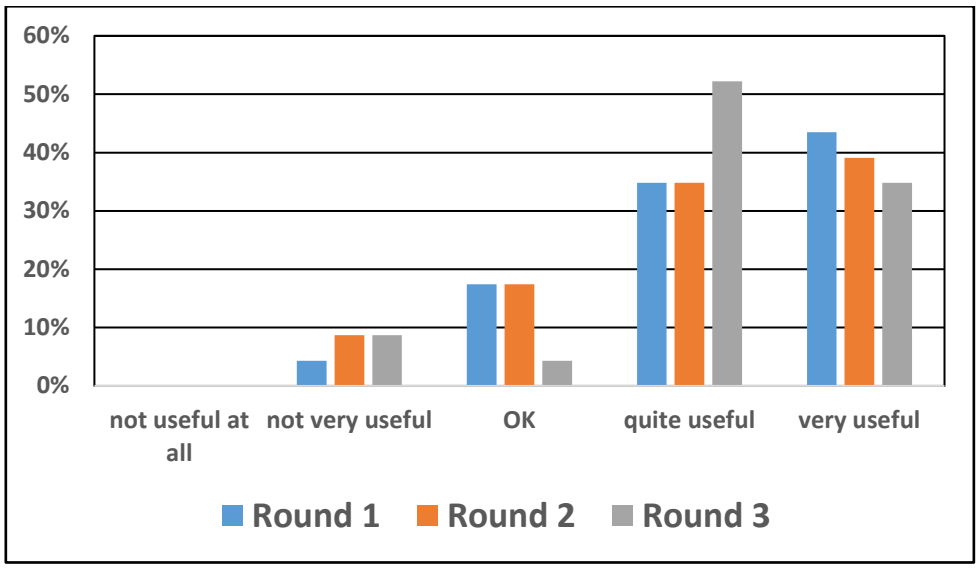

Figure 10. Responses to "Round X was generally..."

Student comments

The free-text comments in the second survey were very illuminating. Some respondents indicated a preference for one round over the others. A couple of particularly interesting comments are given below.

> "(Round 2) was the best because we got to see common mistakes and learn what about these answers was wrong, improving how we tackle questions."

> "Round 1 set me up to tackle the other problems in the next rounds. If you removed Round 1, I wouldn't be able to do the other rounds."

These comments indicate that the structure and order of the rounds was appreciated and necessary for the overall success of the strategy.

Another comment indicated that some students enjoyed one of the rounds more than the others, but also appreciate that liking an activity and finding an activity useful may not always be the same thing:

> "Round 2 was the best. My favourite round was Round 3, but Round 2 was definitely the most useful."

In line with the consolidation and confidence-building aims of the sessions, the comment below underlines what success looks like for this approach.

> "This module has been the best I have taken. After each session I normally feel very confident with the topic unlike in other modules. It is the session I look forward to each week."

Inevitably there are some down sides with this approach. Like all other modules offered by the Department, attendance dropped off towards the end of the semester. As discussed above, there are some students for whom the activities did not work (were deemed "not very useful"). A clear majority of students were very positive about the activities, but it should be noted that there are some students for whom the dial did not shift after engagement with the activities.

4. Reflections on the future of in-person teaching

The department in this case study is moving forward with a "Flipped Classroom Framework". This framework allows module leaders to follow a non-traditional model for their teaching activities utilising asynchronous online resources. For modules operating under the flipped model, there are two 2-hour sessions per week. One of these blocks should be used as an active learning session and the second is an optional supported study session where students can work on problem sheets in small groups or ask questions to the module teaching staff. The structure of the active learning session is not dictated, and the module leader is free to design this as they wish under the proviso that a student-centred approach is adopted and no new material is introduced. Module leaders who do not wish to follow the flipped approach are able to pivot back to the more traditional approach of three hours of lectures and a one-hour tutorial per week.

It should be noted that the future of in-person classes is the subject of much debate across the sector at the moment, with criticism for even considering flipped from some academics (Kapur et al., 2022, for example). Authors such as Nordmann et al. (2021) justify the case for retaining lectures in the "new normal" but on closer examination, the definition which Nordmann et al. use for a lecture may be unfamiliar to some mathematics academics. Although opportunities for student interaction and engagement are encouraged in all institutions and all disciplines, the FILL+ study, for example, found that mathematics lecturers spend over 70% of the class time talking and under 3% of the time asking questions to the class on average (Kinnear et al., 2021). It seems that Nordmann et al.'s definition is in fact that of a "good" lecture with student engagement and interaction as a core aim of the activity. With this in mind, the approach given in this case study could be classed as flipped with active learning in-person sessions, but the lecturer is still talking for around 30% of the class time when the whole room is brought back together to discuss each of the three rounds. Perhaps a more appropriate way to move forward is not to label sessions as "active learning" or "traditional lecture", but to start from the perspective of "what opportunities are there for students to engage with the material in class and how much time is allocated to this?" A binary perspective on "lecture or active learning session" could be unhelpful for the range of approaches and a closer examination of the various interpretations of "lecture" highlights this. There is a similar risk that the "active learning" label indicates to a subset of academics that students are just left to their own devices on a set of problems for the entire session. We should be aware that there are extreme interpretations of "lecture" and "active learning session".

Kapur et. al (2022) argue that there is too much variability in flipped classroom approaches with the classification becoming open to individual interpretation. Kapur et. al emphasise their opinion that similar effects (in terms of outcomes) can be better achieved through a traditional lecture-based approach including student engagement. In addition, Kapur at. al believe that flipped approaches simply perpetuate passive learning. In support of some issues raised by Kapur et al., the author agrees that active learning is the most important component. The nature of flipped requires asynchronous online resources and students have been unanimously positive about the provision of these high-quality resources. This component of a flipped strategy clearly has benefits in terms of accessibility. The author's approach to the class time under flipped is very much focused on consolidation and does not assume that students are already at a pre-determined "baseline" of knowledge after engaging with the asynchronous resources. Students in 2021/22 were attending the in-person classes even when they openly admitted they had barely engaged with the resources for the particular week and were playing catch-up. These students came because they still saw benefits in the classes and felt that these gave them the push to get caught up with the material. From this perspective, an approach to flipped which results in students being less likely to give up on the module seems like a positive outcome. The author's approach places a clear structure on the active learning sessions and ensures that students are constantly engaged and not lingering for too long

on one particular activity. The approach here does not accentuate failings but instead encourages discussion / debate and engagement with short "do-able" challenges related to the material. The aim is that the active learning sessions should act as a springboard and confidence-boost for students to tackle more challenging questions on the weekly problem sheets.

Future plans at the institution in this case study include collating and sharing experiences from module leaders who have adopted the flipped model (around half of all mathematics modules at the institution will be delivered in flipped format this academic year). As students will have a mix of more traditional and flipped teaching experiences, it will be interesting to investigate how students are responding to these different approaches.

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