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Utilising Features of Sport Commentating to Provide a Framework for Co-Teaching the Online Lecture

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Utilising Features of Sport Commentating to Provide a Framework for Co-Teaching the Online Lecture

Abstract

Higher education teaching abruptly changed during the COVID-19 pandemic to remote, on-line learning and teaching. The use of on-line communication software to teach became the norm and remains at many institutions. This software contains features, such as the chat, that offer teaching and learning advantages; however, potential benefits can be challenging to realise for academics used to traditional modes of lecture delivery. In most cases a solo-taught lecture designed for a physical room does not transition well to the on-line space. Co-teaching, which involves two or more academics teaching the same class, is a pedagogy that can improve engagement and satisfaction for students and academics alike. However, how co-teaching can transition to the on-line space and take full benefit of the communication software features is not well known. We recognised that some aspects of sports announcing (commentating) align with desirable qualities of co-teaching on-line. In this paper we use these features to develop a practical framework for co-teaching in the on-line space and evaluate the model in a second-year university science subject. Using data from student surveys, we found that the co-teaching model helped integrate the chat functionality into the main lecture and led to improved engagement and enjoyment of on-line classes. The model also assisted students in identifying key learning outcomes. Using the framework as a practical guide for how to incorporate co-teaching into on-line classes helps realise the benefits of contemporary communication software.

Practitioner Notes

1. Features available in on-line communication software, such as the chat, offer rich teaching and learning opportunities.
2. Transitioning solo-taught lectures designed for a physical space directly on-line does not often lead to effective student outcomes.
3. Co-teaching, where two or more academics teach the same class, allows academics to exploit all the features present in communication software.
4. The lack of overt physical cues in the on-line space means co-teaching practice needs to be intentionally designed and incorporated to gain most benefits.
5. We provide a practical framework to allow academics to implement co-teaching into their classes.

Keywords

co-teaching, team teaching, curriculum design, engagement

Introduction

Collaborative teaching is a pedagogic choice that has positive effects for teachers and students alike (Anderson & Speck, 1998; Leavitt, 2006; Morelock et al., 2017). The most effective collaborative teaching practice requires two (or more) teachers to be present in the same space as the students and can take several modes including 'one teach/one observe', 'parallel' and 'team teaching' (Cook & Friend, 1995; Graziano & Navarrete, 2012). Although all the modes are considered effective instructional approaches they do differ in the level of interaction between teachers in the class. The most interactive mode is 'team teaching' (sometimes referred to as 'co-teaching') where both teachers deliver material in some, often specifically defined and deliberate, capacity during the class and it can therefore be considered as representing the most dialogic of all the instructional modes. Although mostly used in kindergarten through to 12th grade (K-12) education, the general benefits of collaborative teaching for both students and staff mean it is also becoming more common in higher education (HE), albeit relatively slowly (Lock et al., 2016). In a broad sense, collaborative teaching in HE has been used for some time as a pragmatic response to massification of HE and is particularly notable in general first year subjects. For example, first year subjects in STEM disciplines such as Chemistry and Biology at large universities often see enrolments in excess of 1000 and can only reasonably be taught with teaching teams. However, while thought of as 'team teaching' in HE these are not genuinely collaborative but usually have academics independently teaching separate classes in a parallel and/or sequential mode (Jones & Harris, 2012; Morelock et al., 2017). Indeed, even with teaching teams, the presence of a solo lecturer remains the predominant scene in most undergraduate lectures despite the well-recognised limitations of this model (Daniel, 2022; Loughlin & Lindberg-Sand, 2023). Similarly to Morelock et al. (2017) we herein use 'co-teaching' to define the mode of teaching in which multiple lecturers are actively teaching and interacting in the same physical or on-line room as the students. This contrasts to 'team teaching' which in HE broadly describes any teaching involving multiple lecturers in a subject. Further, our working definition includes only the dialogic mode described earlier and not modes such as 'parallel'.

Some of the reported benefits of collaborative teaching are evident irrespective of the mode. For teachers (or lecturers) the ability to share insights about content and pedagogy, mentoring opportunities, the enhanced motivation, support and enthusiasm from scholarly interaction with peers and the associated opportunity to reflect on teaching practices have been cited as benefits of collaborative teaching (Banda & Reyes, 2022; Graziano & Navarrete, 2012; Harris & Harvey, 2000; Jones & Harris, 2012; Minett-Smith & Davis, 2020; Morelock et al., 2017; Williams et al., 2018). Moreover, the interaction between two lecturers can help break down the notion of a student-centred or a teacher-centred room to create a blended learning

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environment in which everyone can be a student-teacher. The benefits for students can be quite varied but themes around the ability to gain multiple perspectives on a topic, to observe professional behaviour in communication and team-work, to collaboratively learn and develop critical thinking skills, and to more readily see connections in the curriculum are commonly cited (Anderson & Speck, 1998; Dugan & Letterman, 2008; Minett-Smith & Davis, 2020; Roland & Jones, 2020; Williams et al., 2018). Although there is no strict hierarchy inherent in the different forms of collaborative teaching, it is not unreasonable to suggest that some of these student gains might be better developed using more interactive or dialogic types of collaborative teaching modes, such as co-teaching (Bacharach et al., 2010). Indeed, some of the positives of co-teaching such as modelling positive and productive collaboration and communication are among those 'soft' skills required by graduates to be successful in their future careers (Wilson & Ferguson, 2017), and are increasingly being sought by employers (Australian Industry Group, 2022).

The move to on-line teaching in HE which was rapidly accelerated by the COVID-19 pandemic, raised significant challenges for teaching, including how to transition pedagogy often developed and refined for physical spaces to the on-line space, how to effectively communicate with students and how to manage large classes (Barron et al., 2022). Most classes transitioned to using on-line communication software such as Zoom or Blackboard Collaborate and given the suddenness of the transition many academics just delivered lectures on-line as if it were a normal, physical lecture space. The challenges for students with lecture delivery in this manner are well known (Strohschen & Heaney, 2000; Tice et al., 2021), and it fails to recognise that on-line communication technology includes elements such as the chat, polling and Q&A functionality which are spaces that can be beneficial to students and can help drive engagement and interest. As an example, it was recently noted by Harrison et al. (2022) that the chat '*eliminated the front row thereby empowering more students to participate in class with greater frequency*'. The chat function can be considered a separate, yet parallel room to the main lecture and given the ease at which the chat can go off-topic the solo lecturer delivering material is at a disadvantage and would likely lose the benefits, such as increased engagement and participation, of having the chat function available (Harrison et al., 2022; Vonderwell, 2003).

There are several ways to improve student affect in the on-line lecture, including using break-out rooms, dividing lectures into shorter 'mini-lectures' or incorporating other digital technologies (e.g. Kahoot) (Pacansky-Brock, 2020; Tice et al., 2021). However, co-teaching appears to be an ideal solution to teaching in the on-line space, especially in classes where active student interactions are encouraged. In the on-line co-teaching model, one academic can engage with discussion, steer and moderate the chat and respond to questions occurring in the chat and can link with the main lecturer to ensure the chat and the main lecture remain aligned. One of the benefits of the chat is that it is often the *only* way to communicate with students because, in our experience and that of others (Trust & Goodman, 2023), the biggest challenge to teaching in the on-line space is that many, if not all, students will have their camera and/or their microphone turned off. It is not uncommon for the only active cameras to be those of the teaching staff, which can be a very isolating experience for the solo lecturer.

In contrast to co-teaching in a physical space there is very little literature describing how a co-teaching team can function in the on-line space. As Barron (2021) noted, many interactions and cues such as physical movement or eye contact which co-teachers rely upon in a physical room do not translate to the on-line space. This suggests that new or refined ways of practicing co-teaching pedagogy in the on-line space are needed. Here we have noticed the similarity between co-teaching the on-line lecture and the interaction within teams commentating sport. Sports commentating arose alongside the development of sports broadcasting during the early part of the twentieth century. The conventions underlying how commentary interacts with the on-field action and the audience have continued to evolve as broadcasting media has expanded from radio to television to on-line streaming. Irrespective of the media, Whannel (1992) noted that the role of commentary is to provide three things.

Firstly, it serves to clarify, to organise, to make coherent, the collection of material in the shape of programmes. Second, it provides a particular mode of address by which contact is made between programme and audience. Third, it sets up, cues in and provides a way into the material offered.

It strikes us that if the word 'programme' is changed to 'lecture' then the work of an academic lecture is accurately reflected in this statement. Furthermore, commentators face a dichotomy that also challenges the lecturing academic, namely the tension between delivering an accurate representation of the material (i.e., the sporting event or the lecture content) and the translation of that material to engage the audience. Phillips (2017) suggested that if audience engagement with a sporting event is dependent on how the commentary shapes and frames the event then the commentary is inherently performative and the performance is central to how the sport is received and perceived. The performance nature of sports commentary and the desire to enhance enjoyment and interest in the game is a contributory factor for why commentating has become the team effort now observed for many sports (Fuller, 2008; Lee et al., 2016; Whannel, 1992). In general, the role of the commentary is to provide a description of events ('play-by-play') along with an elaboration of those events (expert analysis) for an unseen, heterogeneous audience (Ferguson, 1983; Muller, 2007). Although a single person can do this, the presence of multiple people with one person being the main play-by-play announcer and at least one co-commentator (considered the expert announcer or 'colour commentator') is thought to promote audience involvement and enjoyment. The interaction between the commentary team and the resulting conversational style is considered important for audience engagement (Fuller, 2008; Whannel, 1992).

Although sports commentating has a focus on entertainment, in contrast to the lecture which focuses on learning, investigating how commentary teams interact is instructive given the parallels with delivering the on-line lecture. Some parallels include the unseen audience (e.g., students not having their camera on), the ability to respond to written comments submitted via social media (mimicking students using the chat) and the description of actions and situations which can be complex (similarly to lecture content). Studies have shown there are very clear functional and stylistic features that distinguish how sports announcing teams interact and the language used (Balzer-Siber, 2015; Ferguson, 1983). Notably, Balzer-Siber (2015) identified four features that highlight collective communication in sports announcing.

1. Taking the Floor: the roles and responsibilities of the commentators are often predetermined and well defined such that there is an absence of speakers overlapping during a presentation. The flow between presenters appears spontaneous and improvised yet is often based on pre-written material (Phillips, 2017).
2. Announcing Expected Performance: In many cases a commentator will signal that they are about to ask a colleague a specific question, which both makes it clear what is required and gives the co-commentator time to think of how to respond.
3. Agreement and Reinforcement: the relationship between commentators is one of cooperation. To show this the commentators are almost always in agreement, which is often observed when commentators recall and repeat what the other has said.
4. Repair: in the advent an error is made it is the role of the commentary colleagues to rectify the error whilst also allowing the erroneous announcer to save face.

The general co-teaching literature contains many examples of practical techniques that can help co-teaching practitioners, such as being collaborative in subject design and preparation, maintaining a professional, equitable relationship and ensuring effective habits of communication (Bacharach et al., 2010; Gaytan, 2010; Graziano & Navarrete, 2012; Harris & Harvey, 2000; Jarvis & Kariuki, 2017; Morelock et al., 2017; Ploessl et al., 2010; Wilson, 2008). Crow and Smith (2003) identified some important general co-teaching characteristics that translate irrespective of the space in which the co-teaching occurs. These include maintaining a '*relaxed and good humoured* interaction style that allows for a '*safe and respectful exchange of views and experiences*'. Indeed, the interaction between lecturers adds an important dimension to the learning process and helps generate an active learning environment that is not possible with a solo lecturer (Crow & Smith, 2003). However, whilst providing a macro lens on co-teaching practice there are fewer practical suggestions for how multiple lecturers should interact in the room, and even less for the on-line space that includes several concurrent communication channels (e.g., the main room and the chat). Much of the literature focuses on the advantages and disadvantages of co-teaching without outlining the actual dynamics and interactions occurring between co-teaching teams (Morelock et al., 2017). The features listed above for sports commentating teams have developed to guide sports commentators, however the intent they describe suggest they may have as much practical application in the co-teaching classroom as they have in the commentary box. Indeed, the overarching commentary concept of a 'main announcer' and an 'expert commentator' lends itself to an on-line teaching space that has a main room and chat functionality. Furthermore, the features of sports commentating occur because there is intentionality in the design of the interaction and dialogue occurring, and this also needs to occur between the co-teaching academics. With intentionality in design the co-teaching process serves the needs of the subject (e.g. alignment with and attainment of subject learning outcomes) and helps control what students may experience from the teaching process (e.g. improved engagement, a greater sense of identity) (Linnenbrink, 2007).

Given the lack of guidelines describing co-teaching in the complex on-line space we sought to utilise the features of sports commentating to develop a practical framework for guiding HE academics co-teaching the on-line lecture.

Development of a framework for co-teaching in the on-line room

The basic principles on which the framework was developed are that - the communication streams parallel to the main lecture (e.g. the chat) are important enough to always require the presence of an academic (the co-presenter); clear interactions between co-teachers are required to link the chat to the main-room and that co-teaching academics should adopt a dialogic approach in discussing material. Utilising features of sports commentating described above, we refined these concepts into two broad guideline categories related to student affect in the co-teaching class (e.g. engagement and enjoyment) and how the co-teaching process can reinforce links to important aspects of the curriculum, notably learning outcomes.

1. Defined, collaborative roles – Main Presenter and Co-presenter

As described above, a dominant feature of sports announcing teams is the presence of a main (play-by-play) presenter and a co-commentator (expert) and these roles are clearly defined. In line with this we adopted an approach in which the co-teachers in each class had clearly defined roles which was either taking the lecture (main presenter) or teaching in the chat ('expert' or co-presenter) and this was clearly defined to students at the beginning of the class. The intent was not to suggest there is any hierarchy or power inequity between the presenters, but to define to students the role that each will play and to highlight the importance of the chat to the class. Because the on-line space is largely absent of visual cues, switching between presenters was most clearly negotiated by asking a specific question, predominantly from the main presenter to the co-presenter. This is a feature of sports commentating as it avoids speech overlap and is important to follow in a co-taught class in order to avoid confusion. However, the co-presenter could interrupt the main presenter to discuss important points arising in the chat or lecture and this spontaneity was encouraged because it meant students' questions in the chat could be brought to the attention of the whole class and it promoted conversation. Indeed, as noted by Harrison et al. (2022) a benefit of the chat is that it helps disrupt the linearity of the often teacher-centred classroom and by responding to student comments and questions raised in the chat the students become more motivated to continue contributing. In some cases, the co-teachers swapped roles during the lecture, this was negotiated before the class and students were made aware when it happened. This could be a temporary switch or continue for the remainder of the lecture. Further, when the main presenter asked class questions, students were invited to respond in the chat and the role of the co-presenter was to take the class through the answers and build more on the topic that is being addressed. Although most students were willing to answer to everyone in the general chat window, we also allowed private/direct messaging to both presenters which recognises that some students prefer a less exposed response. The importance of situating an academic in the chat was to ensure that students could ask questions and they would be responded to instantly. It was not to act as a 'police officer', indeed the chat was allowed to follow any lead or topic the students chose to discuss and exemplifies the tolerance noted by Harrison et al. (2022) as potentially leading to the chat conversations being a learning opportunity. However, moderation would occur in order to steer the chat at key times to ensure a clearer connection to the topic being discussed.

In line with the features of sports announcing teams, a goal of co-teaching is to model cooperative and collaborative behaviour. In on-line classes this can only be modelled using language and, in line with sports announcers, one way to do that is for one teacher to reiterate and support the other teacher's statements wherever possible. This is not to preclude disagreement and alternative points of view, nor does it mean incorrect statements remain unchallenged, which in itself can lead to productive conversations, but overall agreement reflects the relationship aspired to by both co-teachers. In sports announcing the co-presenters will generally agree unless a statement is made that is too blatantly wrong to be approved or it is evident there is an equally plausible alternative which needs to be discussed (Balzer-Siber, 2015).

2. Relevance Marking - Repetition and discourse deixis

Deictic words or phrases are those that point or refer to a place, time or a person and help contextualise what is said with where, when or whom it is said about. In addition to these, discourse deixis references something which has been said or written about previously (Birner, 2013). Deixis is common in face-to-face lectures, for example place or spatial deixis is used by lecturers to direct attention to places in a classroom in order to create and clarify meaning and comprehension (Peeters et al., 2015; Picciuolo, 2023). Deictic phrases have also been used as a way to direct a student's attention to items that are of particular pedagogical importance or relevance within the lecture (Deroy & Taverniers, 2012). In the on-line lecture the use of deictic elements to highlight important material is challenging, partly because the academic and students do not share the common physical space that they do in the traditional lecture theatre, but in the on-line space discourse deixis can be a powerful tool. Sports announcing can guide here because commentators often amplify their propositions with discourse deixis because it helps strengthen arguments they have previously made (Balzer-Siber, 2015). Phrases observed in sports commentating such as '*we have talked about*' and '*like you said*' signal that the statement to follow is related to, or repetition of, a point made previously. The importance of the point is further strengthened when one commentator recalls and reinforces a statement made by another (Balzer-Siber, 2015). In the co-taught class this form of repetition is especially important when those arguments are linked to critical subject learning outcomes. Collaboration between co-teachers on this point requires clear communication in subject planning and design and during the lesson, because when one teacher restates the other's comments it acts as a relevance marker and clearly establishes and reinforces the importance of the original statement. Furthermore, in sports announcing discourse deixis is considered useful for people who may not have watched the game from the start because it gives the impression that the referenced statement should be trusted and that evidence for it has been discussed earlier (Balzer-Siber, 2015). Similarly, this is important in the on-line class because students may be viewing in a distracting environment or be otherwise inattentive (Lepp et al., 2019). We specifically implemented collaborative discourse deixis to highlight learning outcomes, scaffold content across different lectures and as a way to support student learning in the on-line lecture when there are often distractions around them.

Implementation of these guidelines in a co-taught class lead to us investigate the following two research questions (RQ):

RQ 1. How do students perceive the co-taught on-line class?

RQ 2. Do students feel their learning was improved in the co-taught class?

Methodology

3. Implementation of the framework

The subject in which the co-teaching framework was implemented was a second-year science subject, *Cell Form and Function*, at Western Sydney University (Australia) which had a combined enrolment of 330 students in the two semesters investigated in this study (in 2021 and 2022). All lectures had two lecturers present (i.e. the authors), and although it was not studied in this work, this was a decision based on literature indicating that two seems to be an effective number of teachers from a student perspective (Ayish, 2022). Approximately 60% - 80% of students would attend the synchronous lectures each week. Both academics had cameras turned on, but students were not required to have their cameras or microphones on and their primary means of interaction with the academics was via the chat.

4. Data collection and analysis

At the end of semester students were invited to complete an on-line survey (Qualtrics^{XM}, www.qualtrics.com/au/). The survey contained 10 questions (4 for demographics and 6 related to the teaching process, see Table 1) and one open ended question inviting respondents to add any further information they wished. The 6 questions related to teaching were rated according to a 5-point Likert scale where 1 = strongly disagree and 5 = strongly agree. The use of 7 questions in total may seem limited, however this was considered sufficient to gain student insight into the co-teaching methodology whilst balancing the pragmatic need to have a short questionnaire (Brace & Bolton, 2022). This limitation was mitigated by ensuring the 6 closed questions related to the teaching process were quite focused on measuring student satisfaction with specific design elements of the co-teaching methodology. Data from the Likert scale questions was transferred to Microsoft Excel and the mean and standard deviation of responses for each question were determined. This data was then plotted in Origin software (OriginLab, Northampton, MA, USA).

Responses to the open-ended question were collated and copied into NVivo 14 (QSR International) for analysis. We used a hybrid content analysis approach in which the written responses were inductively coded based on phenomena that aligned with the predetermined themes of student affect (RQ1) and student learning (RQ2) (Creswell & Poth, 2018; Hsieh & Shannon, 2005). Additionally, student comments provided on end of semester, University administered Student Feedback on Subject surveys were also analysed on a similar basis. We did not code based on whether the phenomena supported or did not support the predetermined themes, but just if the phenomena were related. This mitigated to some extent the potential for bias recognised in the hybrid approach (Hsieh & Shannon, 2005). One of the investigators (CJ) completed the inductive coding which was independently reviewed and verified by GP. Finally, representative quotes were selected that illustrate recurring themes in the responses. Ethical approval was granted by the Western Sydney University Human Research Ethics Committee (approval number H14340) and was conducted as a sub-project of a university-wide Students

Transition and Retention (START) program of research (approval number H13567). Informed consent was obtained from each respondent.

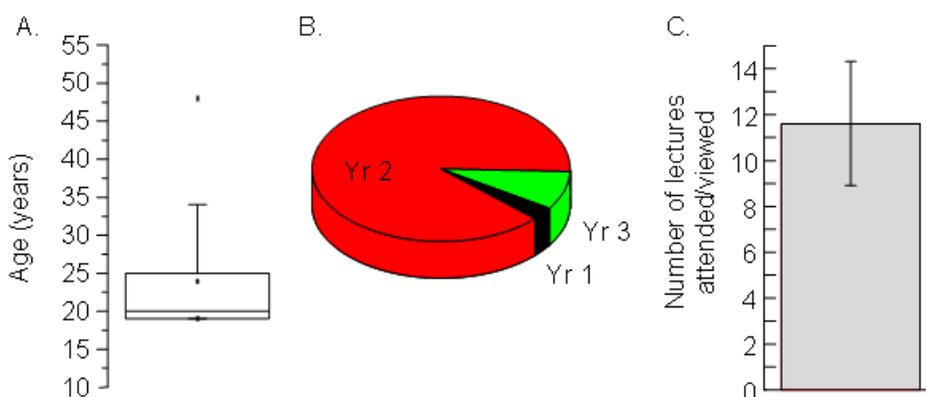
Data Adequacy

The survey was a voluntary, non-incentivised, on-line survey in which low completion rates are not unexpected (LaRose & Tsai, 2014). However, the study presented here has a relatively homogeneous study population with focused research questions and in this situation a smaller study size is considered acceptable (Crow & Smith, 2003; Hennink & Kaiser, 2022; Vasileiou et al., 2018). In the qualitative data we collected, recurring themes and alignment of those themes with existing literature in the fields of co-teaching and on-line education supports the notion that the scale is sufficient to satisfy the aims of this study.

Results and Discussion

5. Participants

Students enrolled in *Cell Form and Function* over two offerings of the subject (Autumn 2021 and 2022) were invited to participate in the survey at the conclusion of the subject. From the two offerings 35 students participated, representing approximately 12% of the eligible cohort. The median age of the participants was 20 years (range 18-48 years), and the majority (88%) were in year 2 of their degree as expected (Figure 1A, B).



6. Figure 1. Demographics of survey participants

(A) Box and whisker plot for age of participants. The median age was 20, the mean was 23.7 with ages ranging from 18 to 48. (B) Pie graph shows that the majority of respondents were in the second year of their degree (88%) with the remaining students in either their first (1 student) or third (3 students) years. (C) The number of lectures attended by the survey respondents was 11.6 ± 2.7 (in total 14 lectures were presented).

Further analysis showed that most students were enrolled in a Bachelor of Medical Science degree with some (~11%) enrolled in the Advanced Medical Science degree. These data reflect the distribution seen in the whole class and thus the non-response error is minimised (Dillman et al., 2014). Although the majority of students were in second year of their degree, we also had

some students (~12%) in their first or third year which reflects the opportunity to take the subject as an elective. The fact that most students were in second- or third-year has implications for this study. Our study group is only those students in the co-taught class, there is no comparison study group in classes that are not co-taught. However, second- and third-year students have lived experience of solo-taught lectures and a reasonable assumption is that their responses are formed based on that lived experience. The lectures for the subject were timetabled and delivered live via on-line conferencing software (Zoom) but were also recorded and posted to the university subject learning system (Blackboard) for asynchronous viewing. The number of lectures either attended or viewed by survey participants was approximately 11 (Figure 1C) and no respondent only used recorded lectures. Thus, the students responding to the survey are doing so from an informed position of having been exposed to the teaching method on a weekly basis during the semester.

7. Survey responses

Survey questions were designed to address aspects of the co-teaching framework described above. The first four questions addressed framework theme 1 related to the roles of each academic in the class and how their interaction engages the students (addressing RQ 1). Table 1 presents the survey questions and results. All respondents either agreed or strongly agreed that the academics presented themselves as equal in the classroom. We believe this is a consequence of clearly articulating the roles and responsibilities of each academic at the start of each class and signposting if those roles changed during the lecture. Parity between co-teachers is considered important for the success of a co-taught class (Ayish, 2022; Morelock et al., 2017). Importantly, the presence of an academic in the chat led to all students agreeing or strongly agreeing that if they asked a question in the chat it would be answered. This is a clear benefit of the co-teaching model in the on-line classroom, because quite large student numbers can be accommodated but with one academic focused on the chat each student can feel like they are part of a small class. In line with Harrison et al. (2022) we found that students would just ask questions when they thought of them, and those questions did not necessarily relate to the content that was currently being discussed. Nevertheless, they were responded to by the academic focused on the chat. In some contrast to Harrison et al. (2022) we suggest that rather than eliminating the front row, having an academic in the chat may help make students feel that they are all equally in the front row. Questions 3 and 4 (Table 1) examine student's feelings towards their engagement with the class. The majority of students (74%) thought the co-teaching model made the sessions interesting, and 67% felt they had the confidence to join the conversation. However, as the error bars in the Likert scale (Table 1) highlight, there was a broad range in responses with several students feeling that the co-teaching model did not make for an interesting class and 11% felt that they could not join the conversation. This latter outcome may be a reflection of a general lack of confidence observed in students irrespective of the teaching mode or it may be an unintended consequence of on-line communication occurring mainly via the chat. With large classes the chat becomes very busy and it can be difficult to participate if students lack confidence, although the ability to privately address the academic through the chat was instigated to alleviate this concern.

8. Table 1

Responses to survey questions related to the co-teaching framework. The Likert scale responses are presented as mean ± SD (n = 35).

Framework Theme	Survey question	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1.	Q1. During the lectures I felt the academics presented themselves as equal partners.					4.2 ± 0.8
1.	Q2. During lectures I felt I could ask questions in the chat and they would be answered.					4.1 ± 0.7
1.	Q3. During the lectures I felt that having two lecturers discussing content made the session interesting.					4.3 ± 0.9
1.	Q4. During the lectures I felt confident I could join the conversation occurring between the lecturers.					4.2 ± 0.8
2.	Q5. During the lectures I felt the discussion between the lecturers helped me identify areas and concepts that were important					4.4 ± 0.6
2.	Q6. I felt my learning in Cell Form and Function was enhanced by having two lecturers present.					4.3 ± 0.7

The last two questions (Q5, Q6 Table 1) were designed to ascertain whether the on-line co-teaching model led to students feeling their learning was improved (addressing RQ 2). The majority (91.4%) agreed or strongly agreed that the co-teaching process helped them identify learning areas and concepts that were important. This result helps validate the co-teaching framework where the repetition and discourse deixis that is intentionally enacted by the co-teaching partners can help students identify key learning areas and outcomes. Finally, 88.5% of respondents considered their learning had been enhanced by the co-teaching model, which largely aligns with previous studies showing that students like classes with multiple lecturers teaching together (Dugan & Letterman, 2008). However, 2 students strongly disagreed, and although it is difficult to say with certainty, these students may be those who prefer a solo lecturer. Analysing the data with respect to year (of degree), enrolled degree or age did not yield further insight, however the limited student numbers in these sub-cohorts suggests that stratifying like this is unlikely to be representative.

9. Written responses to open ended question.

The two themes that were the focus of this study were how students felt in the co-taught class (RQ 1) and how their learning was impacted (RQ 2) and within each of these themes several sub-themes were identified as described below. The open-ended question prompted students to freely express their perspective and their written responses helped to illuminate why some of the survey questions received broad responses across the Likert scale in the closed survey questions. Of the 35 students who completed the survey, 10 wrote a response to the open-ended question. Additionally, we analysed comments written by 17 students who completed the University administered end-of-semester Student Feedback on Subject survey.

Engagement and Enjoyment

A general goal of sports commentating that we brought into the co-teaching process was that the collaboration should help promote enjoyment of the class. This subtheme was coded as engagement and enjoyment and was one of the most frequently occurring codes commonly expressed as:

Having two teachers made the experience enjoyable, both teachers were full of energy and enjoyed teaching.

We believe that the defined roles, intentional interactions and, importantly, a dialogic, conversational and student focused approach all contributed to students finding the class enjoyable. A key student-centred feature of the framework is the placement of an academic in the chat so that student questions were answered, and the chat becomes more integrated into the lecture. Students were able to recognise the importance of this approach:

They both have the ability to answer questions while the other is lecturing or they can also be there as a support to the main lecturer.

Importantly, the conversational style was identified as a contributor to student's feeling more engaged with the class:

Conversational style is more engaging most of the time...

Confusion

A subtheme related to the student affect that emerged from some of the written responses was one of confusion. This unexpected subtheme highlighted a limitation of the conversational style, especially for students with a disability. As one student noted:

Although I like the conversational style used in this unit for lectures, I often struggled to identify the specific learning outcomes for the lecture and feel that, although the conversational approach and enthusiasm of both Gabe and Chris made aspects more interesting, the tangents sometimes made it harder for me to know what specific knowledge I was meant to walk away with and felt bombarded with conversation and not clear on outcomes. I have ADHD and struggle in specific ways

Intriguingly, this student expresses the dichotomy that the conversational approach makes for a more interesting lecture but can also lead to off-topic discussion that promotes confusion. This was also expressed by another student who wrote that lectures were:

....sometimes confusing when talking about extra info that was not part of the syllabus.

Thus, even with strategies intentionally designed to support students identifying key points and learning outcomes, the conversational approach implemented to promote engagement and enjoyment appears to be challenging for some students. This outcome has not been widely reported in the co-teaching literature, although by its nature co-teaching ‘creates an environment of uncertainty, dialogue, and discovery’ (Plank, 2011), so the idea that some students may find it challenging is not surprising. However, the irony is not lost on us given that co-teaching models were initially developed for including special needs students in mainstream K-12 classes (i.e. at primary and secondary school) (Cook & Friend, 1995). Although only a small proportion of students reported confusion stemming from the dialogic nature of the teaching, it does suggest that entirely co-teaching all classes in a subject using a fully interactive, dialogue-rich co-teaching model may not serve the needs of the entire cohort. With this difficulty it becomes understandable why some questions related to interest and ability to join in had some students disagreeing, but we also recognise that these students may also have similar difficulties in a solo-taught class when the instructor moves off-topic.

Learning Process

Subthemes related to the learning process were also identified in the written responses. The co-teaching framework included the elements of discourse deixis and repetition to act as relevance markers in the lecture. Students were able to recognise this was happening and how it led to improved clarity and consequently improved identification of key points:

I found Chris’ summaries extremely helpful to nail-down what I needed to pay attention to from Gabe - The different ways the lecturers had of summarising each others points was very beneficial and did help to reinforce key messages.

Several students were able to articulate one of the main goals and benefits of co-teaching related to discourse deixis – that of the co-teachers not only reinforcing each other’s previous statements, but also reframing and explaining concepts based on their unique perspective and understanding:

*Co-teaching method become apparent that it’s a teaching method that enhances knowledge and perspective from different angles.
They can repeat what the initial lecturer has said but in a different way, sometimes offering a different, more easily understood perspective.*

This theme aligns with outcomes of face-to-face co-teaching classes in which students identified that being exposed to multiple difference knowledge bases was of clear benefit for their learning (Bacharach et al., 2008). Therefore, the clearly designed and implemented co-teaching methodology we employed can ensure that students in the on-line space experience many of the benefits that co-teaching provides in the physical class.

Conclusion

Co-teaching is a pedagogical choice that has consistently shown benefits for students and lecturers alike. Despite this, and the acknowledgement that the collaborative working and learning exemplified by the co-teaching practice illustrate and model desired and authentic work practices,

the use of co-teaching in HE is not prevalent (Bacharach et al., 2008; Minett-Smith & Davis, 2020; Wilson & Ferguson, 2017). The reasons for why co-teaching is not prevalent in HE are varied, often relating to university-driven workload models and allocations, e.g. having 50% workload attributed to each academic in a co-taught class when it is clear in the co-teaching literature, and in our experience, that co-taught classes involves the same if not more time and effort in preparation and delivery than a solo-taught class (Morelock et al., 2017). Additionally, in HE many academics have a strong sense of ownership of their subject which may be related to several things, such as their sense of professional identity as the subject expert; the idea that promotion is related to what they achieved in 'their' subject; and that being in charge will make them immune to redundancy during inevitable financial cycles and corporate restructures (Donnison et al., 2009). Thus, the current culture of HE means there is little incentive to adopt co-teaching despite the known benefits. As Minett-Smith (2020) argues, universities need to rethink what excellence in teaching means and recognise and reward individuals who teach collaboratively. The move away from face-to-face lectures delivered in large, tiered lecture theatres onto on-line delivery, a move that was hastened by COVID-19, has raised significant challenges for HE academics. A notable drawback of on-line lecturing is that communication is not the same as experienced in the lecture theatre, when lecturers and students are in the same physical space there are subtle cues and non-verbal feedback from students that does not happen in the on-line room. In our experience, trying to replicate the traditional lecture and teach solo in the on-line room is ineffectual as it does not acknowledge that the chat functionality is the main way students will communicate. Co-teaching is a way to take full advantage of the on-line space and use the chat as a learning space (Harrison et al., 2022).

The general lack of practical guidelines for co-teaching in the on-line room prompted us to look for inspiration outside the usual co-teaching literature. Sports commentary teams have similar challenges to the on-line lecture and the guidelines they follow, developed over decades, are instructive for the co-teaching team. In the study presented here we show that a sports commentating inspired, co-teaching methodology that carefully defines and plans academic roles, interactions and communication, and one that acknowledges the important role of the chat, can lead to students remaining engaged with the lecture. The chat is an important and integral part of the on-line lecture, and it allows students to not only interact with the academics, but also with each other and in doing so remain engaged and enjoying the class as an experience (Harrison et al., 2022). Our students appear to prefer interacting via the chat, indeed in end of semester student feedback it was evident that some students disapproved of their peers disrupting the flow of the lesson to ask questions via their microphone. This was considered unnecessarily disruptive, especially if they were quick to answer questions. Here, in addition to the open chat, other functionality such as Q&A, direct messaging and webinar modes, can help manage how, and when, students will interact to allow a more equitable response process. This may encourage normally hesitant students to ask questions via the chat as they know it will not disrupt the lesson flow.

The work we describe provides a practical framework with suggestions for how two lecturers can interact in the on-line space to effectively use the chat and ensure students remain engaged and learning. The model can be adapted to incorporate additional lecturers, such as including postgraduate students as chat teachers, which elevates the mentoring potential of the teaching

method. Indeed, including postgraduates into a co-teaching team is beneficial as they are often closer in age to, and more attuned to, the undergraduate population. The use of elements of sports announcing to develop the framework is appropriate for the on-line space because of the similarities in how announcers and teachers are viewing and interacting with their largely unseen audience. Our study shows that caveats remain for the use of co-teaching in the on-line space, especially when the co-teaching team adopts a style that allows for students to contribute to the conversation because even though the majority of students found the conversational style engaging, it can lead to some students feeling lost. We recognise that these students may have also felt lost in solo-taught lectures and future work will compare the same cohort in solo-taught classes with co-taught classes. In previous studies confusion has stemmed from students not knowing who to approach regarding problem-solving or questions (Bacharach et al., 2008) or from disjointed coordination between lecturers (Willey et al., 2018), however this did not arise in our cohort and we surmise that our intentional and explicit guidance on the role of each instructor alleviates this concern.

From a study perspective, the voluntary nature of the survey is a potential limitation as the students who responded may be only those who were generally well engaged with the subject, however the broad agreement in how students perceived the co-taught classes as interesting and engaging does align with previous studies, e.g. (Crow & Smith, 2003). Furthermore, we have not included a specific comparison group of students who experienced a solo-taught on-line lecture. Evidence suggests students prefer co-taught classes (Willey et al., 2018), and we suspect that students responded to our study based on a lived experience of, predominantly, solo-taught lectures, however future work will explore how students perceive on-line co-taught classes compared to a solo-taught class.

The work presented here suggests avenues for further research. For instance, sports commentary has guided our framework, but other media, such as radio, often involves teams trying to engage and connect with a remote, unseen audience (Hale, 2023). It would be instructive to determine if the communication strategies used in these media could assist the co-teaching team in HE. This recognises that the framework we have developed from a Science perspective can be expanded and built upon to provide more guidance to teams in any discipline wanting to co-teach in the on-line space and we encourage people to do so. Further, it would be interesting to evaluate whether the co-teaching methodology reported here retained students' engagement and enjoyment when they view only recorded lectures (i.e. asynchronous). In conclusion, we suggest that the use of co-teaching should be prioritised for on-line classes in HE, especially as the sector moves towards hybrid and flexible (HyFlex) teaching practices which require a very clear and intentional design of the learning experience so that no student, wherever they may be in the on-line space, feels left out (Leijon & Lundgren, 2019).

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