Developing Multimodal Learning in Singapore: Perspectives of Student and Lecturer in a Pilot Study for Hybrid and Hyflex Learning

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The Barcelona Conference on Education 2023
Official Conference Proceedings

Abstract
Now that Covid-19 restrictions have eased in most countries around the world, many universities have returned to full on-campus learning. Some, however, chose to further develop the online or hybrid teaching approaches and move towards new multimodal approaches like “hy-flex”, a portmanteau of hybrid and flexible learning. For this pilot study, a newly retrofitted Hybrid Plus Classroom was used to improve the quality of multimodal teaching. With a mixed methods design, this study documented the experiences of lecturers and students in a private tertiary institution in Singapore, identified challenges, and offers suggestions for improvement moving forward in using the Hybrid Plus Classroom for hybrid and/or multimodal teaching. The sample for this study consisted of 2 courses offered in a Diploma program, comprised of 2 lecturers and approximately 100 students in total. Quantitative instruments included a survey for lecturers and a survey for students, as well as the student ratings given on quarterly course evaluations. Qualitative instruments included lesson observations, and interviews with the lecturers at the end of their course. Initial results showed lecturers and students have a positive attitude towards hybrid and hyflex teaching as well as the potential need for more specialist support for lecturers in lesson delivery. Finally, this paper offers recommendations on roll-out and implementation of multimodal approaches in higher education.

Keywords: Multimodal, Hyflex, Hybrid, Higher Education, Technology

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Introduction

In the ever-evolving landscape of higher education, modes of teaching and learning have undergone profound transformations. The COVID-19 pandemic served as a catalyst for change, prompting universities worldwide to reassess their educational approaches. While some institutions have now returned to full on-campus learning, others have seized the opportunity to explore and enhance multimodal teaching methodologies. In this ever changing environment, students should be better prepared to for increasing internationalisation and individualisation of a 24-hour economy, increased flexibility in higher education is an essential next step(Jochems, Koper, & Van Merrienboer, 2004).

In the context of this pilot study, a multimodal teaching approach is referred to as the integration of various digital tools and technologies to deliver content and engage students in diverse ways. It goes beyond traditional methods of teaching and incorporates a wide range of multimedia resources, interactive platforms, and (digital) learning experiences to cater to different learning preferences and enhance the overall educational experience, including hybrid and hyflex learning. Approaches like hybrid learning, online and face-to-face students in one synchronous session, and hyflex learning, a portmanteau of hy-brid and flex-ible, answered the need for more flexible approaches than traditional modes can offer and has been successfully implemented in colleges and universities alike (Abdelmalak, 2016; Abdelrahman, 2016; Beatty, 2022). Students have demonstrated to score equally well or even higher in hybrid or online learning modes compared to face-to-face class (Little & Jones, 2020; Miller, 2013; Szeto, 2014). The choices in attendance modes are one of the advantages of hyflex learning but research has shown online students in hybrid sessions experienced challenges in communication and connection with the lecturer and the rest of the class, despite the technical connections working fine (Abdelrahman, 2016; Bashir, Bashir, Rana, Lambert, & Vernallis, 2021; Binnewies, 2019; Lakhal, 2017; Moorhouse & Kohnke, 2021; Visser, 2012).

When implementing any new teaching approach, some factors need to be taken into consideration. Social interaction is an important factor influencing all learning environments, including online learning (Tu, 2000). Another factor to consider in the quality of online learning is that, despite the Covid-19 changes, this format is still relatively new for most lecturers and students. A recent study by Flynn-Wilson & Reynolds (2021) showed there is a learning curve in effective hybrid learning, the more online courses students attended, the higher the learning experience was rated. Lastly, an important factor in implementing successful online, blended, hybrid or hyflex teaching and learning, was found to be the support from the higher education institution for both lecturer and student (Beatty, 2022; Szeto, 2014). When developing their hybrid classroom in King Mongkut's University of Technology Thonburi in Bangkok, Thailand, Triyason, Tassanaviboon, & Kanthamanon (2020) compiled a list of 15 requirements for the system to be successfully implemened. Items included: training for instructors; troubleshooting tech issues; guidance for students on using the online platform; capabilities for document exchange; appointment scheduling; chatting functions; video conferencing capability with content sharing; recording; annotation by the instructor; small group discussions; class participation report; questionnaires, exercises, and grading; support a wide variety of devices; and lastly, be affordable.

Some of the main reasons for implementing these modes of learning and investing in facilities like the hybrid plus Classroom, is "unquestionably" to improve student engagement (Sankey, Birch, & Gardiner, 2010)and to personalize learning in learner-centred teaching

approaches (Philippe, et al., 2020). While in the study by Phillippe, et al. (2020) student achievement did not improve, students reported they felt multimodal learning did support better retention and comprehension.

This pilot study, conducted in an international higher education institute in Singapore, focuses on the perspectives of students and lecturers around the utilization of the Hybrid Plus Classroom, a space meticulously designed to elevate the quality of multimodal teaching experiences. Compared to the requirements mentioned by Triyason, Tassanaviboon, & Kanthamanon (2020), the Hybrid Plus Classroom should be well equipped to support student and lecturer in multimodal learning. The aim is to uncover valuable insights, identify the challenges faced, and offer pragmatic suggestions for refining the implementation of the Hybrid Plus Classroom in multimodal teaching contexts.

This exploratory research paper contributes to the ongoing discourse on the future of higher education by offering a better understanding of the implementation process and its potential pitfalls and successes in developing multimodal practices in a higher education institution.

Methodology

Facility

In 2022, a seminar room has been refurbished into a state-of-the-art Hybrid Plus Classroom with the aim to start facilitating hybrid and hyflex classes from January 2023. It has been outfitted with an incorporated system of a desktop computer, 2 monitors, online classroom facilitation software Zoom, learning management system (LMS) Canvas, 2 cameras, a digital whiteboard, visualiser, projector, as well as microphones and speakers integrated into the ceiling. The system is controlled by the lecturer with a console on the lecturer's desk at the front of the room. For content sharing, the lecturer can choose to use the visualiser, desktop computer or connect another device. Through the console, the lecturer can choose the medium through which to share the content: projector screen, digital whiteboard, desktop, visualiser, or directly from their own device. The system also offers the possibility for online students to share content in Zoom and show that content on the main projector screen. The classroom houses up to 80 on-site students and the system houses up to 400 online students. The cameras include one camera for a full classroom overview, for online students to see their on-campus classmates, and a second, roving camera that captures the lecturer standing at the front of the room, as well as the projector screen. The digital whiteboard can be connected to the projector screen, shared directly in Zoom, or used as a separate tool, offering options for annotation, drawing, highlighting on presented content, as well as a space for calculations, spontaneous notes or examples, etc. for all students (online and in-person) to see clearly. Microphones and speakers are imbedded into the ceiling for an improved audio experience for on-site as well as online students. A frequent complaint from online students is they cannot hear when their classmates ask questions or offer comments. With this integrated system, all sound in the classroom is amplified so online students are able to smoothly follow all proceedings taking place in the classroom. Additionally, all on-site students are able to hear questions and comments made by online students as well. Lastly, due to the microphones being placed throughout the classroom, even a student in the back of the class with a soft voice, can be heard clearly by all.

With the fully integrated system, the lecturer needs only press a button on the central console for the online Zoom session as well as recording to start immediately, allowing the students to

log into the session through the LMS Canvas. Recordings are saved on the LMS, for students who cannot attend the live session to watch later and to use for support during exam preparation.

Sample

The sample for this pilot study comprises two course modules within a Diploma program, featuring two experienced lecturers and approximately 100 unique higher education students. Both courses are taught in hyflex format in the Hybrid Plus Classroom, both with approximately 70 students each. The courses are each taught by a different lecturer, but some of the students attended both courses in the pilot. There were 146 enrolled students in total, for both courses. 65 students responded to the questionnaire, while 139 students rated their lecturer and overall course in the quarterly student evaluation form. No additional data was collected on student background, age, etc. Both lecturers are experienced teachers and have taught for more than 10 years and have taught in the institute for over 4 years.

Instruments and Analysis

Employing a mixed-methods approach, this study draws upon a combination of quantitative and qualitative instruments. Quantitative survey instruments include questionnaires distributed to both lecturers and all students, providing quantitative data on their experiences and perceptions of hybrid and hyflex teaching. A separate questionnaire is administered to lecturers and students. The questionnaire for lecturers investigates their previous experiences teaching (with or without edtech tools), the ease of use of the Hybrid Plus Classroom, and which aspects they use for student engagement, collaboration, and sharing opportunities for all students (online and on-campus). The lecturers' questionnaire consists of 20 questions and an open comments field, with 10 questions covering experiences in (hybrid) teaching, 6 questions focusing on the lecturers' preferences in and opinions on (hybrid) teaching, and 4 questions on their experiences teaching hybrid lesson in the Hybrid Plus Classroom. The questionnaire for students focuses on visual and audio quality, technical issues during class, and which Zoom features they use. For both questionnaires, responses were categorized into four levels of agreement: "Strongly Agree," "Agree," "Disagree," and "Strongly Disagree" to reply to a series of statements. Additionally, student end-of-course evaluations are examined to gauge the impact of these new teaching modalities on their learning experiences. At the end of every term, students fill out an evaluation form for the courses they attend, rating overall of the course (ie "overall course rating") and teacher performance (ie "lecturer effectiveness rating") via an automated system that automatically anonymizes responses. For lecturer effectiveness rating, students rate the lecturer on the following 6 statements: [Lecturer] was able to explain concepts/subject content clearly, [lecturer] was able to link theory to practice through a variety of relevant examples, [lecturer] was able to encourage participation, [lecturer] encouraged me to think critically about the subject, [lecturer] was open to students' questions and concerns, [lecturer] was able to make use of technology to complement his/her teaching. For overall course rating, students rate the following statement: Overall, I am satisfied with [the course]. Students provide their ratings on a scale of "Strongly Agree," "Agree," "Neutral", "Disagree," and "Strongly Disagree" for every statement.

On the qualitative front, lesson observations were conducted to gain a nuanced understanding of classroom dynamics. In total, four 1-hour lesson observations were conducted, 2 per course, each conducted by an independent observer, using the institution's standard form for lesson observations. This form focuses on the range and quality of teaching techniques and

materials, with an additional field for comments, where notes are made on the lecturer-student and student-student interactions, activities, and opportunities created for whole-class collaboration and interaction. The pilot is concluded by in-depth interviews with lecturers at the culmination of their courses. A 30-minute, semi-structured interview is conducted with each lecturer, focusing on the challenges and successes in multimodal teaching and pedagogical opportunities in the Hybrid Plus Classroom, as well as hyflex teaching practices as a mode of instruction. Results from the teacher survey and the lesson observations are also incorporated into the interview to clarify answers and gain a deeper perspective. Analysis of the student questionnaire and lecturer's questionnaire data uses descriptive statistics to determine the frequency and percentage of responses. The comments documented during lesson observations, and the interview data are analysed thematically to identify common themes related to the experiences of the lecturer in the Hybrid Plus Classroom.

The study obtains informed consent from all participants and ensures that their privacy and confidentiality are protected. As there are only 2 lecturers participating in the pilot, anonymity is extremely difficult to ensure. No names are mentioned in the data or the report, but heads of the program and higher management will know who the lecturers are that participated. The lecturers are aware of this. The student data from the questionnaire and end-of-course evaluations is gathered and treated anonymously.

Results

Results from the lecturer and student surveys are reported separately below.

Students

The students completed a questionnaire and rated the course and lecturer in the end-of-course evaluation. A total of 65 students participated in the questionnaire, 62 students attended sessions face-to-face and 3 attended online. The questionnaire encompassed three key aspects of their learning experience: audio-visual clarity, preference for learning mode, and active participation. For face-to-face classroom sessions, a significant majority of students expressed high levels of agreement regarding audio-visual clarity. Table 1 shows 40 students (65.6%) "Strongly Agree," and 19 students (31.1%) "Agree" that they can hear and see the lecturer clearly in this format. The results for students attending though online Zoom also align with these results, all "Strongly agreed"(33.3%) or "Agreed" (66.6%) that they can hear and see the lecturer clearly. When it comes to seeing and hearing their classmates clearly, face-to-face students rated less favourable with 18 students (30%) "Strongly agree", 36 students (59%) "Agree", and 7 students (11%) rating "Disagree", as seen in table 2. Online students felt more strongly they could not see and hear their classmates clearly, with 2 students (66.7%) "Disagreeing".

When asking the students about active participation in class, student generally responded positively, as seen in table 3. Of the face-to-face students, 23 (37.1%) "Strongly Agreed" that they can actively participate in the lessons, while 35 students (56.5%) "Agreed." Only four students (6.5%) expressed disagreement, with three "Disagree" responses and one "Strongly Disagree" response. All three online students (100%) "Agreed" they can participate actively.

The questionnaire also mapped students' preferences regarding the mode of learning, as shown in table 4. Students were given the choice between "Face to face in classroom" and "Online Zoom" mode. Looking at all 65 students, a majority of them (73.8%), expressed a

preference for "Face to face in classroom" sessions. About a quarter (26.1%) favoured "Online Zoom" sessions. Of the online students, the majority (66.7%) also preferred a face-to-face mode. Only one online student (33.3%) preferred to attend classes online.

Table 1. Student questionnaire: I can hear/see the lecturer clearly.			
Count of ID	Column Labels		
Row Labels	Face to face in classroom	Online Zoom	Grand Total
Strongly agree	40	1	41
Agree	19	2	21
Disagree	1		1
Strongly disagree	1		1
Grand Total	61	3	64

Table 1: Student questionnaire: I can hear/see the lecturer clearly.

Table 2. Student questionnaire: I can hear/see all my classmates clearly (online and offline).			
Count of ID	Column Labels		
Row Labels	Face to face in classroom	Online Zoom	Grand Total
Strongly agree	18		18
Agree	36	1	37
Disagree	7	2	9
Grand Total	61	3	64

Table 2: Student questionnaire: I can hear/see all my classmates clearly (online and offline).

Table 3. Student questionnaire: I can participate actively to the lesson.			
Count of ID	Column Labels		
Row Labels	Face to face in classroom	Online Zoom	Grand Total
Strongly agree	23		23
Agree	35	3	38
Disagree	3		3
Strongly disagree	1		1
Grand Total	62	3	65

Table 3: Student questionnaire: I can participate actively to the lesson.

Table 4. Student questionnaire: I prefer joining classes:			
Count of ID	Column Labels		
Row Labels	Face to face in classroom	Online Zoom	Grand Total
Face to face in classroom	46	2	48
Online Zoom	16	1	17
Grand Total	62	3	65

Table 4: Student questionnaire: I prefer joining classes face-to-face/online.

In addition to the questionnaire, students filled out the end-of course-evaluations on lecturer effectiveness as well as overall course satisfaction. The lecturer effectiveness for both courses was rated at an average of 4.2 out of 5. The 21 online students (15.1%) rated their lecturers a 4.6 out of 5 for both courses. The face-to-face students rated their lecturers a 3.7 out of 5 (41.7%) and a 4.0 out of 5 (43.1%). Similarly, the overall course satisfaction was rated an average of 4.2 out of 5. The 21 online students (15.1%) rated the overall course a 4.6 out of 5 for both courses. The face-to-face students rated the overall course a 3.6 out of 5 (41.7%) and a 4.0 out of 5 (43.1%). Table 5 offers a detailed look at the minute differences between the ratings.

Table 5. End-of-course evaluations: Student ratings for lecturer effectiveness and overall course satisfaction.		
Total Respondents	Lecturer Effectiveness	Course Satisfaction
58 (Face-to-face)	3.69	3.57
9 (Online)	4.56	4.56
60 (Face-to-face)	4.01	3.97
12 (Online)	4.56	4.58
139 (Total)	4.20 (Average rating)	4.16863 (Average rating)

Table 5: End-of-course evaluations: Student ratings for lecturer effectiveness and overall course satisfaction.

Lecturers

The lecturers completed a questionnaire, participated in lesson observations and an interview. The questionnaire consisted of 20 questions regarding their experiences in (multimodal) teaching, their preferences in (multimodal) teaching, their experiences teaching in the Hybrid Plus Classroom, as well as one open comments question.

Experiences in (Multimodal) Teaching

When asked which mode of teaching they prefer, one lecturer selected “Traditional physical classroom”, while the other selected “All of the above”, indicating the traditional physical classroom, hybrid teaching and fully online teaching. One lecturer indicated having “No previous experience” with multimodal teaching and learning models using interactive tools,

while the other indicated to have "both experience as a learner and an instructor". When asked how often the lecturers use interactive tool(s), one lecturer indicated "None", while the other indicated "Every lesson". When asked which learning activities, they usually implement to engage students, both lecturers indicated "whole class Q&A or discussion", one lecturer also indicated "Group and pair work". For teaching in Zoom, both lecturers indicated using "Annotation", "Chat", "Recording to Zoom cloud", "Screen Sharing", and "View participant list". One of the lectures also indicated using "Breakout rooms", "Hide/ Show Webcam", "Mute/ Unmute", "Non-verbal feedback (eg reactions, raise hand)", "Polling", and "Virtual backgrounds". One lecturer indicated using the university "Desktop computer" to facilitate the Zoom session, the other lecturer indicated using a "Laptop".

Preferences in (Multimodal) Teaching

The lecturers shared the same opinions and preferences on hybrid teaching. Out of the options "Strongly agree", "Agree", "Disagree", and "Strongly disagree", they both indicated they "Agree" to the statements that "Hybrid Teaching has the potential to improve student satisfaction", "Hybrid Teaching provides more opportunities for student interaction using chat, breakout rooms, polling, share screen in Zoom", and "It is significant to give students the opportunity to learn and collaborate in a Hybrid Learning Model because it will prepare them for their future". Both lecturers also indicated "Yes" to the statement "I would like to implement hybrid teaching practices, the skills and strategies." Sharing their opinions on using Zoom, both lecturers indicated "Yes" for the statements "Zoom is easy to use", "Zoom is easier to use than my previous meeting solution", "Zoom is reliable", "Zoom is more reliable than my previous meeting solution", "I like that recording is seamless as it is set as automatic recording", and "Overall, I am satisfied with Zoom's performance".

Experiences Teaching in the Hybrid Plus Classroom

Using the Hybrid Plus Classroom, both lecturers indicated the ease with which to schedule and start the Zoom session was "Very Easy" and rated "Excellent" for ease with which to conduct lessons in the Hybrid Plus Classroom. Neither lecturer experienced any technical issues while teaching with Zoom and indicated "No" or "Non applicable" for the potential technical issues of "Audio (Online students cannot hear you. You cannot hear online students)", "Online students unable to view Screen share/ teaching content", "Online students unable to join Breakout sessions", Recording does not automatically show up in my Canvas Course after lesson", "Recording corrupted (no audio, no teaching content etc)", and "Online students unable to view polls". When asked which of the teaching aids featured in the Hybrid Plus Classroom enhanced their teaching experience, they both indicated using the "Ceiling microphone", "Zoom control on Touch Panel", "Seamless switching between teaching content", and the "Visualizer". One lecturer also indicated to have used the "Gallery view of Online students on Monitor 2". For the open comment section at end of the questionnaire, one lecturer mentioned the "Need to understand how the equipment works and connect to each other e.g. the link to the digital whiteboard and the projector."

For qualitative instruments, four 1-hour lesson observations and 2 interviews were completed.

Lesson Observations

Reoccurring themes observed in the lesson observations included content delivery, student engagement, and use of the facilities in the Hybrid Plus Classroom. Both lecturers devoted a significant portion of the session, approximately three hours, to presenting information. The subject content of the 2 pilot modules is numerical in nature. The focus of the classes was a step-by-step breakdown of formulas and calculations, to allow students to write along with the correct calculations to the problems presented in the course content. The extended lecture duration left little time for students to interact with the material independently or engage in any team or applied learning activities. It also restricted the lecturer's ability to assess student learning. Despite the lecturer's attempts to engage students through questions and discussions, there was limited interaction from the students, particularly online participants. The class consisted of a mix of face-to-face and online students, with a majority of students attending in the face-to-face mode. Online students were not actively addressed during the class. The lecturer's interactions, questions, and clarifications were primarily directed towards face-to-face students. The observed class seemed to lack activities and discussions, despite the extensive information delivery. The Hybrid Plus Classroom offers various facilities for content delivery. One of the lecturers used the digital whiteboard for annotations, the other lecturer focused primarily on using the visualizer and printed materials, seemingly underutilizing the available technology. During the session, as part of the system, the light at the front of the classroom turns off to emphasize the projector screen. This causes the online students to see the lecturer less clearly, as they are standing in the dark. Findings from the lesson observations were incorporated into the interview questions during the lecturer interviews at the end of the module.

Lecturer Interviews

During the 30-minute semi-structured interviews, the following themes were discussed: technical issues and benefits; student interaction; hyflex teaching; and pedagogical approaches for teaching in the Hybrid Plus Classroom.

The evaluation of the technical aspects revealed a notable balance between benefits and challenges associated with the Hybrid Plus Classroom system. Both lecturers found the system to be user-friendly, particularly emphasizing the ease of use for audio, visual components, and integration with LMS Canvas and Zoom. With some practice, the system proved to be readily accessible and operable through the console. Challenges emerged concerning connectivity and accessibility, particularly for students in countries with limited internet access and for students with certain brands of devices. Additionally, the system's reliability was crucial, as disruptions in operation could induce stress and pressure on both lecturers and students. Instances where students faced disconnection or lengthy waiting times were particularly highlighted as stressful. The evaluation of student interactions underscored several key observations. The enhanced audio quality and the system's annotation and illustration features were identified as advantageous by lecturers. These capabilities allowed for clear instruction delivery and additional examples, benefiting both in-person and online students who could hear and see the content clearly. Identified challenges emerged concerning student engagement, particularly in the online environment. Lecturers encountered difficulties in motivating online students to activate their webcams and participate actively. Concurrently, they faced challenges in ensuring punctuality and attendance for in-person classes. Integrating additional online tools, such as polls, to enhance engagement posed a potential complication, leading to a cautious approach of not

incorporating further tech tools at that point. In hindsight, this decision was recognized as a missed opportunity, as one of the lecturers expressed the desire to utilize such tools for improved engagement. The evaluation of the hyflex teaching approach highlighted several benefits and challenges. Both lecturers vocalised a positive view of hyflex learning options, offering student the freedom of choice on which mode to attend classes in; online, face-to-face, or watching the recordings. The recording options in the Hybrid Plus Classroom provided a valuable opportunity for students to access high quality session recordings if they were unable to attend live sessions. However, both lecturers suggested that younger students, particularly fresh first-year students, might face challenges in adapting to the self-directed learning skills needed for hyflex learning. Lecturers expressed concerns related to the impulse control and discipline of these students, particularly in terms of class attendance and reviewing session recordings. In their view, hyflex learning appeared well-suited for adult learners who are mature, confident, and self-directed. In this pilot, there was an opportunity for lecturers to adapt their teaching approaches to the hybrid teaching format and the Hybrid Plus Classroom's capabilities. Instead, lecturers adhered to traditional lecture-style teaching approaches, which presented a noteworthy contrast with the potential of the hybrid format. When asked whether they made any changes to their delivery to adapt to hybrid sessions and the availability of the facilities in the Hybrid Plus Classroom, both lecturers indicated they made no changes. One of the lecturers indicated the Hybrid Plus Classroom facilities allowed for optimal delivery of the content as was intended, suggesting the previous classrooms used did not offer a learning experience for the course as it was designed.

Conclusion and Recommendations

The main findings in this pilot study on multimodal teaching in a Hybrid Plus Classroom, indicate that students perceived they had a positive, and equitable learning experience, similar to the findings by Philippe, et al. (2020). Online and face-to-face students could hear and see the lecturer clearly and indicated they could participate actively in the sessions. Lecturers appreciated the clear audio and video facilities and the technological facilities, offering multiple ways to deliver course content. Where a lower level of active teaching approaches stood out during the lesson observations, students overall rated the courses and lecturer highly. The lecturers indicated the Hybrid Plus Classroom is easy to use and both appreciated the audio and visual facilities for content delivery, but they also indicated the technology requires some training and practice to fully and fluently control.

To build on the findings of Triyason, Tassanaviboon, & Kanthamanon (2020) and their Hybrid plus Classroom requirements for successful implementation of multimodal teaching in a Hybrid Plus Classroom, 3 recommendations are presented, based on the outcomes of this pilot: preparation, pedagogical approaches, and institute-wide support. Firstly, when preparing for implementing multimodal teaching a Hybrid Plus Classroom, after the required facilities have been put into place, an integrated training for lecturers should be facilitated as well as onsite support for any technical issues. Training should include the technological facilities and possible pedagogical approaches as recommended by Triyason, Tassanaviboon, & Kanthamanon (2020), as well as practice rounds. Also, ensuring technological infrastructure is easily accessible for all students, both on-campus and online. Secondly, pedagogical approaches need to be formulated to facilitate learning, making use of the facilities available. Suggestions can include breaking up long segments of lecture by introducing interactive activities within lectures, such as small group discussions, case studies, and problem-solving tasks. Interactive activities offer students opportunities to engage with the material and apply it practically. Interaction between online and face-to-face

students can be improved by targeted group activities by means of breakout rooms, group discussions, or online collaboration software, e.g. Google Jamboard, Google Doc, Padlet, etc. Encouraging students to use the chat function for asking questions creates an alternative channel for participation, especially for those who may be reluctant to speak verbally. This works for online, but also for on-site students and can contribute to improving connection and learning as a social construct (Abdelrahman, 2016; Bashir, Bashir, Rana, Lambert, & Vernallis, 2021; Binnewies, 2019; Lakhal, 2017; Moorhouse & Kohnke, 2021; Tu, 2000; Visser, 2012; Vygotsky, 1934). Effective communication ensures that students are informed and engaged from the beginning of the class, e.g. notifying students about a delayed start of the session. Lastly, a broad base for support and implementation (Beatty, 2022; Szeto, 2014), including head of program, course designer, teaching and learning centre, lecturer, student representatives, etc., to develop a blueprint for effective teaching practices, attainable for all parties involved, including approaches, materials, modes offered, level of freedom in choosing mode of attendance, and support for students adjusting to self-directed learning. This will improve institute-wide investment in the process and the outcomes. By implementing these recommendations, higher education institutions can effectively harness the potential of multimodal teaching approaches, creating inclusive, engaging, and adaptable learning environments that benefit lecturers and students alike.

Keep in mind not all solutions that work in a Singaporean setting will work everywhere else. Cultural differences, education levels, access to and experience with technology, are all factors to be considered when setting up and implementing a multimodal teaching approach.

Acknowledgement

We would like to acknowledge the support and hard work of Dr Chong Fui Chin and all SIM staff who were involved in the Hyrid Plus Classroom project as well as the Pilot study.

References

Abdelmalak, M. M. (2016). Expanding Learning Opportunities for Graduate Students with HyFlex Course Design. *International Journal of Online Pedagogy and Course Design (IJOPCD)6(4)*, 19-37.

Abdelrahman, N. &. (2016). Hybrid Learning: Perspectives of Higher Education Faculty. *International Journal of Information Communication Technologies and Human Development (IJICTHD), 8(1)*, 1-25.

Bashir, A., Bashir, S., Rana, K., Lambert, P., & Vernallis, A. (2021). Post-COVID-19 Adaptations; the Shifts Towards Online Learning, Hybrid Course Delivery and the Implications for Biosciences Courses in the Higher Education Setting. *Front. Educ, Sec. Educational Psychology, Volume 6* .

Beatty, B. J. (2022). *Hybrid-Flexible Course Design; Implementing student-directed hybrid classes.* EdTechBooks.org.

Binnewies, S. W. (2019). Challenges of Student Equity and Engagement in a HyFlex Course. In C. C. Allan, *Blended Learning Designs in STEM Higher Education. .* Singapore.: Springer.

Flynn-Wilson, L., & Reynolds, K. E. (2021). Student responses to virtual synchronous, hybrid, and face-to-face teaching/learning. *International Journal of Technology in Education, 4(1)*, 46-56.

Jochems, W., Koper, R., & Van Merrienboer, J. (2004). *Integrated e-learning: Implications for pedagogy, technology and organization.* Routledge.

Lakhal, S. B. (2017). Blended Synchronous Delivery Mode in Graduate Programs: A Literature Review and Its Implementation in the Master Teacher Program. *Collected Essays on Learning and Teaching, 10*, 47-60.

Little, P., & Jones, B. (2020). A comparison of student performance in face to face classes versus online classes versus hybrid classes using open educational resources. *Journal of Instructional Pedagogies (24)*.

Miller, J. R. (2013). Student choice, instructor flexibility: Moving beyond the blended instructional model. *Issues and trends in educational technology, 1(1)*, 8-24.

Moorhouse, B. L., & Kohnke, L. (2021). Adopting HyFlex in higher education in response to COVID-19: students' perspectives. *Open Learning: The Journal of Open, Distance and e-Learning, 36:3*, 231-244.

Philippe, S., Souchet, A., Lameras, P., Petridis, P., Caporal, J., Coldeboeuf, G., & Duzan, H. (2020). Multimodal teaching, learning and training in virtual reality: a review and case study. *Virtual Reality & Intelligent Hardware, 2(5)*, 421-442.

Sankey, M., Birch, D., & Gardiner, M. (2010). Engaging students through multimodal learning environments: The journey continues. *27th Australasian Society for Computers in Learning in Tertiary Education*, (pp. 852-863.).

Szeto, E. (2014). A comparison of online/face-to-face students' and instructor's experiences: Examining blended synchronous learning effects. *Procedia-Social and Behavioral Sciences, 116*, 4250-4254.

Triyason, T., Tassanaviboon, A., & Kanthamanon, P. (2020). Hybrid classroom: Designing for the new normal after COVID-19 pandemic. *11th international conference on advances in information technology*, (pp. 1-8).

Tu, C. H. (2000). On-line learning migration: From social learning theory to social presence theory in a CMC environment. *Journal of network and computer applications, 23(1)*, 27-37.

Visser, L. (2012). Obstacles an opportunities of distance higher education in international settings. In L. Visser, Y. L. Visser, R. Amirault, & M. Simonson, *Trends and Isssues in Distance Education: International perspectives* (pp. 55-70). Information Age Publishing.

Vygotsky, L. (1934). Social constructivism theory.