

A 4C Model for Hyflex Classrooms

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Abstract — In last two years, universities around the world have been using hyflex teaching due to COVID-19. This allows students to attend physical/online lectures in a flexible manner. That means, a class comprises both classroom students as well as online students. In this paper, we present a model for hyflex classrooms that highlights 4Cs: Content, Collaboration, Community and Communication. Based on the 4C model, a hyflex classroom has been designed and implemented through various teaching/learning tools or elements. These include the effective use of presentation slides, annotations, chatbox, open education resources, multiple choice exercises, group exercises etc. The effectiveness of these tools/elements were evaluated by means of an initial student survey. These results provide valuable insights into hyflex teaching/learning.

Keywords — hyflex teaching, hyflex classroom, online learning

I. INTRODUCTION

Due to COVID-19, universities around the world have been using online, hybrid or hyflex teaching in the last two years. Unlike traditional face-to-face teaching, online teaching delivers a class via the digital media. Hybrid teaching uses a mixed model, e.g., providing some lectures through face-to-face teaching while other lectures through online teaching or e-learning (i.e., using a more blended learning approach). Hyflex teaching seeks to deliver a lecture to both online students and classroom students at the same time, with the instructor usually in the classroom. This is the most challenging model as it combines face-to-face teaching and online teaching in the same class through two different means and with two different groups of learners. While it is challenging to the teacher, it provides students with the greatest flexibility and hence it is called hyflex teaching.

A hyflex class provides a student-centered learning environment, which seeks to integrate face-to-face teaching, synchronous online teaching, and asynchronous learning. A teacher delivers a lecture in a physical classroom. Students can choose to attend the course in person in the physical classroom and participate online through a video conferencing software. The most popular video conferencing software adopted by educational institutions are Zoom, WebEx, Blackboard Collaborate and MS Teams. They can support teachers to interact with online students in a face-to-face-like environment. Other features are designed to increase student engagement with activities similar to those conducted in a physical classroom (e.g., group discussion). The video recording feature can be used as supplemented asynchronous materials for students which allow students to learn at their own pace [1][2][3]. The learning management system (LMS) is also helpful in a hyflex class. The most popular LMS

software include Blackboard Learn, Microsoft Teams, Moodle, and Canvas. LMS can be easily integrated with various tools to expand their software functionality. Teachers use the LMS to do course administration, assign tasks, and track student performance. Students can use LMS to manage their learning after class, such as downloading PowerPoint files, readings, and videos [4][5].

This paper aims to present a 4C model for hyflex teaching, share teaching experience and present initial survey results. The remainder of this paper is outlined as follows. Section II presents related work on hyflex teaching. Section III presents the 4C model and teaching experience. Section IV presents and discusses the student survey results. Section V draws a conclusion.

II. RELATED WORK

In this section, we give an overview of related work highlighting the challenges and issues on hyflex teaching as well as outlining some possible solutions. The new hyflex teaching approach affects both the teachers and students in different aspects. They need to adapt their teaching methods and study habits to a new learning environment. The first obvious challenge is related to the interactions between physical and virtual space in a hyflex class. The teacher's movement in a physical classroom is often constrained because of the limited range covered by a camera [6][7]. Since the teachers' attention is limited, it is hard to provide a comparable learning experience for the two groups of students. When a teacher answers questions from online students, less attention can be devoted to classroom students, and vice versa. Many teachers experience fatigue in this new hyflex learning environment [8].

In a hyflex teaching environment, teachers and online students cannot have direct interactions in the same physical space. In particular, there are limited visual (e.g., eye contacts, facial expressions) and audible cues to communicate with the online students. Online students are often reluctant to turn on their cameras and/or their microphones. This creates a communication barrier between online students and the teacher. As a result, teachers find it difficult to track online students' learning progress and their engagement. In a regular in-person classroom, transparent communication and guidance between teachers and students can enhance learning. The real-time interaction and warm presence can strengthen students' feeling of being supported. In a hyflex class, teachers often find it difficult to maintain a sense of care and to implement a caring pedagogy throughout a semester [9][10][11]. Online students often feel being excluded from

the main class and their discussion is often out of reach from the instructor [6]. Furthermore, there is always a delay for the teacher to handle questions posted by online students. When online and offline students need to conduct discussion, audio delay can also be an issue. To encourage students' feedback, the connectivity among the teacher, and both online and classroom students should be strengthened [7]. In other words, a sense of community should be maintained. Online students are often difficult to know when to speak because of unclear nonverbal cues online. That means, they usually ignore each other, resulting in low quality discussion. Hence an effective mechanism or protocol is needed to coordinate the discussion (i.e., to specify who should speak at a time slot) [12].

In a hyflex class, various technological issues may directly affect the teaching efficiency and quality. For example, how the interaction in a physical classroom can be presented to online students is partly constrained by technical devices (e.g., camera angles and clips) [7]. For laboratory sessions involving technical equipment, there are significant challenges for a teacher to perform hands-on experiments or demonstrations for online students. In other words, there are practical difficulties in fulfilling certain learning objectives through online laboratory sessions. Another common challenge in a hyflex class is related to assessments, including quizzes, assignments, tests and exams to be conducted in an un-proctored manner. For example, students can search for answers directly online or complete questions in a collaborative manner. Teachers need to redesign assessment questions to ensure academic integrity [13].

Compared with classroom students, online students are relatively less motivated to learn as they are likely to experience more distractions (e.g., personal or home issues). As a result, they may lose concentration (e.g., cannot perform consistently in a hyflex class). Furthermore, online students often attend a lecture like watching a video (i.e., unlike a real lecture environment). To foster active learning and enhance students' self-regulation skills, group-based or collaborative learning plays an important role. To facilitate active participation in discussion, students are encouraged to take on active leadership roles. Furthermore, it is also important to give classroom and online students a balanced opportunity to participate in the classroom discussion [14].

Taking into consideration the aforementioned challenges and issues, and inspired by the related work, we present the 4C model and share some hyflex teaching experience in the following sections.

III. 4C MODEL

In this section, we present the 4C model. Going back to basics, the fundamental question is: "What should be the basic components of a classroom for good teaching/learning?" By developing a model, we can design a hyflex classroom and associated teaching/learning activities more effectively.

Fig. 1 shows the 4C model with four components: Content, Collaboration, Community and Communication. We believe that they should be the common elements for both physical classrooms and online classrooms. The first C is Content, which is of course the most important component. This involves presenting the teaching materials (e.g., slides and other multimedia materials) in a classroom. Through the teaching materials (Content component), students can learn the subject (e.g., knowledge and concept). The second C is Collaboration. In an effective classroom, students should not be passive listeners. The teaching should engage the students' attention, perception, and memory processes that will lead to the acquisition of knowledge and desired mental representation. In general, the teaching materials (Content) should be designed in such a way that involves learning activities to facilitate the cognitive processes (i.e., active and meaningful learning). Here our focus is to achieve this goal through collaboration or collaborative learning activities. The third C is Community. In an effective classroom, students should learn in a community not alone (i.e., a sense of community). The community problem is particularly acute in the hyflex teaching mode, given two groups of students one online and one in-class at the same time. The last C is Communication, which is also important as students need to ask questions and interact with the teacher and other students.

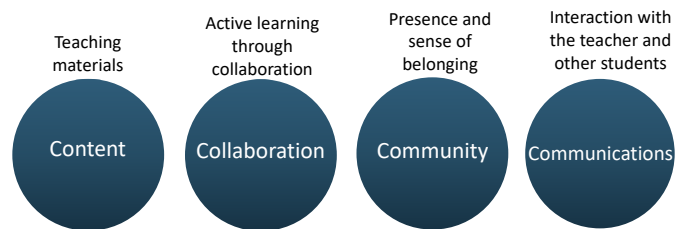


Fig. 1: 4C model

Based on the 4C model, Fig. 2 presents the 4C components of a hyflex classroom. The aim is to implement the 4C model using the available hardware and software. In the background, MS Teams is used, which shows the chatbox. For the Content component, PowerPoint slides, a web browser etc. are overlaid on the MS Teams to fit the content window as shown in Fig. 2. Note that they can be chosen effectively and efficiently at the menu bar using this arrangement. For the Community component, a video/camera view is shown in the top right corner. The whole screen is shared through MS Teams. That means that both the classroom students and online students can see the same view (i.e., from the classroom projector screen and the computers, respectively). Students can communicate through chat messages. In the following sections, further discussion will be provided on the aforementioned teaching/learning tools and elements.

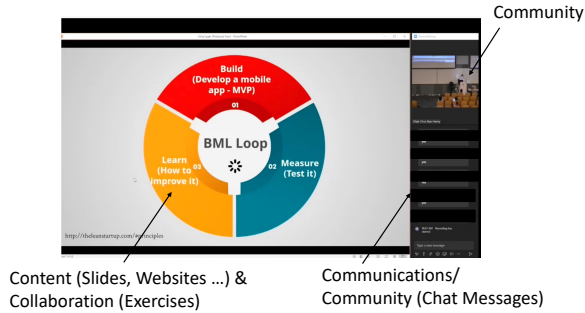


Fig. 2: 4C components in a hyflex classroom

First, lecture slides can be presented through the Content window (see Fig. 3). Note that for presenting PowerPoint slides, the “Browsed by individual (window)” option should be chosen to fit the slides into the Content window/space accordingly. When presenting the slides, it is also desirable to use annotations (e.g., highlighting the presentation parts clearly). One option is to use the free “Zoom it” tool. Note that the annotations can be used for other materials shown on the screen as well. Based on our experience, students find this arrangement useful to keep in pace with the flow of the presentation. When presenting the slides/materials, students can communicate with the teachers using the chat box. That means, teachers can see students’ chat messages. During teaching, verbal responses can be provided to students. For example, if a student asks a question on the slide, the teacher can answer it verbally to the whole class. Note that while students could also ask questions verbally, many students preferred using the chatbox. Apart from presenting lecture slides, open educational resources or YouTube videos can be presented as well. As mentioned before, a teacher can switch among different content elements easily.

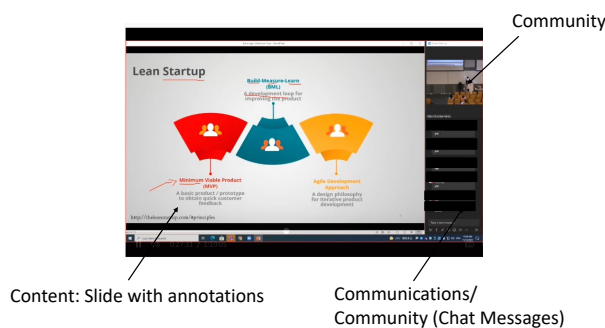


Fig. 3: Presentation with annotations

Sometimes, a teacher can refer to materials in the learning management system (LMS) such as announcements and discussion forums. Fig. 4 shows an example (i.e., presenting materials in the LMS) through the Content window. Again students can ask questions through the chat box.

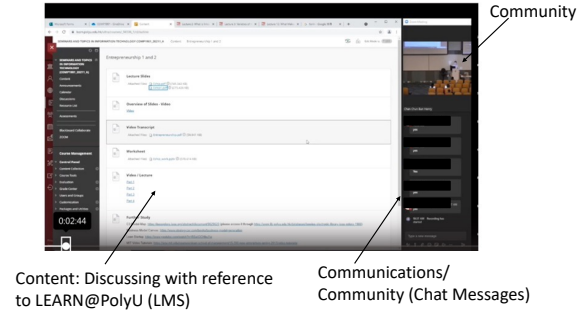


Fig. 4: Discussing with reference to LMS

For the Collaboration component, two main elements were used: individual multiple choice questions and group exercises. The aim is to enhance active learning by students. Fig. 5 shows an example of doing multiple choice questions using Microsoft Forms. There are two types of feedback to students. The first one is to show the overall results (i.e., percentages of the answers). The second one is to provide individual feedback to students. Student answers can be captured in a spreadsheet with their email addresses. Hence, individual feedback can be sent easily.

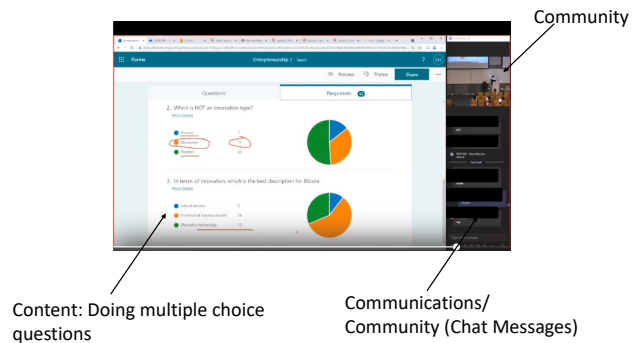


Fig. 5: Doing multiple choice questions

Last but not least, we have also tried a metaverse-inspired co-working space (based on Virbela) as shown in Fig. 6. A major problem with hyflex teaching or hyflex learning mode is that the online students feel that they are in a different space, a space distinct from the one occupied by the teacher and classroom students. This co-working space seeks to increase the cohesiveness of the two learning communities. Students can create different characters in the virtual space. In this case, student groups were given a demo space to showcase their projects (i.e., by showing a demo video). The projects are related to virtual startups they created in the virtual space. The virtual characters can interact in the virtual space or community as well.



Fig. 6: A metaverse-inspired co-working space

IV. EVALUATION

In this section, we evaluate the effectiveness of various teaching/learning tools or elements for a hyflex classroom through an initial set of data from student surveys. These students took a freshman seminar subject, which was delivered through the aforementioned hyflex classroom. The class had 153 students and 55 student responses were collected and analyzed. The students were asked to rate through an online form the effectiveness of the tools/elements using a five-point scale (i.e., whether they agree that the tools/elements are effective): “Strongly agree”, “Agree”, “Neutral”, “Disagree” and “Strongly disagree”). Note that each student could only submit one form.

Fig. 7 shows the effectiveness of the presentation slides/materials. As expected, they are the most important Content element. Over 85% of students strongly agreed or agreed that presentation slides/materials are effective. Indeed, over 47% strongly agreed with the effectiveness, which is the expected result. That means, presentation slides are still the most important element for delivering the lecture content.

Fig. 8 shows the effectiveness of using annotations on the presentation slides/materials. Based on our observation, students like teachers to use annotations for better clarity (e.g., to keep in pace with the presentation). This can be reflected from the result in Fig. 8. In fact, the same number of students strongly agreed or agreed with the effectiveness of presentation slides and annotations (i.e., they are equally important based on the student responses) although slightly more students gave a neutral rating for the effectiveness of annotations. The result indicates that the annotations are as important as the presentation slides. Indeed, annotations can enhance the clarity of the presentation especially in a hyflex environment (e.g., for online students with a smaller screen size).

Apart from the presentation slides, YouTube videos (or open educational resources in general) were used to enrich or complement a lecture (i.e., another Content element). Fig. 9 shows the effectiveness of using YouTube videos in hyflex teaching. It can be seen that a high percentage of students strongly agreed or agreed the effectiveness of using YouTube

videos. Compared to Figs. 7 and 8, the total percentage for “Strongly agree” and “Agree” is slightly less than that for presentation slides and annotations but it is still a high percentage. Note that in this case, more students gave an “Agree” rating. The result indicates that open educational resources can play an important role in a hyflex classroom. In particular, the use of videos can enrich the content of a lecture (e.g., enhance the attention of online students).

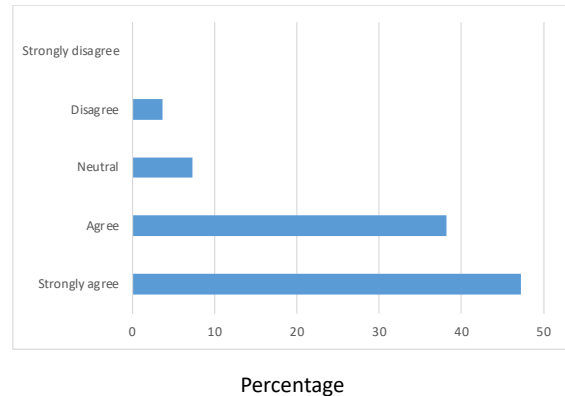


Fig. 7: Effectiveness of presentation slides

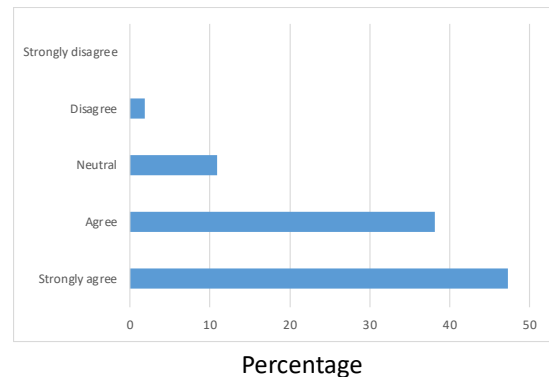


Fig. 8: Effectiveness of the use of annotations

As mentioned, there are two major elements for the Collaboration component. Students were asked to do individual multiple choice questions using Microsoft Forms and group exercises through Microsoft Teams (e.g., by co-editing a file together). Fig. 10 shows that about 75% of the students strongly agreed or agreed with the effectiveness of doing multiple choice questions. However, about 20% of students gave a neutral rating. The result indicates that multiple choice questions can enhance active learning for most students. For the group exercises, Fig. 11 shows that about 84% of the students strongly agreed or agreed with the effectiveness of doing group exercises. In this case, fewer students (about 9%) gave a neutral rating. The result indicates that students prefer group exercises rather than individual exercises in general. Collaborative learning can enhance the learning of both classroom and online students.

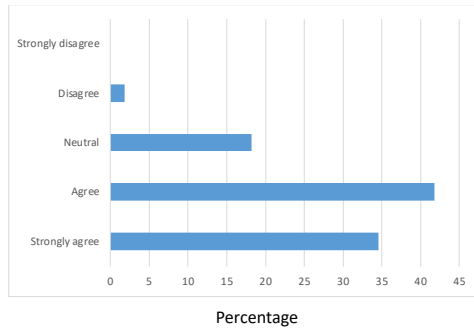


Fig. 9: Effectiveness of YouTube videos

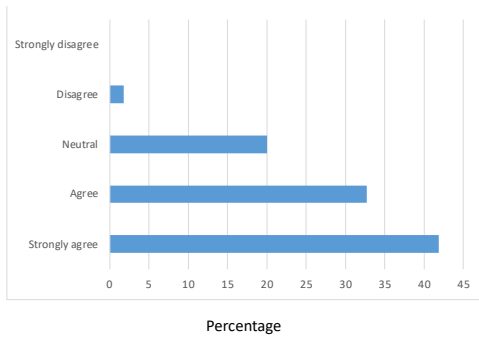


Fig. 10: Effectiveness of multiple choice questions

For the Community component, the video view and chatbox are the related elements. Fig. 12 shows that about 80% of the students strongly agreed or agreed with the effectiveness of video view. In other words, it is important for students to see a classroom view (e.g., to give online students a sense of ‘presence’ or community feeling). Fig. 13 shows that 84% of the students strongly agreed or agreed with the effectiveness of a chatbox. Note that the chatbox is both related to the Community and Communication components of the 4C model. Indeed, the result shows the importance of using a chatbox for the communication function. In particular, online students can communicate with the teacher effectively through the chatbox. This also enhances their community feeling and sense of presence.

Fig. 14 shows the effectiveness of recorded lectures. As expected, about 84% of students strongly agreed or agreed with the effectiveness of recorded lectures. Note that the percentage is slightly less than that for presentation slides (over 85%). The recorded lectures are particularly important/useful for online students who may not have a stable Internet connection so that they can review the lectures later.

In summary, Fig. 15 summarizes the relative importance of the aforementioned tools/elements based on the percentage of ratings of “Strongly agree” and “Agree”. Note that in general all elements/tools are important for hyflex teaching as reflected by the previous results. The aim of the analysis is to rank them to highlight the relative importance. It can be seen that “Presentation slides” and “Annotations” are the most effective tools/elements rated by students. “Chatbox”,

“Recorded lectures” and “Group exercises” are the second important tools/elements. Note that the aforementioned highly rated tools/elements cover all the 4C components: Content, Collaboration, Community and Communication.

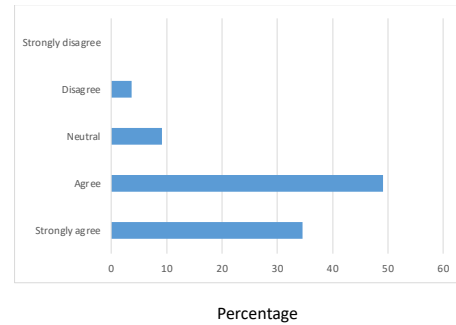


Fig. 11: Effectiveness of group exercises

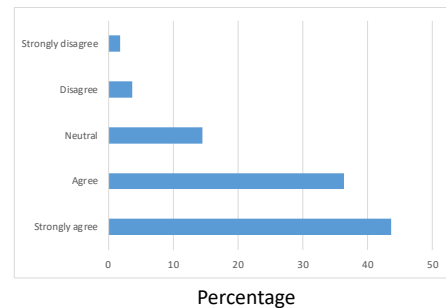


Fig. 12: Effectiveness of video view

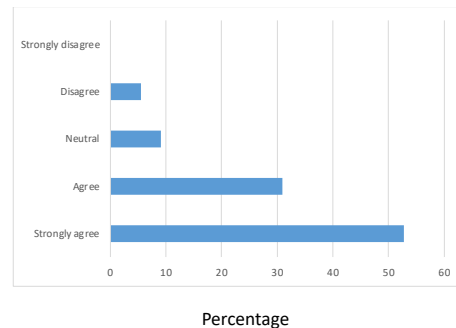


Fig. 13: Effectiveness of chatbox

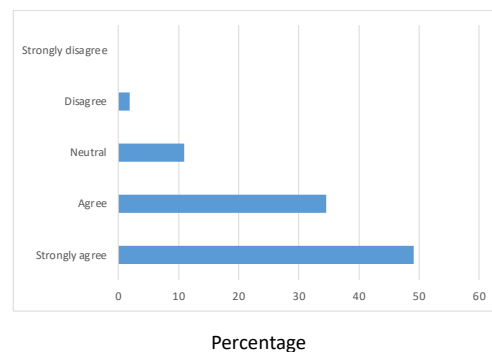


Fig. 14: Effectiveness of recorded lectures

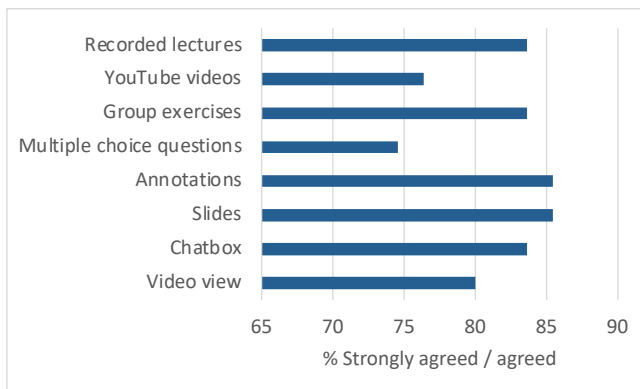


Fig. 15: Relative importance of the tools/elements

V. CONCLUSION

In this paper, we have presented a 4C model for hyflex teaching with four essential components: Content, Collaboration, Community and Communication. We believe that this model should be useful for the design of hyflex classrooms and it should provide a basic framework for further research. Based on the 4C model, various teaching/learning activities are presented to facilitate teaching and learning. A survey has been conducted to evaluate the effectiveness of the 4C model-inspired teaching/learning tools or elements. The results provide valuable insights into the design and implementation of hyflex classrooms.

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