Delivering education in the Hybrid Virtual and Connected Classroom

Faculty of Education & Innovation Research Group Teaching, Learning & Technology, February 2022, Zac Woolfitt with support from Jeroen Bottema

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'Teaching like you would in a regular class really does not work online. So it also does not work in a Hybrid Virtual Classroom. Because you are basically teaching an online class when you are in a classroom.'
(Respondent 2)

'It is an illusion that you can walk in, and the technology will all work automatically.'
(Respondent 9)

Executive Summary

Seven lecturers and two senior support staff were interviewed during 2021 about their experiences with the Hybrid Virtual and Connected Classrooms (HVC/CC). These technology rich learning spaces allow teachers to simultaneously teach students physically present in the classroom and students online. There were two factors driving these didactic scenarios. Firstly, experimentation from innovative teaching staff who were already experimenting with the educational possibilities of these formats for several years. Secondly, the pandemic which imposed limitations on classroom sizes and impacted teaching practice in higher education. An explanation of some of the terminology is provided based on a literature review. Two models are outlined that provide insight into some of the pedagogical and technical elements relevant for this context.

In the interviews, lecturers teaching in these contexts describe their experiences and outline some of the pedagogical and technical challenges faced. These include the pedagogical challenges of adjusting teaching practice to adequately serve the students in the class, and those joining online. Engaging with the students and linking the different student groups was also a challenge. Having sufficient interaction with the students online proved difficult, particularly when they were hesitant to have their microphone or camera on. Students were grateful that the effort was made and glad they could still attend the class, even though it was not in person. Technological issues included having the correct equipment available such as microphones, cameras, screens and suitable connections. And being able to connect the various devices to ensure those in the class and online could see and hear what was going on. There are many variables that make providing education in these contexts challenging. These include the specific learning goals being addressed, the planned learning activities, the number of students in the class and online, the different possible room configurations combined with the location of screens, microphones and cameras. The availability of technical support and being able to reserve the rooms and then practice in them before giving a class were considered important elements.

To optimise the Hybrid Virtual and Connected Classrooms, careful choices need to be made when teaching in these formats. In the case where this format is the result of a pedagogical choice linked to specific learning goals, then continued experimentation and practice can lead to enhanced teaching and learning opportunities. In the case where these classroom formats are a result of external factors (the pandemic and classroom size), then the learning goals and the use of synchronous teaching time should be carefully considered before using these formats. To optimise these classrooms, it is beneficial to reconsider the format of lessons, and which learning goals are linked to which learning activities in the synchronous learning moment. Rather than simply copying a regular lesson into this format, the structure and approach to the class can be redesigned and rethought to optimise the affordances of the Hybrid Virtual and Connected Classroom. The complexity of using these formats, and the additional time needed to do it properly, should not be underestimated. An ongoing dialogue with teachers, support staff and especially students, should be an integrated part of any further implementation in this format.

A series of recommendations is provided that focus on the pedagogical and technical aspects. These include allowing sufficient time to prepare the lessons, practice in the classrooms, and how to engage and connect the two student groups. In the discussion, areas of future research are examined. Since the pandemic, much experimentation has taken place and new equipment, room configurations and options are continually emerging.

1. Introduction

In March 2020, the Dutch Government required all education to take place online because of the measures to prevent the spread of the coronavirus. This accelerated the digitization of higher education. Lecturers were required to deliver online education at short notice. By the start of the academic year 2020 – 2021, the measures had been relaxed slightly, which made it possible for students to partly return to education on campus. Classes were conducted under "1,5 meter" conditions. It was not possible to return to the pre-pandemic teaching conditions. Learning practices arose where some of the students were on campus and some online at the same time, so called *hybrid virtual classrooms* (HVC) (Raes, Detienne, Windey, & Depaepe, 2020). After three months of being able to teach in person, education had to return to fully online from November 2020 until the end of the academic year. In the academic year 2021 – 2022 higher education returns to a 'new normal'. This shifting from teaching fully online, to teaching in the classroom and a hybrid form.

Inholland University of Applied Sciences (Inholland) has been developing technology rich learning spaces for the last few years, as have other universities and colleges in the Netherlands (Fransen & Griffioen, 2019). These learning spaces allow teachers, experts, and students to be together in a physical room while being joined online by students and/or experts via a screen. Several lecturers at Inholland had already been teaching and experimenting in HVC-formats, pre-pandemic (Woolfitt & Swager, 2019) .

Face-to-face education on campus became possible for certain periods of the pandemic. It was important for Inholland to gain insights into the HVC and the characteristics of technology rich learning spaces. HVC-formats support multi-campus teaching and learning which means not all courses have to be offered on all locations. There are also developments with higher education experimenting with other learning environments such as living labs. The HVC could play a significant role in connecting the learning environment on and off campus. Developing technology rich learning spaces can contribute to developing more inclusive, accessible, and flexible education for a more diverse group of students. For some of these learners, such as students with certain limitations where attending classes on campus may be difficult, working students and professionals and international students. Developing formats of hybrid virtual classroom could be a solution for this problem. These formats also need to have a positive impact on student engagement and student outcomes. Further research into the pedagogical and technological design is important.

As a result of the pandemic, some lecturers created HVC settings, using the learning spaces and technology available to them. The Research Group Teaching, Learning and Technology was asked to describe and examine how these spaces were being used. The current research report examines some specific features and characteristics of hybrid virtual classroom settings within Inholland. It examines why this approach was implemented, the type of education that took place and what we can learn from this regarding conditions to optimise these formats for teaching and learning. The research was conducted at Inholland during the academic year 2021.

1.1 Purpose, research question and relevance

The objective of the research is to describe and gain insight into the choices, practices, and experiences of lecturers from Inholland who used hybrid virtual classroom-settings during the academic year 2020 and 2021 in order to optimise the use of technology rich learning spaces.

Central Question

In what ways can the current implementation of the hybrid virtual classroom within Inholland be optimised?

The exploratory research is guided by the following questions:

1. How is the hybrid virtual classroom being used?
2. How did lecturers arrive at these choices?
3. Which educational scenarios derived from which educational goals were used?
4. What support is needed to help educators when teaching in the hybrid virtual classroom?
5. What were teachers' experiences of teaching in the HVC and CC?
6. What advice would you suggest to your colleagues when teaching in HVC and CC

This exploration provides insight into designing and delivering education in HVC-settings and can contribute to the optimization of learning practices using technology rich learning spaces. The results can contribute to the development of understanding amongst teaching staff and support staff of Inholland. When does it make sense to use this format, and when not? Answering these questions provides guidelines for educators, students, and support staff. For the TLT research group, the aim of the research is to generate knowledge about effective teaching and learning practices using technology rich learning spaces.

2 – Theoretical framework

In this theoretical framework some of the affordances of the HVC for teaching and learning are explored to gain understanding of how the HVC can effectively support teaching and learning. It presents a brief overview of some of the academic literature on the hybrid virtual classroom and outlines some educational theories relevant to this study.

2.1 The hybrid virtual classroom and the connected classroom

There are a variety of terms used to discuss the format of combined face-to-face (in person) and online (virtual) learning environments (Raes, Detienne, et al., 2020). Raes, Vanneste, Pieters, Windey, Van Den Noortgate, & Depaepe (2020) write about the *synchronous hybrid virtual classroom*, and regard it as part of *synchronous blended learning*. It concerns a learning activity in which two groups of students participate: a group of students is present on campus and a group consisting of students who are present online at a location of their choice, synchronously with the students on campus. The two groups are connected via a digital learning platform (Raes, et al., 2020; SURF, 2018). Bell, Sawaya & Cain (2014) refer to synchromodal classes where the interaction between online students and face-to-face students is shared during synchronous sessions via the use of videoconferencing and other technologies. The interaction in these sessions is described as synchromodal learning. Linder (2017) states that hybrid classroom settings are where 'face-to-face activities are often combined with technology-mediated activities so that there is more active learning in the face-to-face setting as well as more intentional guidance when students are learning outside the classroom'. Before the pandemic, the SURF Learning Spaces group was involved in defining this terminology and provides a set of practical examples of multilocation classroom[1] with a set of resources [2],[3].

Last & Jongen, (2021) describe the combination of physical education spaces with virtual spaces for synchronous education as *multi-location learning*. The authors describe three combinations: the Hybrid Virtual Classroom, the remote classroom (where the students are simultaneously on location and the teacher is remote) the hybrid remote virtual classroom (a situation that is like the HVC but where the remote students are in the same room).

Figure 1 A hybrid virtual classroom in which online students from different locations join a face-to-face class

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[1] Praktijkvoorbeelden multi-locatieleren.pdf (surf.nl)

[2] Typen onderwijsruimtes | SURF.nl

[3] Active Learning Spaces: Lessons Learned in the United States | EDUCAUSE

The Connected Classroom

Another combination of multi-location learning is the 'Connected Classroom' (CC) or Linked Classroom Model (Bell, Sawaya, & Cain, 2014). This situation was used recently in higher education due to the '1.5 meter' measures implemented during the pandemic. Due to the limited space available in physical educational spaces, rooms were 'linked' to each other by means of the digital learning and instruction environment. Students were distributed over the classrooms to sufficient physical distance between them. The teacher was present in the main room (Room D in figure 2) and supported the interaction via the audiovisual connection. In the connected classroom, both teachers and students may be physically present on campus at the same time, but not in the same room. In this situation, the teacher can visit the other classrooms.

Figure 2 Connected Classroom Configuration

Linder (2017) states that in hybrid classroom settings are where 'face-to-face activities are often combined with technology-mediated activities so that there is more active learning in the face-to-face setting as well as more intentional guidance when students are learning outside the classroom.' Linder states that in a hybrid course the teacher needs to shift pedagogy (teaching methods for children) to apply andragogical principles (teaching methods for adult learners). This is due to the increased need for students to be independent and to learn autonomously. In addition, educators may experience an increase in course preparation time due to the need to match face-to-face with online instruction activities in a constructively aligned approach.

Bell, et al. (2014) describes four different configurations of synchromodal classes: (1) linked classroom model, (2) shared portal model, (3) personal portal model, (4) and small groups model. In the linked classroom model, there are two groups at two different locations, with the teacher at one location. The teacher alternates their location and can teach both groups at the same time. Both groups experience the teacher in a face-to-face setting, and online.

In addition to a virtual environment, multi-location learning requires technology enhanced learning spaces onsite specifically designed for this purpose. Different learning environments are combined into an integrated approach. In the literature, hybrid learning, or hybrid education is often equated with blended learning (Trentin, National, Bocconi, & National, 2014). In these cases, blended learning is seen as a combination of online and face-to-face education, a perspective that arises from organizing education and setting up (virtual) learning spaces.

The limitation of this definition is that a categorisation based on location and technology is not sufficient to make informed decisions about supporting learning. Another perspective of hybrid learning and hybrid education concerns that of practical learning. This concerns an approach in which a combination of learning and instruction activities take place on campus and off campus, in a practical environment (Zitter et al., 2016). In such a learning environment, students work on complex, realistic professional tasks, and products. This perspective of hybrid learning is a current development in higher education where institutes are developing and experimenting more diffuse forms of learning environments (e.g., living labs, etc.). The virtual learning environment can play a key role in connecting the learning environment on campus and off campus. In this context it is possible that new combinations of multi-location learning are developed.

At Inholland, some courses follow a course in a 'Lab' where they work on complex, realistic and challenging professional tasks. 'Labs' are places where research, education, and industry professionals work together on complex and authentic issues. Labs are a place where co-creation of

knowledge takes place, where lessons learned and working mechanisms are mapped and where joint concepts are developed. This is a trans- and multidisciplinary learning environment (Fransen, 2020b) which can be facilitated by the Hybrid Virtual Classroom.

2.2 Pedagogical affordances of the hybrid virtual classroom for teaching and learning

The added value of the HVC for learning and teaching can be specified by clarifying options offered in the HVC. Kirschner (2002) describes the concept of affordances to indicate the relationship between the properties of an object and the properties of the user that determine how the object is handled. Affordance knowledge about the HVC is relevant for the purpose of designing and executing effective, efficient, and attractive educational activities in an HVC setting. In the literature on the HVC, the following affordances are mentioned: accessibility and flexibility, social interaction and individuality.

Accessibility and flexibility
The HVC setting makes it possible for students to participate in both remote and face-to-face educational activities which has organizational advantages. Raes, Detienne, et al. (2020) write in their meta-analysis that the use of the HVC makes education more flexible and accessible. The flexibility lies in the possibility for the student to choose to participate either remotely or to travel to the campus to participate face-to-face, depending on the personal context of the student. An example would be a case of illness where the student cannot travel to the campus but can still participate in the educational activities by participating online. Raes, Detienne, et al. (2020) also link this advantage to social developments in which students in higher education must manage their study alongside work and family commitments. In principle, this flexibility also exists for teachers. As a result of the increased flexibility, education is becoming more accessible to a broader and more diverse target group (Raes, Detienne, et al., 2020). It allows more students to study regardless of their location, making education more inclusive and increasing equity.

Continuity of instruction
The HVC makes it easier to involve outside experts in educational activities via the digital environment (Bell et al., 2014). It allows specific units of study to be offered at several locations for institutions that have multiple locations. As a result, a unit of study does not always have to be offered multiple times for several classes at different locations. This can have benefits on staff and room allocation.

Social interaction and experts
The HVC combines offline and online groups of students, and the interaction between these groups provides affordances for learning. Depending on the composition of the groups, and in particular the composition of the group at a distance, this may allow students to encounter multiple perspectives. A rich learning experience can arise if cooperation and connection between the two groups is facilitated. The HVC can contribute to enriched social interactions. Raes, Detienne, et al., (2020) indicate that the opportunity to bring in expertise from outside allows students to come into contact with a wider range of perspectives and ideas. This involves introducing multiple perspectives and interaction between groups. This is impacted by the exact composition of the students in the class and those online.

Didactic benefits are also described, but there is a caveat to this. There are possible didactic benefits (Bell et al., 2014):
- It eliminates the need to teach the course twice: once face-to-face, once online
- Integrating the two groups make for a richer learning experience, since the two populations often have different perspectives.
- It is a way for online students to participate in program components that are offered on location
- Bringing in guest speakers and presenters via online videoconferencing

2.3 Designing and evaluating learning practices in the hybrid virtual classroom

Design a rich learning experiences that support the learning of online students and face-to-face students during synchronous sessions is complex. Bell, et al. (2014) talk about designing synchromodal learning environments through three phases: (1) Planning & Design, (2) Implementation and (3) Adjustments. The Community of Inquiry framework (Garrison, Anderson, & Archer, 2000) examines the different types of 'presence' that contribute to the educational experience; Social, Cognitive and Teaching (Structure/Process). In a Hybrid Virtual Classroom or a Connected Classroom, the social presence is split into two groups. Those in the room with the teacher and those online. The Cognitive presence refers to elements of how students can construct meaning through sustained reflection and discourse. The process of discourse can be complex when students are in different locations. Finally, the teaching presence (being present, approachable) is mediated by the different student experiences, whether in the room with the teacher, or learning via the online image. Thomas & Graham, (2019) discuss the similarities and differences of evaluating online and traditional courses. They conclude that evaluations of online teaching focus on instructional behaviours and they emphasise the importance of building relationships and community and developing a more comprehensive model for evaluating online teaching competencies. There is no specific mention of evaluating teachers in the hybrid virtual or connected classroom.

Hybrid Virtual Classroom
There are a variety of terms used to discuss this format which are outlined in the theoretical framework below. For this research, the term Hybrid Virtual Classroom (HVC) is used. In the HVC the teacher and students on-site are joined in the lesson, by students who follow the synchronous education online via a screen. Prior to the pandemic, Inholland had invested in several learning spaces that support this format. And some pioneering teachers had already begun experimenting with this teaching approach.

The hybrid virtual classroom enables 'learning and teaching where remote students participate in face-to-face classes by means of rich-media synchronous technologies such as video conferencing, web conferencing, or virtual worlds' (Bower, Kenney, Dalgarno, Lee, & Kennedy, 2014). This is a 'learning environment in which both on-site and remote students can simultaneously attend learning activities' (Raes, Detienne, et al., 2020). Since 2020 there has been a 'rapid rise' of this format and increased interest within higher education in the Netherlands and other countries. The hybrid virtual classroom has 'been designed to connect both onsite students and remote students during synchronous teaching' and while this provides flexibility for students this format 'is also the most challenging one to teach in and to learn in as a remote participant' (Raes, Vanneste, et al., 2020). Raes, Detienne, et al. (2020) conclude their literature review on the hybrid virtual classroom by stating that 'existing research clearly shows the potential of this emerging practice. Despite the challenges, all studies provided cautious optimism about synchronous hybrid learning, which creates a more-flexible, engaging learning environment compared with fully-online or fully on-site instruction.' Blended synchronous learning 'involves using rich-media technologies to enable remote and face-to-face students to jointly participate in the same live class' (Bower, Kenney, Dalgarno, Lee, & Kennedy, 2013). Educators face challenges of communication and cognitive overload caused by split attention.

Raes, Detienne, et al (2020) stress the importance of 'social presence' when creating a positive atmosphere in the class and for strengthening interactions. The 'HVC demands other methods of teaching and different learning activities.' The teacher 'needs to pay attention to both locations and needs to perform certain operational actions on the teaching and learning platform.' This can result in a 'heavy mental load' for the teacher. It is a challenge to avoid ambiguity in the exact status of online students and to reduce their sense of being 'excluded' from the main class. Raes, Detienne, et al (2020) conclude their literature review about research into the Hybrid Classroom by suggesting five areas for future research;
- include larger and more diverse samples to improve generalisability and understand meaningful effects,

- investigate the impact of group membership over time
- examine the real-time data of the learning experience and social presence
- examine the effect on student learning across different settings in relation to certain pedagogical scenarios and
- examine how to approach the technical and pedagogical aspects in a scalable manner.
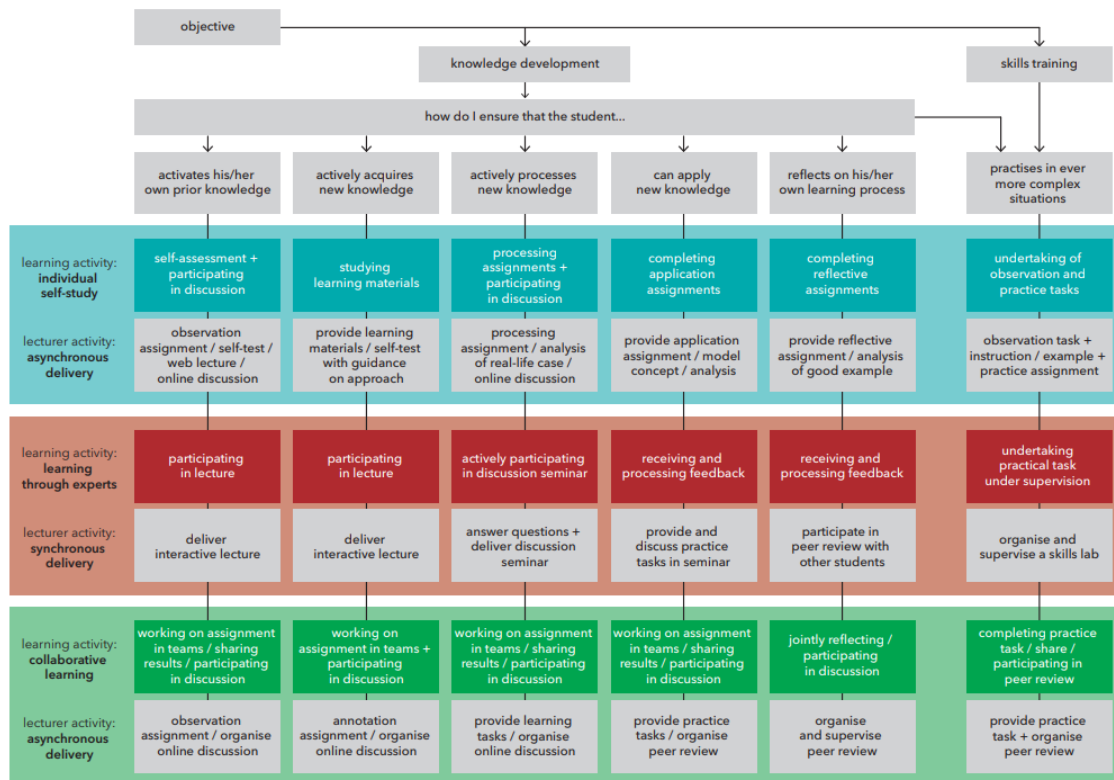
2.4 Theoretical Frameworks and models

Figure 3 Decision aid for online learning (Fransen, 2020a)

Fransen (2020a) outlines a decision tool for online learning which provides an overview of different teaching contexts. Five stages of learning include activating prior knowledge, actively acquiring new knowledge, processing new knowledge, applying new knowledge, and reflecting on the learning process. The hybrid virtual classroom and connected classroom are delivered synchronously by an expert. The 'lecturer and students are directly in contact with each other in person or online through a video and/or audio connection.' This overview can be a useful guideline for analysing and then deciding which learning activities should take place at which point, with which interactions an in which context.
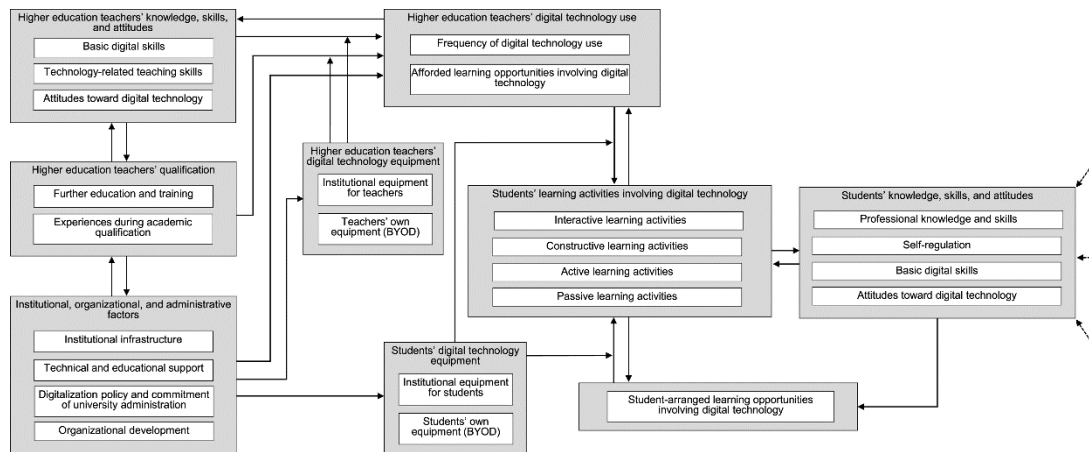
Figure 4 C♭-model: Contextual facilitators for learning activities involving technology in higher education (Sailer et al, 2021).

The C♭-model (Sailer, Schultz-Pernice, & Fischer, 2021) offers an overview of the complex dynamic of factors that lead to successful digital teaching and learning in higher education via suitable learning activities. It maps student learning outcomes, learning activities when using digital technologies, and contextual facilitators for learning activities involving technology related to teachers' instructional use of technology and students' self-arranged learning opportunities involving digital technologies. Other factors discussed are higher education teachers' knowledge, skills, and attitudes toward digital technology; higher education teachers' qualification; students' and teachers' digital technology equipment; and institutional, organizational, and administrative factors. This framework can be useful when understanding factors relevant for developing and delivering education in the hybrid virtual classroom or the connected classroom.

These two models provide a context for examining the synchronous delivery of education in a hybrid or connected context. They outline the relationship between the institutional technology infrastructure and support in relation to the teacher's technical and pedagogical competence in a technology rich learning environment.

3 – Methodology

3.1 Type of Research and Research Questions

This small-scale exploratory study used qualitative interviews to gain insight into the current situation of teaching practice and use of technology in the HVC and CC.

3.2 Research participants

The research population was identified as Inholland lectures who have taught in an HVC or Connected Classroom since the start of 2020. In the first phase, 24 lecturers who had taught in one of the designated HVC classroom were contacted via email. All other Inholland staff were also invited to join the research through an internal message to Inholland staff. One lecturer from the researcher's personal network, from another Dutch Hogeschool, was also interviewed.

3.3 Research instruments

Survey

A short survey in MS Forms was sent to 24 teachers with experience of teaching in the HVC/CC. This confirmed the department they worked in, their experience of teaching in HVC/CC, reasons why they used this format, which facilities they used, support received and whether they would be willing to be interviewed for the research. A short survey was posted to all faculty within Inholland via the internal communication platform with the option to participate in the research. In total, 9 faculty responded, and the results were collected in an excel sheet. Six lectures indicated they were available and were interviewed.

Semi Structured Interviews

6 Inholland lecturers, 1 external lecturer and 2 senior support staff were interviewed via a semi structured interview. The research protocol and questions were developed based on the literature review are in the appendix

3.4 Data collection procedure and analysis

The interviews were conducted online via MS Teams and, with permission of respondents, recorded for data analysis. Either one or two interviewers were present. The video recordings of the interviews were viewed by one researcher and summarised. The interviews took place mostly in Dutch. The interviews were summarised in English and sent to those interviewed for a member check before analysis. The interviews were discussed by both researchers. Key aspects identified from the literature review were used to create categories. These were then used to analyse the data.

3.5 Validity and reliability

Validity refers to the correctness of the measurements and focuses on whether what was measured was what intended to be measured. Validity can be compromised when there are systematic errors that can be influenced by the robustness of the design and concretization of the research. Reliability refers to the stability of the measurements and focuses on whether a measurement is repeatable and if so, would lead to the same results. Reliability can be compromised when there are random errors which can also be minimised by careful, traceable, and unambiguous conducting of the research. In the current research, validity takes precedence over reliability because the repeatability of the measurements is not possible. Validity was addressed in this study through the theoretical embedding of the research and through member checking all interview summaries. The impact on validity and reliability was reduced by recording all interviews. Care was taken to document the research procedure to contribute to the traceability and transparency of the research (Saunders, Lewis, & Thornhill, 2016).

3.6 Expected Impact of the research

The direct impact can be measured in the short term. After lecturers refer to the findings generated during the research. Teaching practices can be shared with the target group in a broader context. Impact can be measured by discussion with those who have read the research report. At a later stage, those teaching in these contexts can be interviewed to see how the research findings helped their ongoing teaching practice. Students can be involved at a later stage regarding their perspective of their learning experience in this format.

Table 3 Overview of impact

Impact goal	Target stakeholders or publics	Reasons for being interested in the project	Activities to engage this target group	Indicators of successful engagement	Indicators of progress towards impact	Risks to activities and mitigation	Risks to impact and mitigation	Who is responsible and what resources are needed?	Timing
To help educators make an informed and reasoned choice when deploying the HVC/CC	Educators at Inholland	They will have the chance to teach in the hybrid classroom and this can help them decide whether to do it, and if so, how to do it best.	Involve in the interviews, focus group and research.	Number of educators that are involved, their openness to discussion, their adjusted choices and practice after involvement.	They use the guidelines developed as part of the decision whether to use hybrid, and if so, how to use it	Educators do not use the advice, or do not understand it.	Make it part of a structured process when choosing the format.	Didactic advisers, promotion internally via Inholland	Once ready (2022)
To help didactic advisers make an informed and reasoned choice when advising educators and planners who are considering deploying HVC/CC	Didactic experts and educational designers	To be able to give good advice and support to educators and planners	Inform them of the research process and progress.	They process, and actively apply the advice	Involvement and interest in the research.	Lack of information, information not visible, not a priority	Have clear communication of research process, inform, open channel for discussion.	Researchers, TLT	During research process (2021)

3.7 Ethical considerations

In designing and conducting the research, the Code of Conduct for Practice-oriented Research for higher professional education (Andriessen, Onstenk, Delnooz, Smeijsters, & Peij, 2010) was used. The results from the interviews were processed anonymously (referred to as respondent 1, etc.) and can be traced back to the person for the 'member check'.

4 – Results

4.1 How the hybrid virtual and connected classroom is being used

Pedagogical
The HVC classrooms were being used in a variety of ways. To large and small groups. To deliver lesson content ('sending' information) with supporting PowerPoint slides, delivering instruction as preparation for in-class activities and livestreaming specific video content to the class to be paused and discussed by experts. Bringing in external experts (planned or at short notice) to give their perspective. There were individual and project group student presentations, a practical session handling a piece of scientific equipment and collaborative building of a web site.

Of the seven lecturers interviewed, four were using the Hybrid Virtual format and three the Connected Classroom format. This format is characterised as synchronous delivery from an expert (Fransen, 2020a). In one case, the online students were allocated the role of 'online jury' to discuss in their online group, then to give peer feedback to students who were presenting in the class. This format is characterised as asynchronous delivery with collaborative student learning (Fransen, 2020a).

Room set-up and configurations
Many different room configurations of both formats were used. Variables include room size, number of students and teachers, number and position of cameras, screens and microphones, the mix of students/teachers physically present in the same space and online and the use of moderators and student assistants. The software used was either MS Teams or Zoom.

Each of the seven lecturers interviewed had different room configurations. The four using the HVC had different class sizes. This varied from one student online with 4 students in the class, to 10 students online and up to 20 in the class. The HVC configurations were either specifically designated for that purpose, with specific camera and microphone set-up such as round table, voice activated to speaker, or were improvised as modified teaching spaces with microphones and cameras added.

Three lecturers used combinations of the connected classroom (CC). This involved teaching simultaneously to two rooms with 10 students in each, up to 7 rooms with 10 students in each. The teachers taught from a 'mother' room and communicated to the students through the screens in the individual connected classrooms. In two cases, the CC room layout required one student in each remote room to plug in their own laptop, to make a connection to the screen in the room so the students in their room could view the teacher in the 'mother' room.

4.2 How lecturers arrived at their choice

One lecturer had already been experimenting with HVC before the pandemic. The choice was made to combine and integrate two separate student groups (one in the Netherlands and one part of an international course). Another also saw this as an opportunity to bring two different student groups together, combining classes who would not normally be able to meet. Creating a richer mix within the composition of the classroom. One lecturer was developing the CC pre-pandemic to ensure clear synchronous instruction to all students before and during project group sessions. All other lecturers made the choice to facilitate 'Covid Compliant Learning.' Capacity in the physical classrooms was reduced so only 20% of students could attend in person. Teachers wanted to avoid students missing the large amount of class content in the sessions, so provided these options. Due to scheduling it was sometimes not possible to teach the class multiple times which meant practical solutions were needed to facilitate larger groups. Remaining students were provided online access to join the class. In some cases, students chose not to come to class but to attend online. This was for different reasons such as health concerns due to the pandemic, travel time, or other personal commitments or circumstances.

In most of the cases examined here, the circumstances of the pandemic were the leading reason for lecturers to teach in these formats.

4.3 Educational scenarios derived from educational goals

One lecturer brought experts into the classroom via the online format to discuss specific medical videos. Facilitating discussion between different student groups and the expert. Either the expert could not travel in person to the class due to their schedule or was only available between consultancies to join the class and share their expertise for 20 minutes. Two lecturers emphasised the importance of bringing separate student groups together who would not normally be able to meet, due to distance, scheduling or teaching availability. The online hybrid option made this possible.

Several lectures ran a flipped classroom format. Students prepared in advance and then discussed this in class. Students on one course watched an instructional video in advance about a piece of technical equipment. This equipment was then handled in class by the students, with the online audience viewing the interaction. In one CC context, students received instruction and then worked in project groups for a full day, with support from a project coach and subject expert. One lecturer provided information on statistics and then students worked on exercises and there was feedback and interaction between the student groups.

4.4 Support needed to help educators when teaching in these contexts

Pedagogical support
In several cases, the initial in-person classroom lesson was delivered unmodified, but with the addition of some students joining online. In three cases, teachers were the only teacher. In some cases, there was one or more technical support staff on hand. In other cases, there were more than one teacher, with different roles in each session. These included roles such as project coach and content expert. There were functional roles such as moderator and technical facilitator. Several lecturers mentioned the difficulty of keeping an eye on the chat within the virtual environment. Trying to do this on their own smartphone or another channel resulted in cognitive overload and difficulties in delivering the lesson content.

Technical support
Support was needed to book and schedule the actual classrooms. Help was needed before the session to practice and experiment with the classroom set-up and technology. In some cases, student assistants were paid to provide the technical support. Additional help was needed manging the audio quality, cameras, lighting, cable connections, laptop docking stations, external microphones and other hardware and resolving software issues. Logging into the correct online session, software and account issues were mentioned as challenges, particularly when multiple sessions were open at the same time. This resulted in some 'audio feedback' due to lag time between devices. In one of the CC configurations, one student per room was required to use their own laptop to log into the class screen for the benefit of students in that class. Teachers mentioned that it is important to have designated equipment provided by the university to resolve this situation. Online support sessions were made available by the service desk which one lecturer used for setting up the learning management system in the specific context of the CC.

4.5 Teachers' experiences of teaching in these contexts

Pedagogical

Several teachers mentioned the opportunities to bring student groups together which enriched the diversity of the student mix. It was also mentioned several times that the split attention makes it more difficult to teach the two groups. Teachers 'like to see the eyes of their students' and miss the energy and seeing the feedback. This can make it very difficult to engage students who are online into the discussion via the screen. The teacher can follow the non-verbal signals in the class but not so easily online. Teachers mentioned the desire to speak to students directly and to engage them in the discussion. Additional effort was needed by the teacher (and the moderator) to create a safe and comfortable teaching environment. It required extra effort to keep an eye on the chat. One teacher mentioned there are less distractions in the live environment. It can be very difficult to get online students to turn their cameras and microphones on. And teachers mentioned it is hard to know what the online students are doing. There is little insight into the physical environment in which the online students are studying in. One teacher mentioned that the students joining via the screen may have less 'presence' in the physical class. Several teachers mentioned the importance of having a clear strategy for teaching in these classes. Learning activities often take more time than in a regular class. It takes additional time to switch between the students in the class, those online and to read and monitor the chat. It requires an adjusted lesson plan and teaching approach to make the class useful for all. And it costs more energy to keep both groups engaged. When a teacher 'shares their screen on MS Teams' this makes the video image of the teacher appear 'smaller' on the screen. This in turn requires more mental effort from the students to follow the teacher's explanation. The supporting non-verbal communication of the teacher becomes harder to see. Several teachers mentioned the challenge of creating an equal experience for both groups of students, particularly for those joining online. The pace of work of students in the remote or online classrooms was often slower than those students working in the room in with the teacher. Some teachers also mentioned the benefits of efficiency of time and resources when giving a class one time to a larger group.

Students

One teacher said 'For students in the classroom it is like watching a football match live in a stadium. There is high involvement, and the experience is more intense. For those following online, it is like watching a football match on a TV in a bar. You are following what is going on but are much less involved'. Many students attending online were appreciative and grateful that they could attend the class. Teachers received feedback that it was worth the effort. The students who were physically present in the classroom, had already travelled to school. This created an extra degree of engagement than those studying online. It required more self-efficacy and intrinsic motivation to stay focused when joining a class online. Students were often very hesitant to turn on their microphone and camera and join the class discussion via the screen. One teacher mentioned that it may require more effort for a student to say something online than when they are in the class. In one case, online students joining the screen in class appeared as a larger-than-life head on the screen. This can be socially awkward and made some students more reserved and hesitant to participate. Some teachers experienced less energy and interaction with the online students. And mentioned the difficulty of reading non-verbal communication. One teacher mentioned that the level of online student involvement could be affected by whether they were wearing headphones to help them concentrate. If students in class physically 'stand-up' for an activity, those online felt awkward joining.

Technical

It was a challenge for some of the teachers to manage all the technical issues of teaching in this environment. There was quite a steep learning curve to get the equipment set-up and tested. It was not always clear to those online, who the teacher was talking to or who in the class is talking. In a roundtable setting the camera automatically highlighted the person speaking. Teachers used the online forum and chat to create more interaction between the groups. Students often communicated within

their informal channels such as WhatsApp or Messenger. Some online students asked questions to the teacher in the room via the laptop of a student in the room. Or joined the class directly through a fellow student's laptop. In a connected classroom, if a student connected their laptop in one of the remote classrooms, the teacher only saw the name of the student who connected their laptop. They did not see the names of the other students in the room. This made personal interaction more difficult. When the teacher wrote on a board in the classroom, it was difficult to ensure that all students could see information written on the board. In one case, there were difficulties with the chat when not every student could access it. This made communication more difficult. Trying to open additional MS Teams session via the teacher's phone also proved complex.

4.6 Advice when teaching in these contexts

All those interviewed had suggestions based on their own practical experiences of teaching in the HVC or CC and the key points are summarised here.

Pedagogical advice

Advice for preparation, planning and choices
- You need to be well prepared. Plan your teaching activities in advance such as when you plan to switch between different groups, the online chat or the students in the room. Try to minimise these moments. Plan a variety of content and formats to keep it engaging.
- Create a complete and detailed plan for the lesson overview. Specify roles, learning goals, and timing. Specify roles clearly in advance if there are several teachers and know what each person is doing when. Provide a moderator to manage the flow of communication and check the chat.
- Have a very clear script for how the class will be run and who will do what and ensure all teachers understand it. Have roles clearly defined for all those who are involved.
- Make clear choices about what teaching activities are synchronous and asynchronous. Plan each class in the context of the whole curriculum. A live session must be a condensed version of a normal class. Plan carefully in advance specific activities for those in person and those online and how to engage them. Do not try to cover all your normal class content in this format.
- Make lesson content (slides) available to students in advance so it is easier from them to follow the class online.
- Practice in the HVC/CC as an actor would practice in a new theatre to get a 'feel' for it. Try to imagine what it is like to be the student online. Do a test run with a colleague where you experience this, so you know how the online students see your lesson.
- Do not use this format to give a long lecture with lots of information. Use content and then combined with exercises and discussions. Think very carefully before using the HVC/CC due to complexity, planning and additional staff costs.

Advice for classroom management
- Always ask a question first to the students online, then to those in the classroom.
- Plan to actively connect the two group to create immersive interaction.
- Since there is less non-verbal communication from online students, address them directly. Ask them to use the chat. Be prepared for less direct interaction from those online and work to engage them.
- Place online students into groups and place them in break-out rooms. Then allocate each group a separate screen in the classroom to make interaction with them easier.
- Consider having an additional teacher who focuses exclusively on the online students.
- Ensure that for online students that their audio and video works in both directions so they can be seen and heard.
- Use a quiz format (voting Yes or No by showing a red or green object) to encourage students to switch on their camera.
- Ask online students to share their screen to involve them when they are presenting.

- Make it attractive to be at school. Do not make it too easy an option for students to choose the online option and stay at home. Give online students specific tasks to keep them actively involved.
- Encourage online students to ask their questions in class through a communication channel with another student.
- Ensure students joining the class via a large screen are not 'larger than life.' Represent them as normal size. Help students online to know what they look like on screen in the class so they can have better understanding of their presence and how to interact.
- Move between the connected classrooms to engage students and answer their questions.
- Have a variety of well thought out learning activities that encourage interaction and student involvement.
- Go ahead and experiment. Take time to get comfortable in the context.

Advice regarding technology

- There is a steep learning curve with the technological aspects. Practice in advance to get ownership and develop competence of the room setting. Meet the teaching staff before the lesson and go through all the technology checks and specific roles. Fully test all equipment in advance and practice with teachers in break out rooms. Ensure you are visible in the camera and can be seen and heard for those online. An automatic camera (e.g., on a round table) or tracking camera makes it easier to see who is speaking. Make sure you are standing in the right place to be seen by the camera and it picks up your audio. When the teacher is visible on a screen, choose appropriate font size, ensure good lighting and audio to reduce cognitive load for students learning. Where possible, have automated tracking and zooming to capture teacher movement.
- Use only one log-in to the MS Teams session to avoid causing audio feedback in the room. Ensure good sound coverage for the whole room. If the teacher is at the back of the room, ensure a good clip-on microphone so the audio is clear. Mesh microphones hanging in the room can be used to pick up student questions in the room so those online can hear them. If you set up the sound incorrectly you get feedback which can be difficult to resolve.
- Without the correct classroom equipment, it is difficult to provide an equal experience in person or online. The technology should be arranged by the institution and not rely on students bringing the right equipment for other students to learn.
- Encourage students to open their own backchannel for communication (MS Teams, WhatsApp, or chat).
- A teacher may feel they do not have adequate hours to prepare in an HVC/CC setting and this needs to be facilitated.
- Use a room that is flexible and allows different layouts and arrangements.
- Involve students (paid) to provide technical support.
- Make sure the teacher is visible in a large enough image when on the screen (particularly if screen sharing).

5 – Conclusion and recommendations

5.1 Conclusion

In this small-scale exploratory research, the current use of the hybrid virtual and connected classroom within Inholland was examined. Even before the pandemic, a small number of innovative teachers were already experimenting with the HVC/CC. And Inholland had already been developing and trying out variations of the HVC/CC. The various terms described in the literature have (e.g., multi-location learning) have been described here as Hybrid Virtual Classroom and the Connected classroom. Due to the many variables and different formats, it remains complex to describe and compare the different configurations since each teacher had their own approach in their own context.

Once policy stated that fewer students were allowed to attend school in person, more teachers experimented with this format. It was driven by the need to continue providing education on campus but with less physical space. This resulted in several experimentations. The HVC was only indicated as a specific pedagogical choice in a few cases. Seven lecturers used various combinations of room settings, group size, and formats, using both HVC and CC. The two senior support experts interviewed gave a critical and realistic overview of the complex realities of facilitating this format in a short timeframe.

Teachers stated they needed pedagogical and technological support to teach in these technology rich classroom environments. In the current situation, those who agreed to be interviewed were either innovators or teachers who were already experimenting with technology rich learning environments before the pandemic. They have a need for pedagogical and technological support but are also prepared to experiment and try things out. Teachers agreed that they need additional preparation time that should be included when teaching these classes. When more than one teacher is involved, this requires additional planning and budgeting to ensure that moderators or student assistants are available. Accessing and booking classrooms of classrooms and having sufficient technological support is also essential. Teachers experienced the environment as being sometimes stressful trying to understand and manage the technical issues to communicate clear with students, being visible and audible in two-way interactions. Relying upon students to have the adequate technology for the class to function also proved an additional burden when systems, cables or devices did not connect properly. Reading and understanding the different groups, particularly engaging adequately with those online remained a challenge.

As outlined in the literature review, the use of these teaching formats allowed for increased accessibility and flexibility for students. It also allowed for continuity of instruction and interaction. Switching to fully online would also have been an option in some cases. Teachers mentioned that there was social interaction for those within the class, but not so much between the two different groups (online vs. in person) and minimal interaction between the online students. Use of blended learning approaches allowed for some classroom preparation to be covered in the asynchronous moment to allow for alternative teaching activities online.

Teachers explained that their students were grateful that they could attend online based on their own circumstances, travel time, health issues which has been described as an important element in the literature. This example of continuity of instruction (Bell et al., 2014) was mentioned in several of the cases. Several teachers mentioned the option to bring experts into the classroom who may not normally have been able to attend. Either as a late addition to the course, or simply for 20 minutes to share an expert option (Raes, Detienne, et al., 2020). In addition, several staff mentioned the benefits of efficiencies by being able to teach more students at once, thereby avoiding repeating lessons (Bell et al., 2014).

There is limited literature that outlines evaluating the teaching experience and effectiveness of the HVC/CC. In the cases studied here, teachers explained that the complexities of the pedagogical and technological challenges required a steep learning curve, investment of good preparation, and sufficient competency to function in the technology rich learning spaces. In the current situation, most teachers adapted to the pandemic situation to find a quick solution, or to develop experiments further. Optimising teaching and learning in these technology rich environments requires substantial investment in resources. These include time, equipment, training, and support which is highlighted by Sailer et al., (2021). The improvised and experimental approaches covered in the cases here show that improvising and experimenting is a good starting point for educational innovation. However, as part of a structured didactical concept, there is a long way to go before these formats are integrated into a larger scale educational vision.

It can be concluded that in order to optimise the Hybrid Virtual and Connected Classrooms, careful choices need to be made when teaching in these formats. In the case where this format is the result of a pedagogical choice linked to specific learning goals, then continued experimentation and practice can lead to enhanced teaching and learning opportunities. In the case where these classroom formats are a result of external factors (the pandemic and classroom size), then the learning goals and the use of synchronous teaching time should be carefully considered before using these formats. To optimise these classrooms, it is beneficial to reconsider the format of lessons, and which learning goals are linked to which learning activities in the synchronous learning moment. Rather than simply copying a regular lesson into this format, the structure and approach to the class can be redesigned and rethought to optimise the affordances of the Hybrid Virtual and Connected Classroom.

5.2 Recommendations

The teachers interviewed provided several tips and suggestions regarding planning and teaching in these contexts. In general, teachers advised only teaching in this context when it was necessary, or when carefully planned. The hybrid virtual and connected classrooms can be used in situations when there is limited space, or when health restrictions require it as an option. The HVC can be used to bring in guest speakers and to bring different group of students together who may not normally meet encounter each other, to enrich the learning environment. However, since the pandemic, much experimentation has taken place and new equipment, room configurations and options are continually emerging.

The CC can be used when there is limited space for teaching based on group size. The centralised instruction from an expert can be used to ensure efficiency and consistency of message for all students. However, when a larger room is available and a suitable flexible learning space, this instruction could be provided in one central room with students being supervised by coaches. It is recommended to only use the HVC set-up when necessary. Due to the complexity of the technical and pedagogical requirements, this format should be used when there is sufficient training, adequate equipment, enough support staff, and a clear goal for this format. Where that is not the case, it would be an option to decide either to teach the class 100% online, or 100% in-person. The complexity of using these formats, and the additional time needed to do it properly, should not be underestimated. An ongoing dialogue with teachers, support staff and especially students, should be an integrated part of any further implementation in this format.

5.3 Discussion

As one teacher mentioned, 'Teaching like you would in a regular class really does not work online. So, it also does not work in a Hybrid Virtual Classroom. Because you are basically teaching an online class when you are in a classroom.' (Respondent 2). This quotation captures some of the challenges of teaching in the hybrid classroom. We may naturally default to familiar teaching habits, but the situation is different, and an adjusted pedagogy is needed. It becomes clear that hybrid may at first appear a simple solution, is in fact more complicated at many levels. As one of the senior support staff mentioned, 'It is an illusion that you can walk in, and the technology will all work automatically.' (Respondent 9). It is important to create realistic expectations with staff and management about what

is possible and can realistically be expected in these contexts. It should certainly not be viewed as a quick fix.

These formats should be used when choices are based on a pedagogical vision. In the current pandemic situation, creative and practical solutions were implemented, and some of the experiences are referred to in this report. The process of optimising teaching and learning in the hybrid virtual and connected classroom requires further research regarding measuring learning differences. Some of the questions that can be explored in future research into the hybrid virtual and connected classroom are:

What is the difference in learning between students online and in the classroom? How do practical issues of room allocation, costs, and sufficient support impact the optimal delivery of the lesson from the teacher? What additional pedagogical adjustments and techniques can result in more proficient and fluid interactions and increased learning to enrich the student experience in their ongoing educational process? Which learning goals should be managed in which learning contexts? How do pedagogical approaches need to be adjusted to maximise the learning outcomes in these contexts?

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7 – Appendix

Appendix 1 - The Hybrid Virtual Classroom in Seven Minutes
A Summary of some of the report findings presented in the format 'The Hybrid Virtual Classroom in Seven Minutes'.

What is it?
In a Hybrid Virtual Classroom (HVC), faculty and students interact in person in the classroom, while at the same time, being joined by students online who are synchronously present via a screen. Synchronous hybrid virtual classrooms 'have been designed to connect both onsite students and remote students during synchronous teaching' (Raes, Detienne, Windey, & Depaepe, 2020). This format has been used in some universities for several years, either as experiments or part of their longer-term educational vision.

The set-up has some similar components to an evening news programme. The host interacts with guests in person in the studio while also interaction with those online via a screen. A structured exchange of ideas and discussion can be facilitated between those in person and online. In the educational context this allows faculty to reach students in the class and online synchronously. Terminology for these classroom configurations is still quite fluid and is in the process of being defined. This format is sometimes referred to as Synchronous or Simultaneous Education or the Hybrid Classroom.

Why you need to know this?
Use of the Hybrid Virtual Classroom is part of ongoing educational innovation. Some higher education had already been experimenting with this format. The HVC had been used to manage overcrowded lecture rooms. If a lecture room was full, students could go to a second room on campus or follow the class from home, as it was live streamed. This option has been seen by some as a possible solution to make education more flexible. So that students have freedom can choose to attend a class in person or online. Faculty and support staff have been improvising and finding their own creative technical solutions to serve the in person and online students simultaneously. Once restrictions were placed on teaching in person during the pandemic, not all students could attend class in person. Classrooms had reduced capacity. In some cases, the HVC was used as a short-term solution to logistical issues. The pandemic conditions may have resulted in a compromise in some cases. Finding a technical solution to a logistical challenge, without always being able to deliver a suitable educational solution. Higher education continues to experiment with this format building on previous experiments or setting up new formats from scratch. Understanding the pros and cons of this format can help faculty make better choices when considering when and why to use this format. And understanding what technical and pedagogical support is needed when teaching in this context. Traditional educational formats may be being squeezed into formats that are not appropriate. Facilitating new educational environments is technically possible with online and hybrid environments. The pandemic has broken open traditional structures within higher education and is challenging our shared mental models about what higher education should be. The quick implementation of the HVC under stressful pandemic conditions, has forced higher education to reflect more deeply on the type of education and purpose of teaching in person online. While it has not been easy until now and has met with creativity and energy to make it work, it is an area that we can refine further and develop as part of an enhanced pedagogy in higher education.

How does it work?
The faculty and students in the physical location are connected via camera and audio to the online environment. Students attending online join the class via screens in the classroom. Two-way interaction between those online and in the class is enabled. This can be through audio/video, or via a back-channel, such as a (moderated) chat. Lecture slides, demonstrations and course content are visible to both groups. A simple and low-tech approach involves faculty running an online session from their laptop and communicating with students on their screen via their laptop video camera, and in person with the students in the class. This format has limitations based on the number of students, the

size of the classroom, the location of classroom microphones, speakers, and screens. Technical solutions increase in complexity to high-tech classroom infrastructure and technology rich learning spaces. This can involve several cameras (either automatic motion sensor, or with camera crew), microphones, speakers, screens and additional support staff to support the technical production and to manage the incoming questions. To run an HVC, the following components are needed. A communication platform through which the interactions take place such as MS Teams, Zoom or Google Classroom. Adequate microphones to pick up what the lecturer (and students in the class) are saying. Appropriately placed screens in the classroom to allow the online students to be seen by those in the class and by the lecturer. Camera(s) to capture the lecturer's face, non-verbal communication, movements, and teaching space to show the blackboard or interactive whiteboard. Additional factors influence the exact room configuration. These include the number of students in the classroom and online, the size of the room and the number of classrooms that need to be equipped. Simplifying the technical complexity for the teacher is a challenge. In an ideal situation, a lecturer would enter the classroom, plug in their laptop, touch the screen and the session would start. They could teach their class as normal, interacting with those online as if they were in the classroom. However, due to the technical and pedagogical challenges, the reality is often different. Additional support staff and some technical set-up time are required to ensure the learning experience is of a sufficient quality for all students.

An example in practice

Five years ago, two of the medical master programmes at Inholland developed a synchronous hybrid virtual classroom for part of the course at the Haarlem campus. Both courses had 20 students per class. On the first course, the majority of the student were in class, but were joined online by a few students in Aruba. On the second course, a group of 10 Dutch students following one master programme were joined by 10 students following another masters but located in different international locations. A round-table camera was set-up which could accommodate this specific student numbers in class. The camera was voice activated so the speaker in the room was automatically in view when they spoke. Good quality microphones were installed and a large screen for displaying the online students. This classroom context was only used for certain learning sessions. For classes that focused on interaction, discussions and sharing options from different experts and perspectives. In another course, it was used by an expert who was streaming medical videos while giving a live audio explanation in real-time about the video. This could be stopped and discussed by those in class or online. Before the lessons, preparation and assignments must be completed by students. The synchronous classroom sessions were only used to discuss the work prepared and to foster interactions and discussion between the students and experts. There were several reasons why the hybrid virtual classroom was used. Students were located across Europe and the Caribbean. Several students studying part-time in the Netherlands could not make it to class based on their work schedule. This allowed for two different master programmes to be combined which had some logistical and financial benefits. It also enriched the learning context by allowing practitioners from different disciplines, who would not normally meet each other, to give a wider range of insights into the cases discussed. Before starting, teachers practiced in advance with this set up, and adjusted the technical and pedagogical approach during ongoing iterations, while experimenting with technical and pedagogical configurations.

What should you pay attention to?

If you will be teaching the two groups synchronously, then ensure you have time to practice in the actual classroom. Also, try to experience yourself what it is like to follow a synchronous session online as a participant. What you can see and hear and the degree you are able to interact fluently with those in the classroom. Communicating equally with the two separate group of students, those in class and those online, is often experienced as complex and tiring. Connecting the two groups and ensuring there is enough two-way interaction between the groups requires advance planning. One tip is to always address the online students first. Focus should be placed on creating a context in which students online and in class feel safe and comfortable to turn their cameras on and communicate remains challenging. Delivering the standard class with no adjustments to the approach may result in those online receiving a lesser experience than those in the classroom. Ensuring equity of experience for both groups is not straightforward. One-way delivery of lecture content does not always transfer

well to this format so consider other ways to manage the delivery of your curriculum. All technical aspects must be addressed, and the teaching approach modified to ensure the online audience is suitable engaged. Additional time is needed to train faculty and to practice. Time is needed to adapt lesson plans and modify slides and lesson content. Interactive elements such as synchronous discussions and quizzes can be included. The technical complexities and pedagogical adjustments needed mean that if this format is to be used, it should be sufficiently facilitated with time, and technical and pedagogical support. In most cases, a traditional lecture that involves one way communication does not translate very well to this environment.

How to start?

Firstly, pay attention to the specific learning goals that need to be handled in the session. Carefully consider which parts of the lesson need to be synchronous and whether some elements could be delivered asynchronously. Some content can be delivered asynchronously as pre-recorded video lectures, reading, case-texts, assignments and quizzes. This in turn require rethinking the use of synchronous classroom time. The focus can shift to more discussions, interactions, checking knowledge, developing and enhancing student understanding, and less sending. There are many new technical solutions being developed with smart microphones, tracking cameras, interactive screens, simple one-touch button operations being offered. However, these only facilitate the delivering of the lesson and will make the overall experience technically better and easier to implement, for those involved. However, this exposes us to questions about how the time is being used and what activities are taking place. We are learning and experimenting what works in this context and developing and enhancing our technical and pedagogical skills. We are at the start of journey of experimentation and discovery and each organisation is working to understand how and when it should offer this format to students and staff, and what support and training is needed. Evaluations and research into this are needed to develop this format further in an evidenced based context.

Appendix 2 – Interview Protocol lecturers

The attached protocol is for a 30–45-minute individual interview to be conducted via Teams.
Respondents are 6-8 selected teachers who have completed a short online survey regarding the Hybrid
Virtual Classroom.

Intro

Thank you for your time. We appreciate your input to share your ideas and contribute to the development of teaching practice within Inholland.

Interview protocol

The purpose of this research is to gain insight into the reasons why a teacher used the format of the Hybrid Virtual and/or Connected Classroom. To understand the exact formats of the different classroom set-ups used. How they prepared for it, what they experienced. And to collect tips and suggestions for other colleagues who will be teaching in this format.

Procedure

We hope that it is o.k. that we record the session. This data will only be used internally within Inholland for the research purposes. The data will be handled confidentiality and will be anonymized. Every respondent has the right to opt out at any point and no reason needs to be provided.

Aspect	Opening Question	Follow up questions
A. General Context	1. In the survey you explained [X], is that correct? 2. Please could you explain in a bit more detail exactly what type of lessons you gave and the context of the classes? 3. Could you explain the reasons why you used the format of the Hybrid Virtual Classroom and/or the Connected Classroom? 4. Could you explain a little more about your experiences in the HVC/CC/	<<Creating rapport and establishing continuity) • Location, course, year of study, number of students (in the room, online) • Please can you describe/sketch out the set up (on A virtual whiteboard/piece of paper). Camera angles, numbers of students, location, microphones. See 5 different scenarios visualized below)
B. Choices	1. What were the learning goals for the class?	• How does the context of the HVC CC contribute to the learning process? • What was the relationship with different learning phases of the students?
	2. What activities did you do during the class?	• For those physically present in the classroom • For those online? • Can you explain why you choose these activities? • To what extent did these activities enable you to reach the learning goals based in this context? • To have a 'conversation' with the students (Lauriallard)
	3. How did you manage interaction with the students online and in person?	• How did you experience this approach? • Which pedagogical issues did you encounter? ` • Did you have a moderator or colleague to help you with the interaction?
	4. What was your perception on how the students experienced the lesson?	• In the classroom? • Online/other classroom? • How did you evaluate or get feedback from the students?
	5. What does it ask from student to learn in this context?	• In class • Joining the session online
C. Teaching Process	1. General question: How did you prepare for this class?	• How much do you believe in your own self-efficacy? • How would you classify yourself regarding the knowledge and skills to design, teach and evaluate hybrid virtual classroom lessons? • Did it cost extra time?

		• Extra work?
	2. In what ways was this preparation different to your normal preparation?	
	3. What additional support did you get when preparing for this class?	• Technological • Pedagogical • Other
	4. What technical and/or pedagogical issues did you encounter?	• How did you solve those issues?
	5. To what extent do you think that the invested time and effort was worthwhile?	• Can you explain in more detail? • Could you give an example
	6, How did you experience the classroom you taught in?	• To what extent did the classroom match or fulfil your needs?
D. Reflection, advice, tips	1. Based on your experiences, what would you recommend to other teachers?	• What would you do the same? • What would you do differently? • What would you recommend to other colleagues?
	2. Can you suggest the three most important tips for your colleagues?	
	3. Based on your experiences, what other ways of using the HVC CC do you consider could be of value?	• Which context
	4. What have we not asked you about this subject that you would like to share with us?	

Conclusion
Thank you very much for taking time to share your experiences with us. We appreciate this. Based on your input, we will develop a set of tips for teachers teaching in these contexts. We will keep you updated on the progress of the research. If you have any questions, please do not hesitate to get in touch.

Appendix 3 – Research protocol – Technical Staff

Protocol individual semi-structured interview (ZW & JB)
The attached protocol is for a 30–45-minute individual interview to be conducted via Teams.
Respondents are 6-8 selected teachers who have completed a short online survey regarding the Hybrid Virtual Classroom.

Intro
Thank you for your time. We appreciate your input to share your ideas and contribute to the development of teaching practice within Inholland.

Interview protocol
The purpose of this research is to gain insight into the reasons why a teacher used the format of the Hybrid Virtual and/or Connected Classroom. To understand the exact formats of the different

classroom set-ups used. How they prepared for it, what they experienced. And to collect tips
and suggestions for other colleagues who will be teaching in this format.

Procedure
We hope that it is o.k. that we record the session. This data will only be used internally
within Inholland for the research purposes. The data will be handled confidentiality and will
be anonymized. Every respondent has the right to opt out at any point and no reason needs to be
provided.

What have we learned from the interviews so far?

1 – In most cases implemented as the only option under Emergency Remote Teaching.
2 – Or, as a teacher experimenting
3 – Technical issues – Sound in all rooms, student laptops, seeing the teacher
4 – pedagogical issues – adjusted or unadjusted lesson approach. Size of faces on screen.
5 – Emergence of new opportunities (e.g., online dragons' den). Enriching for future.

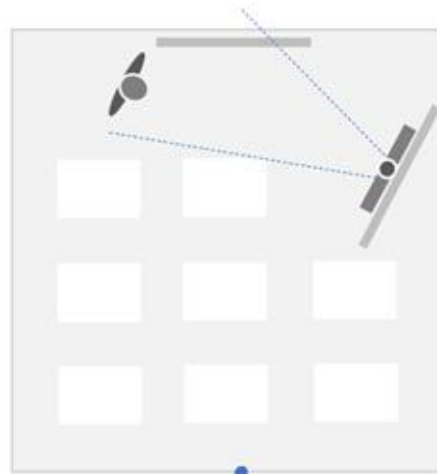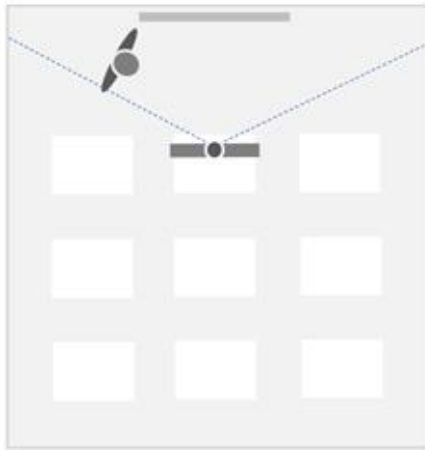| Aspect	Opening Question	Follow up questions
A. General Context	4. Please could you explain in a bit more detail exactly the context of the HVC/CC at Inholland since the start of 2020? 2. Could you explain the reasons why these formats were developed by Inholland? 3. Could you explain a little more about your experiences of supporting teachers in the HVC/CC/	• Is the overview below a complete representation of the different locations and formats where HVC/CC can be used at Inholland? (Ask this question by email!)
B. Choices	1. What types of learning and teaching activities were covered in this context?	• How does the context of the HVC CC contribute to the learning process? • What were the goals of teachers when using this format?
	2. What was your perception on how the teachers and students experienced the lesson?	• In the classroom? • Online/other classroom?
	5. What does it ask from students to learn in this context?	• In class • Joining the session online • Which pedagogical issues were encountered?

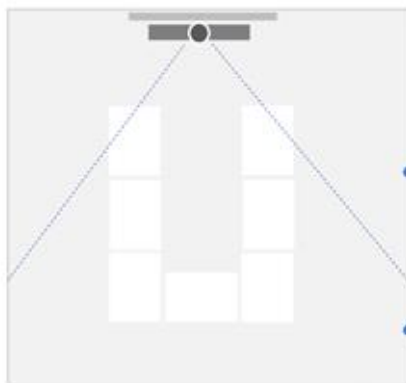| C. Technical Process	1. General question: How did you help teachers prepare for teaching in this format?	Could you give an example?
	2. In what ways was this preparation different to preparation you would provide for a normal class?	Could you provide some examples?
	3. What technical issues were encountered?	• What are the implications for Inholland regarding these technical issues? • How did you solve those issues?
	4. At what point is the invested time and effort in setting up and supporting the locations worthwhile?	• Can you explain in more detail? • Could you give an example
	5. To what extent do the facilities match and fulfil the needs of teachers and students?	
D. Reflection, advice, tips	1. What are your recommendations in this context to develop for the future?	• What would you do the same? • What would you do differently?
	2. Can you suggest the three most important tips?	
	3. Based on your experiences, what other ways of using the HVC CC do you consider could be of value?	• What future do you see for the HVC/CC within Inholland?
	4. What have we not asked you about this subject that you would like to share with us?	

Conclusion

Thank you very much for taking time to share your experiences with us. We appreciate this. Based on your input, we will develop a set of tips for teachers teaching in these contexts. We will keep you updated on the progress of the research. If you have any questions, please do not hesitate to get in touch.

Appendix 4 - Settings and Scenarios: Hybrid Virtual and Connected Classroom
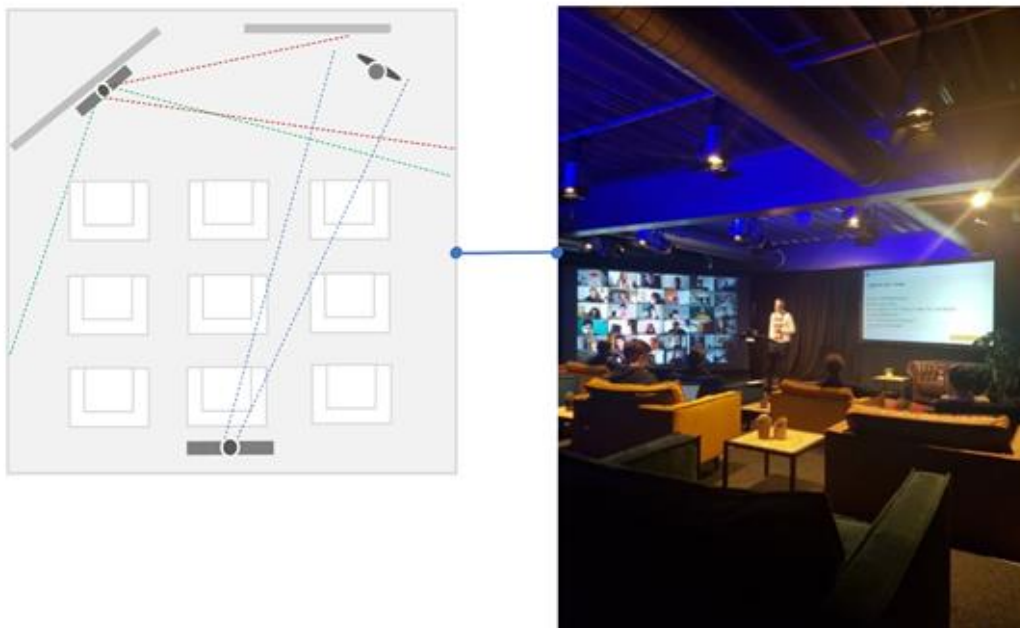
Scenario A – Hybrid Virtual Classroom

Scenario B – Hybrid Virtual Classroom
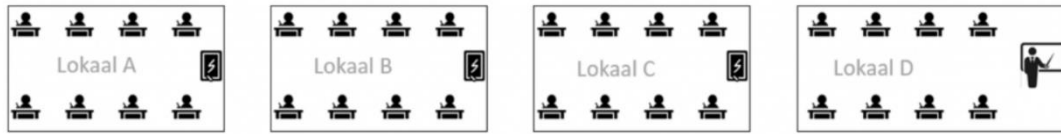
Scenario C – Hybrid Virtual Classroom

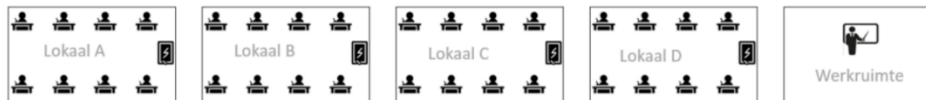**Scenario D – Hybrid Virtual Theatre**

(Illustrations courtesy of Frank Gombault)

Scenario E – Connected classroom

Scenario F: Connected with teacher in a separate workspace

Scenario G: Connected classroom plus students in a virtual workspace

(Illustration from Griffioen, 2020)