User Experience Design : Coursework 1

Part 1: Ethnographic Study

Abstract

This research study examines lecturer interactions and technology use in hybrid university lectures to determine their impact on online and in-person student engagement and inclusion. Using an ethnographic method, we carried out in-person and online lecture observations, and student interviews across a variety of hybrid lectures. Our findings show that in-person students receive more attention and opportunities to engage with the lecture, while online students experience passive learning conditions due to technology limitations and the lecturer's behaviours. This study highlights the challenges faced to ensure inclusivity for students in hybrid environments.

The Research Question

"How do lecturers' interactions and technology used in hybrid lectures impact online and in-person student inclusion?"

Methods

To answer our research question, we used participant observations to document real-time interactions in hybrid lectures, collected field notes and lecture recordings for further analysis, and conducted semi-structured interviews to gain student perspectives to examine the role of technology in hybrid learning.

Data collection

To collect data we separated into groups to observe various hybrid lectures, a student interview, and document field notes. The study took place over 10 days, covering a total of 8 hybrid lectures across different modules and different classroom/hybrid setups. The interview was with a 20yr old female student in her final undergraduate year. We focused on understanding real-time interactions between lecturers and students, specifically looking at the inclusion efforts from the lecturers to engage online students versus in-person students.

Data analysis

The data collected from observations, field notes, and interviews were analysed using thematic analysis *(Braun and Clarke, 2006)* to identify patterns in the lecturer-student hybrid interactions and to bring forward major issues. Observations were coded into categories and

field notes were reviewed to highlight differences in in-person and online students, while student interviews provided insight into individual lived experiences of hybrid learning. The different forms of data from multiple sources facilitated a comprehensive understanding of the inequalities and challenges surrounding hybrid lectures.

Observations

Lecture A

The lecture took place in a large hall with an online live stream via Echo360. Menti allowed in-person and online students to submit questions anonymously, but online queries were only addressed every 20-30 minutes, while in-person students received immediate responses. The lecturer would often check in on in-person students but not online participants.

The Echo360 camera is from a wide angle view with poor lighting, making it hard to see the lecturer's expressions. In-person students benefited from eye contact and physical presence, while online students lacked visibility and had no option to turn on their cameras. In-person questions were not always repeated, potentially causing a loss of context for online viewers. The lecturer responded to in-person behavior and showed no online engagement awareness.

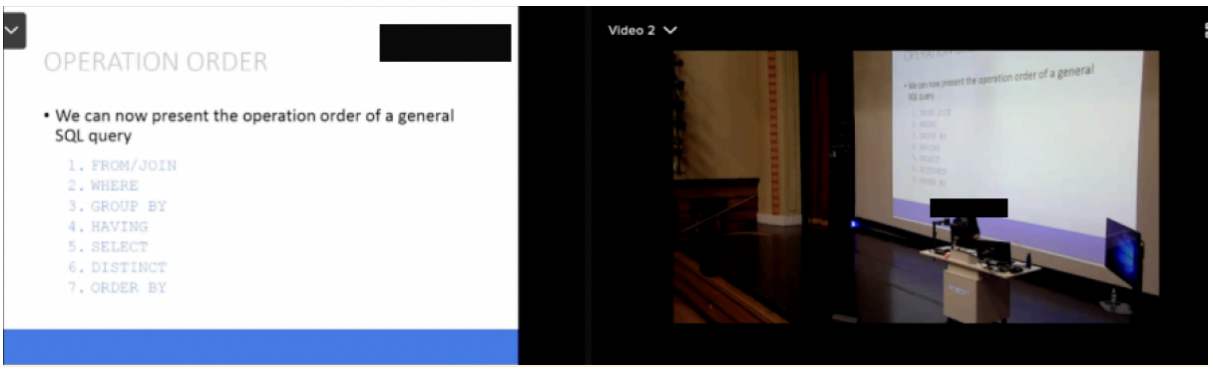

Figure 1 : Echo360 screenshot - student view of Echo360 live lectures

Lecture B

Lecture B took place in a large hall with an online live stream via Echo360. The lecturer did not carry out a sound check or acknowledge online students when commencing the lecture. Unlike Lecture A using Menti for questions, there was no tool for online students to interact. No chat, camera, or microphone to facilitate real-time interaction.

In-person engagement varied by seating. The lecturer focused on front-row students, occasionally making eye contact or asking them questions, whereas students in the balcony appeared less engaged. A student from the back asked a question, but the lecturer's answer was not repeated for the class or online viewers.

The lecturer stayed near their laptop, likely to control slides, which led to students seated on the side near the laptop for interaction. The session ended without any engagement from online students.

Lecture C

Lecture C took place in a medium sized hall and was live streamed on Zoom. There were technical difficulties when the lecturer was unable to utilise powerpoint tools to point at the screen, the captions lagged on Zoom, and the current lecture slide was not visible on Zoom.

The lecturer encouraged engagement by conducting a 2-person experiment, an activity which favoured in-person students. Despite the lecturer using Menti, and inviting students to interrupt to ask questions, only in-person students frequently asked or answered questions, and participated in experiments. Online students did not participate in these ways and the one online student who asked a question was not answered by the lecturer.

Lecture D

Lecturer D was streamed via Echo360 and Teams with 40 in-person, and 11 online students. The lecturer was muted for five minutes with no audio check for online participants.

Front-row students engaged actively, but those in the back struggled to hear as questions were not repeated. Online students had no way to participate, with inactive chat and no cameras used. Some in-person students therefore relied on ChatGPT to clarify concepts as they struggled to ask the lecturer.

Teams captions were inaccurate for technical terms and casual speech, but no adjustments were made. The session ended without any interaction with online students.

Student Interview

Interviews with students revealed similar patterns to the observations. Students reported feeling disengaged during online lectures, often opting to watch recordings later rather than attending live. They noted that online lectures felt more like a broadcast rather than an interactive learning experience, especially due to limited participation options and lecturer focus on in-person students.

Analysis

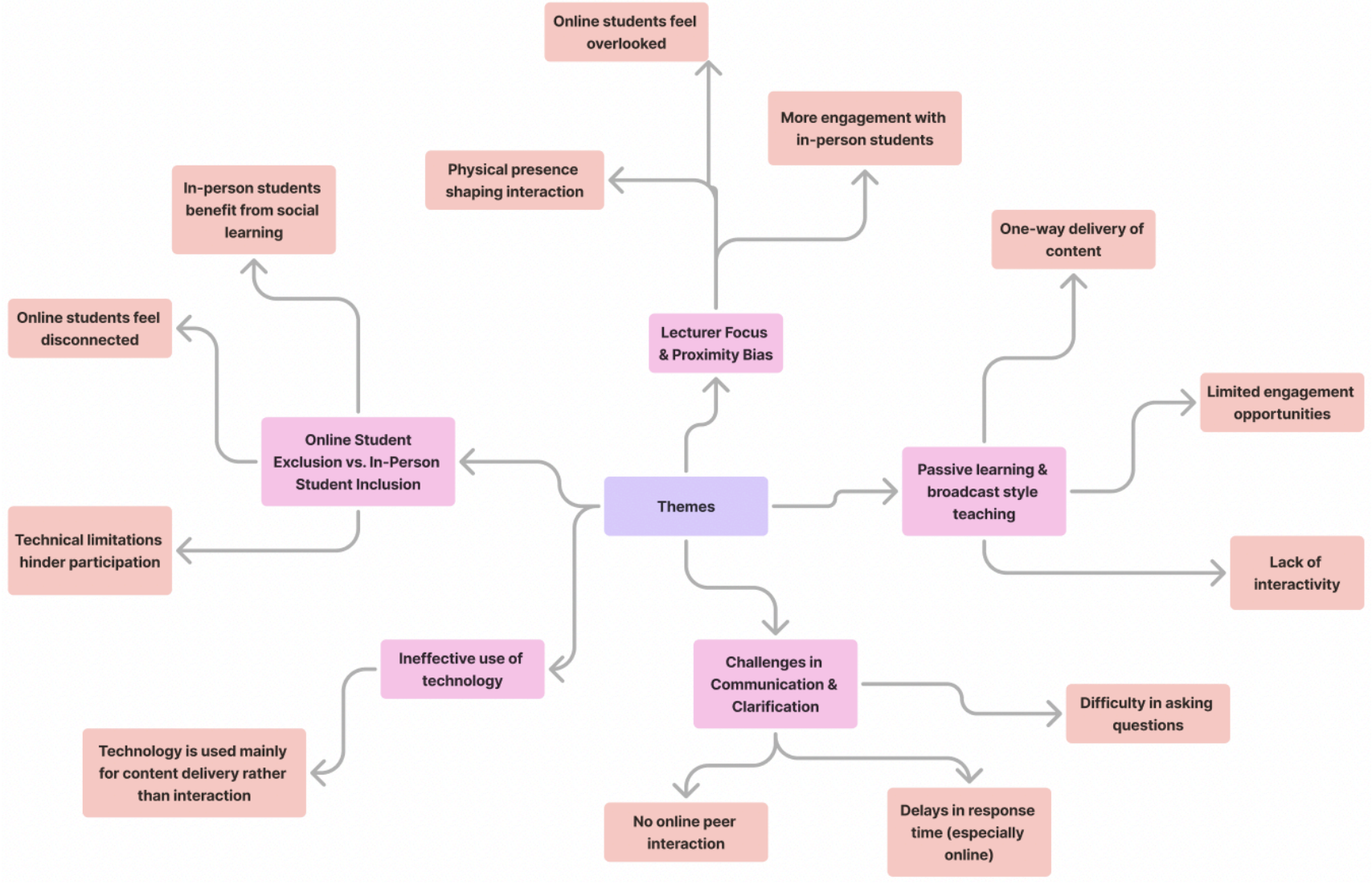

Figure 2 : Thematic Analysis Themes Mindmap

Passive Learning & broadcast style teaching

Hybrid learning often creates a passive learning experience for online students, who function more as spectators than active participants (*Montgomery College, 2020, as cited in Werang & Radja Leba, 2022*). Without camera, microphone, or interactive chat options, online students experience one-way content delivery rather than a true learning experience. Additionally, the wide-angle Echo360 fails to show lecturer facial expressions and gestures, making it harder to interpret meaning *(Faturrahmi, 2025).*

From a phenomenological perspective, this makes online students feel detached from the lecture environment as they miss out on any level of human-interaction, making lectures feel impersonal. Student A expressed this feeling stating:

"It's easier to watch later at a convenient time…Echo360 videos are hard to follow and very boring."

This suggests that online students often opt to watch recorded lectures later, treating them more like pre-recorded broadcasts rather than engaging in real-time learning.

This disparity reflects a major UX challenge in hybrid learning—while in-person students benefit from a collaborative learning environment, online students are often left in an individual, isolated learning mode. Without opportunities for real-time engagement, online students default to watching later, further reinforcing their passive role.

Lecturer Focus & Proximity Bias

Lecturer focus and proximity bias emerged as a key observation theme. Lecturers are typically concentrated near their laptops to change slides, so naturally focus on students closest to them, leading to unequal attention across the lecture space.

For online students, this issue is worse - lecturers often fail to check chat messages, do not notice raised hands online, and miss online students entirely when walking around the stage. Student A talked about this disparity:

"It's a matter of convenience… they have made the effort to go to that lecture so they are more inclined to give them attention."

Meanwhile, in-person students receive eye contact, direct questioning, and immediate feedback, reinforcing a hierarchy of inclusion where online students are ignored. A student explained:

"I prefer just an in-person lecture because it holds your attention better—you're being watched, so you can't get distracted as much."

The lack of attention creates a relaxed atmosphere for remote students, making them less likely to follow lecture norms they would have followed if they were in the room (e.g. talking during the session or multitasking).

From a phenomenological view, online students experience a sense of exclusion when the lecturer does not acknowledge their presence. Without eye contact, directed questions or verbal check-ins, online students may feel like passive watchers rather than lecture participants. Observations confirm this, as one session recorded *"Lecturers rarely acknowledge online students, occasionally glancing at the laptop but only addressing the physical audience."*

Online Student Exclusion vs In-Person Student inclusion

Online students are often excluded from lecture activities because there is no easy way to interact - live-streaming platforms like Echo360 do not have a chat or camera. This aligns with findings that online learning requires students to be self-directed and manage their learning more independently than in-person students, making it easier to postpone engagement (*Montgomery College, 2020, as cited in Werang & Radja Leba, 2022*). In-person students can easily ask questions and receive instant feedback, but online students struggle to get noticed, with hand-raising features often being ignored as the lecturer does not focus on the streaming application's interface.

From a phenomenological perspective, online students feel invisible and disconnected from the lecture due to the lack of visual or verbal recognition and the dominance of in-person students. Observations show that lecturers fail to encourage online students to engage: "*Lecturers encourage in-person students to engage in discussions and experiments, while online students do not participate."* The lack of shared participation in group work, question and answer, quizzes, etc., leads to online students possibly feeling like they are just in the background and isolated from the lecture.

In-person students engage in public interactions, benefiting from verbal acknowledgment and group discussions. In contrast, online students are forced into a private mode of participation, where their engagement remains unseen and unheard, which can reinforce feelings of exclusion.

Ineffective use of technology

The observations show that streaming technology is used for content delivery rather than a means of promoting interaction. Shown in our observations in Lecture B, the lecturer did not acknowledge online students, and in Lecture D, the lecturer remained muted for five minutes, demonstrating a lack of attention to online students. Lecturer laptops are typically focused on lecture slides instead of the streaming/Menti chat. Furthermore, lecturer laptops are often silenced, with turned off notifications, preventing streaming applications from notifying lecturers of new messages. These factors contribute to the inability of online students to ask, or answer questions.

Online students are unable to answer questions in ways which could be alleviated through effective technology use. Applications provide mechanisms for students to raise their hands

online, which would immediately signal the lecturer. Furthermore, student understanding could be gauged through using reactions such as a thumbs up or down, which students also do not use. Cameras could be used to capture student facial expressions, and microphones could be used to mimic synchronous communication. Although, the fault is not entirely on students because part of why they do not use such functionalities is because they would not be seen by the lecturer.

Therefore, the failure of lecturers and students to leverage functionalities provided by streaming platforms hinders online student inclusion. The choice of technology in hybrid learning significantly impacts student experience. Platforms like Zoom offer more interactive features (public chat, hand-raising, camera use), whereas Echo360 enforces a private, passive lecture experience due to its lack of real-time engagement tools. This variation in technical design directly impacts the inclusivity of online students in hybrid lectures (*Montgomery College, 2020, as cited in Werang & Radja Leba, 2022*).

Challenges in communication and clarification

Online students do not experience the fast-paced, synchronous efficiencies of in-person communication and clarification.

In-person students can raise their hand, immediately gaining the lecturer's attention. Online students do not possess this physical presence, causing delayed interactions and lecturers awkwardly waiting for online students to type responses.

Online students also miss out on non-verbal cues that help lecturers know when to clarify a point. Lecturers can see confusion on an in-person student's face and rephrase their explanations, but online students have no way to signal their understanding in real-time.

The technical issues, unacknowledged chat messages, and failure to repeat in-person questions makes it difficult for online learners to keep up with discussions. This forces these students to seek alternative ways to clarify lecture content (e.g., using AI).

From the phenomenological perspective, online students experience a build-up of questions and misunderstandings which they struggle to get real-time clarification for. Without lecturers being able to provide immediate support, remote students feel disconnected, reinforcing the idea that their learning is secondary to in-person students (*Montgomery College, 2020, as cited in Werang & Radja Leba, 2022*).

Overall, asynchronous versus synchronous communication methods impact in-person versus online student engagement and inclusion.

Part 2: Design

Context

As gathered from the ethnographic study, there was a consistently emerging theme of proximity bias from lecturers. Lecturers often forget about the presence of online students as they focus on in-person interactions, navigate slides and move around while teaching. As a result, remote students experience minimal interaction, becoming easily distracted or dismissed.

Our Hybrid Presence Robot creates a multimodal representation of online students in the physical lecture space to address this. Robots are evenly placed throughout the lecture hall to ensure equal participation opportunity regardless of where discussion occurs. Having multiple ensures online students maintain consistent visibility and allows lecturers to engage naturally with remote students.

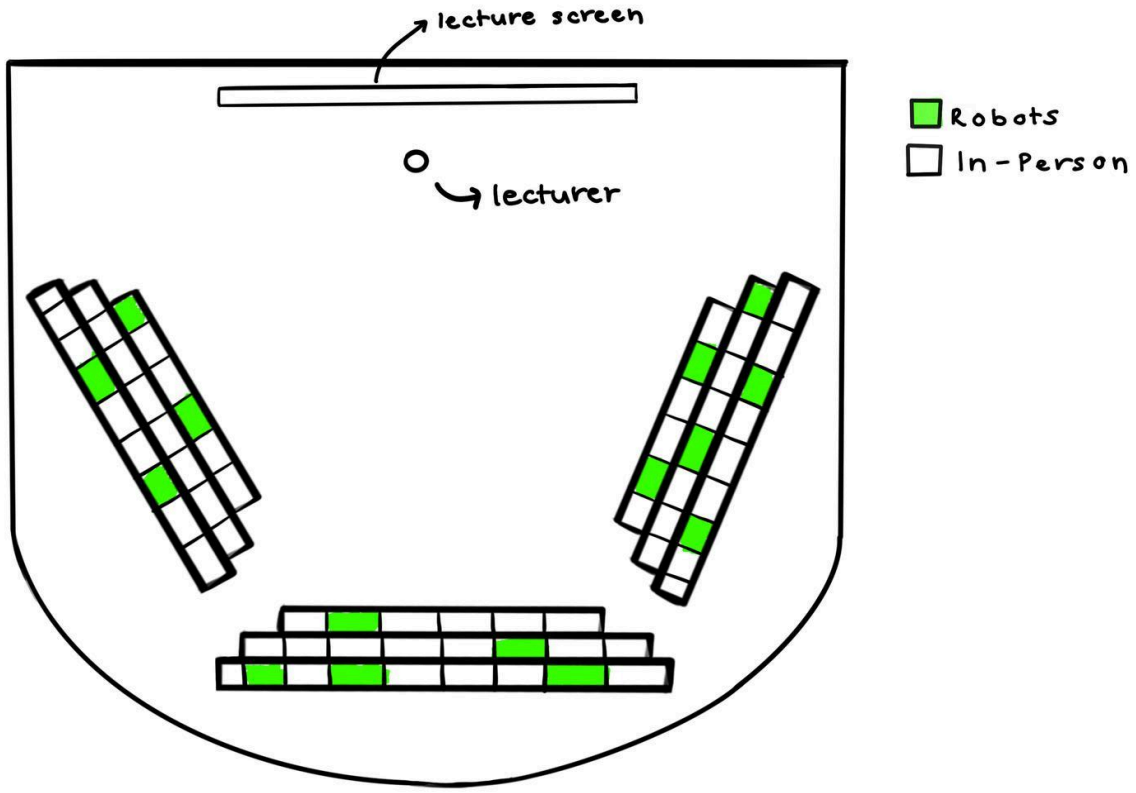

Figure 3 : Lecture hall

When a remote student wants to ask a question, the robot enables active participation rather than passive observation. Gunawardena and Zittle *(1997)* emphasise the need for “techniques that enhance social presence” in academic settings. Even with chat functions present, such as in Teams, online students still experience significant delays in receiving responses compared to when physically raising their hands.

According to Nigay and Coutaz *(1993)*, multimodal systems are characterised by processing and data fusion, enabling communication through multiple channels. Their research emphasises the importance of integrating different input modalities simultaneously. Our robot achieves this by combining the following inputs to create a comprehensive physical representation of the online student:

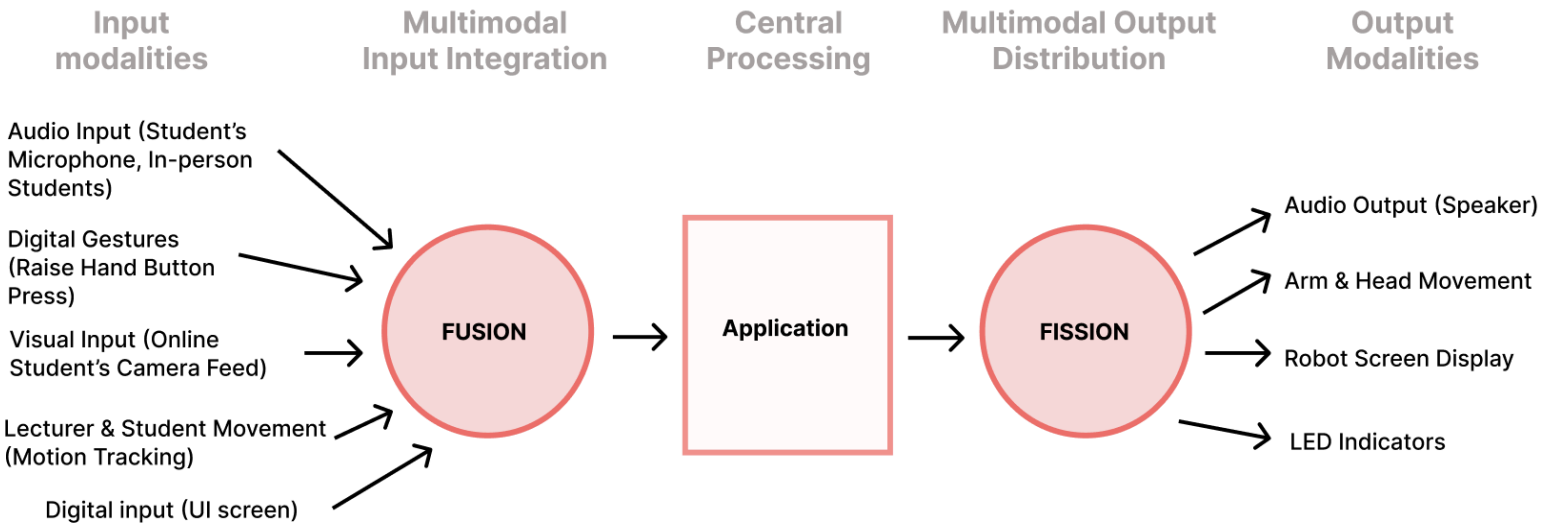

Figure 4 : Multimodal Interaction Diagram

- Audio input (student's microphone) → projected through the robot's speakers.
- Digital gestures (hand-raising button) → translated to a physical robot arm movement.
- Lecturer movement tracking → Robot head movement
- Visual input (online student's camera) → displayed on the robot's screen.
- Digital input (traffic light system) → LED indicator.

These outputs allow for different kinds of visibility and immediate feedback, design principles identified by Norman *(2013)*. For example, the LED indicators provide crucial visual cues about the students' status. Norman's design principle of visibility explains that "visibility is critical" for understanding what actions need to be taken. For the lecturer, the LED colour could signify when a student has a question, making the action visible and prompting the lecturer to respond. For the student, the system provides feedback through interface confirmation when they select their status, confirming their action has been registered.This ensures clear communication and usability on both ends.

The screen display automatically rotates between the connected online students, ensuring fair visibility and preventing students from feeling disconnected as they did when broadcast style methods were used. Additionally, this dynamic display helps address the issue of online students being unable to display 'non-verbal cues', such as facial expressions, which our observations found lecturers use to gauge student comprehension.

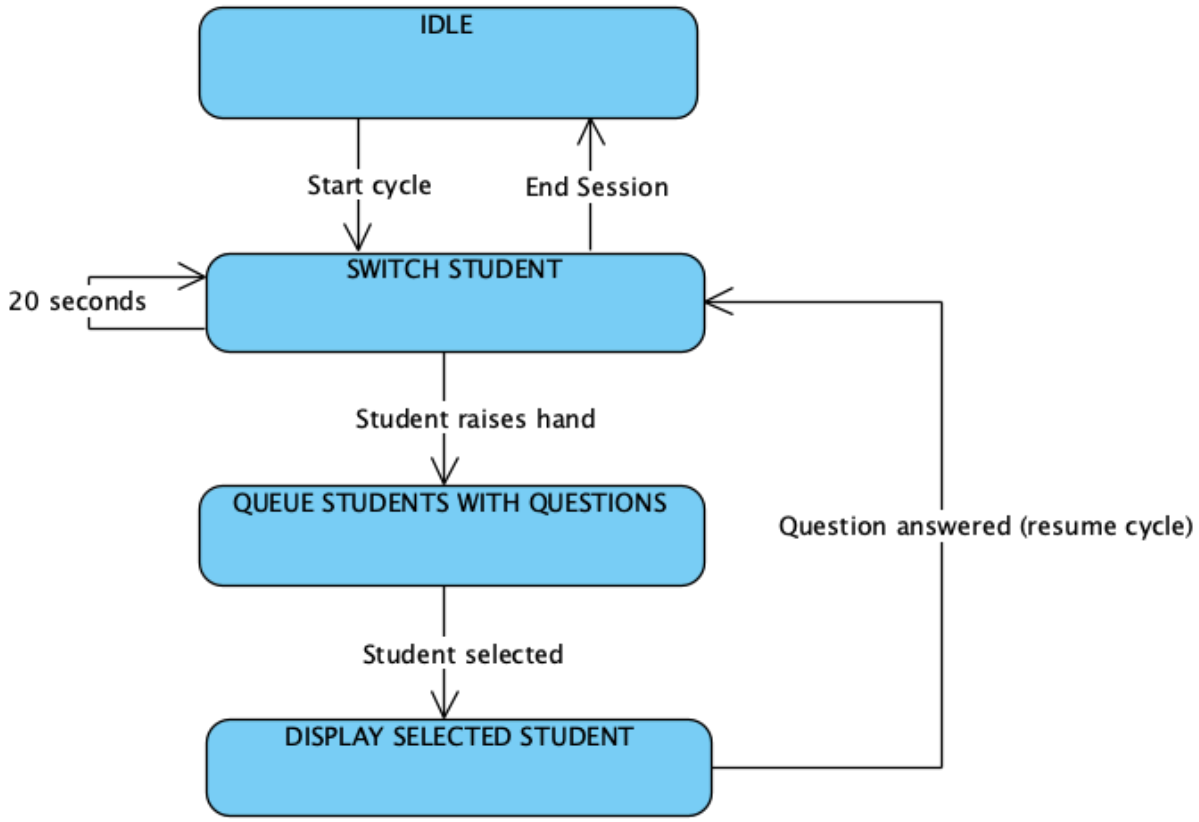

Figure 5 : State Diagram of Screen Display Switching Mechanism

The head tracking mechanism follows the lecturer's movement and turns toward speaking students, while omnidirectional microphones capture in-person questions that lecturers often fail to repeat. This creates an inclusive environment where remote students can follow classroom discussions and experience complete learning rather than receiving only partial information.

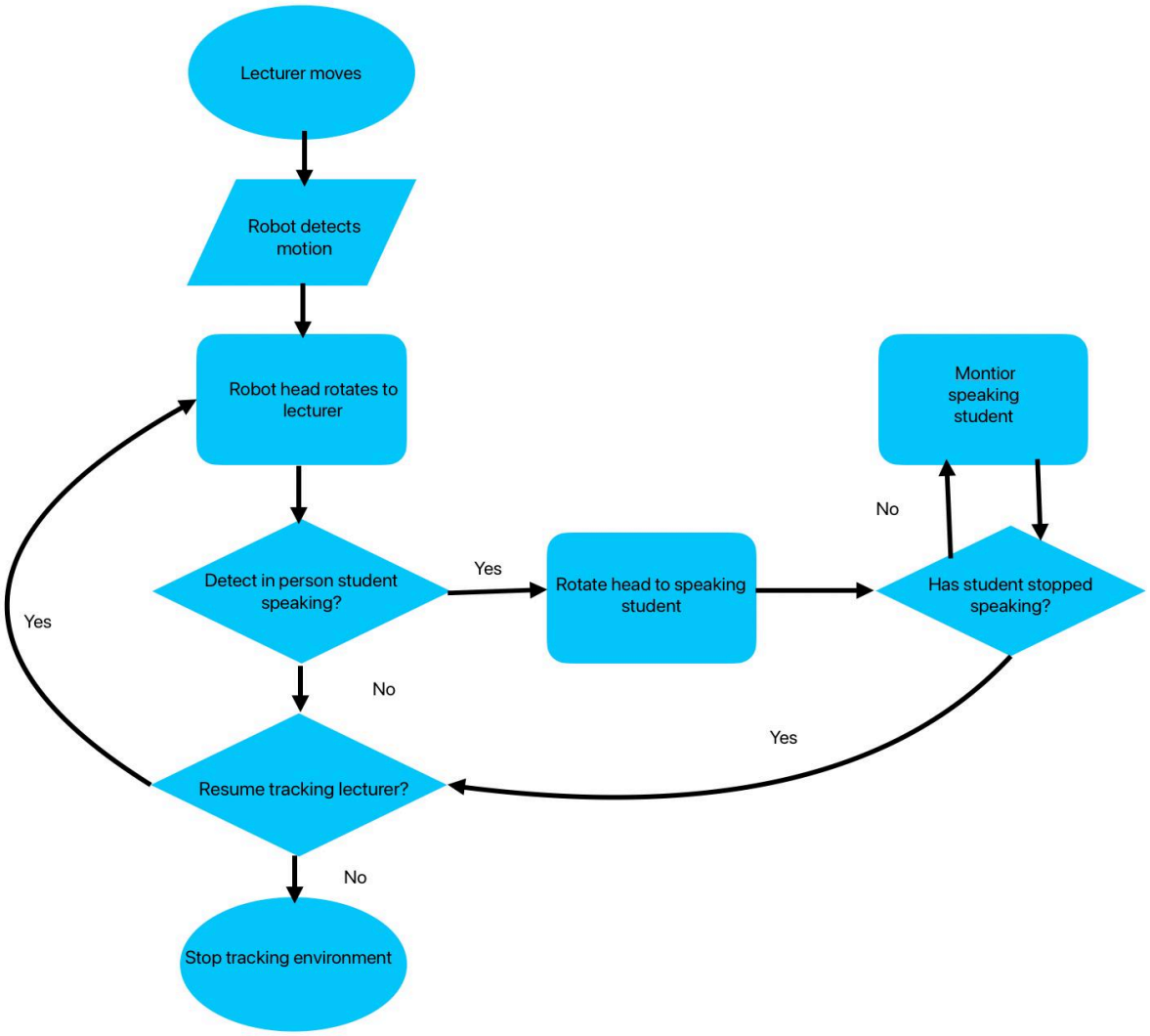

Figure 6 : Flow Diagram of Robot Head and Camera Tracking Interaction

Interface

Given our observations of current implemented technology: Teams, Zoom and Echo360, we were able to discern that it created a passive/broadcast style of teaching that failed to include online students and promote engagement. The design of the system aims to make the hybrid classroom inclusive for all students, providing equal attention and opportunities for real-time engagement within lectures. It's a multi-modal interaction system that takes in motion, audio, video, mouse/screen input to provide a physical, audio, video output to interact with the physical lecture. The interface provides the primary functions:

- Mute/unmute request system
- Camera on/off button
- Physical interaction system
- Student selection system
- Live stream of the lecture hall/screen and other online students
- An LED traffic light system that indicates their level of understanding (red = no understanding, amber = raise hand (for a question/interacting with lecture), green= understanding)
- Automatic rotation of online users on robot interface

Through a button on screen, users are able to provide consent for the data used for the system, this data is the same data already used within current implemented systems such as Zoom. Students are able to access their interface on their device through the application (see figure 7.1). Within their interface students can access the traffic light system through the option panel, a commonly used intuitive system used in physical classrooms that allows the lecturer to assess student comprehension. Students are also able to access live video streams of the lecture hall/slides and other students, giving them a virtual environment that simulates being in the physical lecture hall.
Students then can press the amber button (shaped like a raised hand) to raise the robot hand/turn on its led indicator to ask a question (see figure 7.2). In the event that the student is chosen to speak they are shown for the duration of the lecturer-student interaction, further promoting engagement and understanding between the lecturer and the student (see figure 7.4-7.8).

Students also through on screen buttons will be able to turn their camera on and off, giving the lecturer the opportunity to communicate non-verbally and build relations with the students they are teaching online as they would in a physical classroom. Multiple students share a robot and are rotated through periodically, using a green camera indicator to indicate they are being shown on the robot face (figure 7.1). Students on camera are given a lecture seat virtual background allowing the users to feel more comfortable being on camera and maintain privacy, therefore encouraging active participation.

The lecturer on their device's interface can easily select students using the green button or cancel with the red button, see the list of students that are waiting, or randomly select waiting students. These features aim to remove lecturer bias, allow them to see who they are interacting with therefore giving them the opportunity to further engage with them inside and outside of lecture (figure 7.3).

Part 3: Analysis

AI Virtual Study

The virtual study was conducted using the AI tool DeepSeek-R1 to analyse the ethnographic patterns in hybrid lectures. Input included previous observational data and tailored prompts. The AI was instructed to conduct a thematic analysis to identify key themes derived from the observations, and then prompted to design an interactive platform focused on user experience, addressing these findings. It was also specified that for the design it will propose, it does not need to be physically coded, and that the technology for it, does not need to be completely feasible in every aspect. This was important to allow the AI to understand the task in the same way we had been instructed to do it, prioritising actionable insights over generic solutions. Based on the ethnographic analysis findings, the AI proposed 'SyncEd' to address the key issues:

Technological Inequity

- Online students were passive observers with tools like Echo360 (no chat/cameras), contrasting with higher engagement via Mentimeter/Zoom.
- SyncEd's SyncPad **unified interface** - a shared digital layer, eliminates fragmented tools. It would replace the static Echo360 stream with interactions - integrating live polls, chat and cameras into a single platform to enable constant access to interactivity. This would force engagement by design, mirroring in-person spontaneity.

Engagement Disparities

- In-person students dominated verbal discussions, while online contributions were ignored (eg. 11-minute response lags).
- SyncEd introduces **Dual-Channel Q&A** - an AI-moderated queue merging vocal and typed questions, directly addressing oversight observed in 70% of the lectures. Gesture-based reactions (e.g confused buttons) allow silent engagement, replicating in-person students' non-verbal cues.

Hybrid Collaboration

- Group tasks excluded online students (e.g. in-person experiments)
- **HoloTable** - a **hybrid Augmented Reality/physical workspace** bridges this gap to allow students to join via avatars with access to shared interactive boards, mirroring peer interaction observed among in-person students (e.g. pointing at slides). This fosters seamless and equitable collaboration of online and in-person students in real-time, absent in the current setups.

Lecturer Overload

- Lecturers missed 40% of online chats while troubleshooting tech (e.g. 8-minute mic failures)
- **AI moderation dashboard** flags unanswered questions, auto-transcribing dialogue occurring in-person for online students. This reduces cognitive overload for both lecturers and students, eliminating reliance on external apps. A virtual teacher assistant feature, inspired by student reliance on ChatGPT for clarifications, would provide instant answers to repetitive tech issues.

UX Workflow

Automated pre-checks would resolve tech issues pre-lecture, preventing 23% of dropouts from setup delays. During lecture, a 360° smart camera would track lecturers, giving online students front-row visibility and hence reducing the reliance of post-lecture transcripts.

Comparison

Both ethnographic studies identify key challenges of the hybrid learning experience, particularly disparities in engagement between online and in person students. The AI's study addresses that online students were passive observers compared to their in-person counterparts, as they were frequently excluded from discussions as a consequence of technical limitations and lecturer bias. This aligns with the real study, which observed that lecturers frequently ignored remote students, especially when focusing on in-person interactions, or failed to identify technical issues such as muted mics, or screen sharing errors. Both findings emphasise the importance of addressing technological barriers and lecturer habits to create a more inclusive hybrid learning environment.

The differences in findings between the real ethnographic study and the AI's study primarily lie in their focus and interpretation of the challenges posed by hybrid learning. The real study emphasised the phenomenological experience of online students, highlighting feelings of exclusion due to a lack of visibility and interaction. It focused on lecturer proximity bias and ineffective use of technology, such as Echo360's limitations, which led to passive learning for online students. In contrast, the AI's study adopted a systemic approach, identifying tool fragmentation and technical barriers as the root causes of engagement disparities. The AI placed stronger emphasis on collaborative learning, suggesting that group work and peer interaction were lacking in hybrid setups. While the real study highlighted the social exclusion of online students due to a lack of interaction, the AI's study focused more on structural inefficiencies, such as laggy captions and underutilised interactive tools.

The differing perspectives are reflected in the proposed solutions. SyncEd is a virtual platform that leverages AR/VR focusing on structural issues such as tool fragmentation by enhancing collaborative learning by utilising features like HoloTable and AR avatars. This approach is technically innovative, which resolves the issue of collaboration present in the AI's ethnographic study. However, this theme is absent in the real study and lacks grounding in the observations provided as well as applications in large lectures with minimal

interactions between students. On the other hand, the robot focuses on behavioural fixes to improve interaction between the students and lecturers. By prioritising phenomenological exclusion present in the real ethnographic findings, an empathetic design is prompted to enhance online students' social presence in lecture environments.

The design direction of both proposed solutions are similar in their goal to standardise the experience between in-person and online students by enhancing online student engagement, despite their differing approaches. Both incorporate multimodal interaction to enhance communication: the Hybrid Presence Robot uses physical robots with screens and LED indicators to visually simulate online students while, SyncEd employs a 360° camera and AI-powered feedback to allow online students to remain visible. Both solutions prioritise real-time feedback, and minimise lecturer bias by offering tools that make online students more visible, such as SyncEd's AI moderation and the robot's hand-raising mechanism. Both address technical limitations present in the ethnography analysis by streamlining communication and reducing delays, resulting in online students receiving equal attention and opportunities for engagement. Furthermore, both designs incorporate automated feedback loops: , while SyncEd flags unanswered questions to reduce lecturer overload *(Sweller, 2011)* in large lectures the robot’s queue system may be less effective in fast-paced lectures where manual queue management could disrupt the lecturer's workflow. While the AI generated and real solutions are both theory driven, SyncEd focuses on Cognitive Load theory *(Sweller, 2011)*, while the robot aligns with Norman's principles of visibility and feedback *(Norman, 2013)*, enhancing usability through clearly given affordances.

SyncEd, while being a more scalable design, beneficial for larger institutions, its dependence on AR/VR makes it less suited for situated presence, facing high infrastructure costs and hindering accessibility in lecture environments with limited tech and budget support. In contrast, the real study's Hybrid Presence Robot is a more realistic and feasible physical hardware solution in a real-world setting, using modern technology and focusing on tangible interaction as well as immediate feedback.

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