Final Video: https://www.youtube.com/watch?v=vMxpfSsWL8E&feature=youtu.be

Homepage: (William)
https://whmcdaniel.github.io/

A. Task / Problem Definition

1. **Introduce your problem.** (Annie)

With COVID-19 closing schools, teachers and students have no choice but to transition to remote learning. As a result, the web conferencing software Zoom has rapidly become a popular tool for hosting virtual classrooms for students of all ages. Zoom allows both synchronous and asynchronous classes, but we will only be addressing the synchronous aspect. While there is a learning curve, most students in middle school and above are capable of learning how to use Zoom's features such as attending a Zoom meeting on their own, thus able to continue their education online. However, many students in elementary school and below are struggling to adjust to virtual classrooms and often require adult supervision for handling technological tasks or staying focused (Grinevičius and Tymulis). Consequently, primary school teachers are struggling to use Zoom as an effective substitute for face-to-face instruction (Blum).

The Seven Stages of Action for a typical interaction of a typical student using Zoom is as follows: a student's typical goal is to attend a synchronous Zoom class and stay engaged for the duration of the class. Engaging can include listening to the teacher, asking relevant questions, communicating with verbal and non-verbal cues like a thumbs-up, and participating in activities. To achieve this goal, the student should plan to download the proper software, complete the prerequisites for attendance, check to make sure they have access to proper hardware, and engage in class as described. Next, they specify the sequence of actions. If they are using Zoom for the first time, they should begin with downloading Zoom, creating an account if necessary, and setting a display name. For both first-time and returning users, they should retrieve the meeting link and meeting room password if available, adjust hardware such as the microphone and camera, and engage in class as described. Then they perform this sequence and perceive feedback from the computer like a message of a successful download, an incorrect password error, hardware issues, and difficulty in interaction with the interfaces, and they may interpret them as prompts to resolve the problem or continue if no issues arose. At the end of the meeting, the student compares how well the outcome matched the goal as well as how smooth the experience was.

The sequence described above has steps that cannot be followed by a typical primary school student without guidance of a parent or guardian. Overall, primary school students have limited motor abilities, spatial memory, attention, and working memory, and may be illiterate or have partial literacy (Liu). They also have limited technological knowledge and skills, thus need parental assistance for using Zoom's features (Mandel).

With this in mind, several interfaces are unsuitable or can be improved for these children. Certain unsuitable aspects include keyboard input, which is not ideal for children who have not developed the skill to type on a keyboard, and the assortment of affordances available to students, which may overwhelm or distract the students during a call and impose unnecessary responsibility to the students. Existing signifiers also rely solely on visual cues (icon and text-based label), which may be inadequate for visually impaired children. Additionally, it is common for children to be unable to stay still for a lengthy period without getting distracted or restless ("Normal Attention Span"). To remediate this, teachers often incorporate various activities into their lesson plans to keep their students interested. While Zoom has a number of interactive interfaces such as polling, whiteboard, annotation, chat, and screen sharing, the interactions can be short-lived, one-sided, or limiting in affordances. Furthermore, these children are at a crucial social development stage and need plenty of interaction between adults and peers ("Social Development"). Zoom affords visual, textual, and auditory communication between participants, but not without some limitations. For instance, all messages sent through the chat interface are displayed in a manner where a message can easily become buried and lost. Another example is the lack of feedback for the host from the breakout room menu, which forces the host to enter a specific room to hear the conversations within a room. In all, these factors pose challenges for younger students to succeed in remote learning.

2. **Identify your potential users.** (Nikola)

There are two main user populations that are affected by our problem of study. These two groups are younger, elementary-aged students, and elementary school teachers. For the students, their two main tasks are being able to join the Zoom meeting, and communicating with the teacher and other students. A solution to our problem would allow for students who may not be technologically literate yet the ability to use Zoom and streamline their experience with online learning. It would allow for students to communicate with one another more effectively, and they can focus more on their education and learning, rather than struggling with trying to set up their computer in order to join the Zoom meeting, or trying to get their microphone to work to respond to the teacher's questions. As for teachers, their main tasks would be similar to the students. They need to be able to join the Zoom meeting and be able to communicate with their students. It is reasonable to assume that most teachers at this point would be able to effectively complete these tasks. However, teachers also need to be able to control and handle their class in an appropriate manner. While this may be an easy task with in-person classes, how can a teacher maintain order in his/her class? While a teacher can easily mute a disruptive or loud student, how do they make sure that their students are on task? How do they make sure that students are continuously engaged with their activities? With a solution, teachers will be able to more effectively maintain control over their class. Teachers would also be able to ensure that their students are doing their activities and not getting distracted. This would also be of benefit to the

students, as their learning experience would be greatly enhanced.

B. Analysis of Existing Solutions

1. **Describe existing solutions.** (Rachel)

   The latest rounds of Zoom updates have semi addressed the issues educators previously faced with zoom, however issues of focus and social engagement remain an exhausting task. Zoom's latest updates allowed for improved learning through a more cognitive and interactive environment for students and teachers. These updates build upon the basic zoom chat, reactions, and virtual backgrounds. The first update is a polling feature that allows teachers to create a poll before the session and then record answers during class, this can help remind students to stay engaged during the session as well as allow a teacher to understand if students are understanding content or paying attention during class. Another feature that allows for teachers and students to interact on an increased level is the use of a shared whiteboard and annotation suite. These functions allow students to show teachers their thoughts or answers with both parties having the affordance of interacting simultaneously to solve problems or highlight notes that stand out in the classroom. Zooms current interactivity solutions like the chat and reactions buttons are helpful for communication within the classroom however, they still foster a distanced learning environment that doesn't involve aspects of face to face learning such as body language, physical signals (like nodding or hand raising), or a rhythm of conversation typical in a primary and secondary education. One of the largest updates that Zoom has implemented allows for new language learning assistance. This greatly improves the learning and listening experience on Zoom for those who need language interpreters. The drawback for this feature though is that the service must be requested and approved through Zoom before hand. Even though the latest Zoom updates have improved the learning experience for a few there is still a greater need for a specific Zoom learning environment if schools are going to continually use Zoom as the main form of education. The need for an improved platform should have the goal to reduce the hardships for parents needing to teach their children and allow educators and students to return to a more interactive and social learning environment.

2. **Describe potential guidelines and solutions.** (Paul)

   Zoom does not seem to follow or target any usability guidelines specific to children. Instead the focus is on providing a balance of features and usability fitting for adults in a professional setting. These solutions conform to general UI principles such as those highlighted by Microsoft for windows applications, ie. intuitive grouping of options and recognizable icons ("User Interface Principles"). All of this works well for teachers, but neglects the other half of our user group. Recent updates that may be relevant to children focus more on interactivity and expanding options for the teacher, ie. the polling feature, annotation suite, and shared whiteboard. This focus on interactivity addresses

part of our main issue, but does little for making Zoom more easily understood and usable by children under 12. Currently, Zoom has a single UI for all users meaning it cannot be tuned specifically to the needs of children - who have specific physical and cognitive needs (Punchoojit and Hongwarittorrn). Compared to adults or even older children, those under 12 have limited motor abilities, spatial memory, attention, working memory, as well as language abilities (Liu). A separate client / mode may be required for Zoom to meet this group's usability needs, similar to the simplified kids mode offered on Samsung Android devices. Additionally, it may be necessary for design to distinguish between kids aged 3-5, 6-8, and 9-12 as each can respond poorly to design intended for the other (Sherwin and Nielsen). However, this may overly broaden the scope of the project, so we will focus on options that are helpful for most age groups under 12.

Relevant Usability Guidelines regarding children (Sherwin and Nielsen):

1. Use animation and sound when appropriate to stimulate engagement.
2. Keep physical limitations in mind, make elements easily clickable and avoid keyboard usage as much as possible.
3. Avoid scrolling, relevant info must be on a single screen.
4. Keep options to a bare minimum to avoid confusion and redundancy.
5. Use easily understandable icons instead of text where possible.

C. Proposed Solution

1. **Proposed Solution**

We propose to improve engagement, usability, and socialization in Zoom meetings by making the following changes:

1. Engagement:
    a. Incorporate new features: multiplayer, mouse games and interactive presentations
    b. Provide an easier experience of sharing and streaming videos, which should be better than the existing screen sharing feature
    c. Decrease distractions
        i. Remove or restrict the option to change the virtual background and screen name (Widdicombe)
        ii. Give hosts the affordance to select and grant access for certain participants to access screen share, interactive presentations, whiteboard, and games at any time
2. Usability: a measure of how well a specific user in a specific context can use a product/design to achieve a defined goal effectively, efficiently and satisfactorily (Punchoojit and Hongwarittorrn).
    a. Create a simplified client for kids with fewer affordances.
        i. Remove some functionality:

            1. put mic and camera functions under parents tab or leave it solely to the teacher
            2. Remove the invite button above chat
            3. Remove the record button
        b. Make the signifiers better (i.e. give color to the symbols, read-out the name of the button when cursor is hovered over)
        c. Minimize keyboard input and maximize mouse/touch input
            i. Add speech-to-text that automatically mutes the user upon usage
            ii. Add sending audio recordings that automatically mutes the user upon usage
            iii. Add clickable word suggestions
    3. Socialization:
        a. Breakout rooms can be modified to include videos of all the participants, so the teacher can visually see who is engaged
            i. Group view feature similar to Microsoft Teams together mode
            ii. Transcript the conversations in breakout rooms to let the teacher see the conversations without joining a breakout room
            iii. Allow participants to afford using the whiteboard
        b. The chat feature can be organized to have threads for different conversations. Various signifiers can be implemented to make the different threads clear.
            i. Questions to the teacher can be highlighted to distinguish them from the rest of the chat and improve visibility
            ii. Names of the participants can be in different colors
            iii. Align your responses to the right
        c. In the participants view at the top of the Zoom meeting, participants who don't enable their videos may have an icon associated with them (instead of just a black screen), to make each participant more recognizable. Zoom will afford these associative icons that students may select.

While Zoom's newest update allows for greater interaction between students and teachers with the polling system, it may still prove to be difficult to use for elementary school children. The idea itself is great for increasing interaction, but it fails to meet with younger students' needs. Additionally, the update also allows for more interactive presentations by allowing teachers to use a shared whiteboard. This is additionally a great idea, but not enough to solve the issues we found in our research. Overall, our solution aims to make Zoom more targetable for young, elementary-aged students by increasing its usability and interactivity. Our proposed solution involves adding new functionalities and signifiers to the current Zoom meeting environment and revising existing solutions (ie. chat, breakout rooms, etc.) by imposing limitations to accessibility, modifying the organization, and removing some functionalities.

2. How will you measure success?

In order to test how distracted the students are, we could administer a pop-quiz after new material has been taught. If students perform better with the new interface, then our goal of reducing the amount of time students are distracted will be accomplished.

As for testing the useability of the new interface, we could ask students to perform various tasks, such as joining the zoom meeting or raising their hand, and measure the amount of time it takes for them to complete that task. We would compare the times between the older and newer interfaces and if it takes less time for the students to complete a task with the newer interface, then the goal would be considered a success.

Works Cited

Blum, Susan. "Why We'Re Exhausted By Zoom". *Inside Higher Ed*, 2020, https://www.insidehighered.com/advice/2020/04/22/professor-explores-why-zoom-classes-deplete-her-energy-opinion.

Grinevičius, Jonas, and Denis Tymulis. "11 Posts Of Kids Struggling With Distance Learning That Are Both Depressing And Hilarious". *Bored Panda*, 2020, https://www.boredpanda.com/kids-struggle-virtual-school-quarantine-zoom/?utm_source=google&utm_medium=organic&utm_campaign=organic.

Liu, Feifei. "Designing For Kids: Cognitive Considerations". *Nielsen Norman Group*, 2020, https://www.nngroup.com/articles/kids-cognition/.

Mandel, Bethany. "'Remote Learning' Is A Disaster, And Terrible For Children". *New York Post*, 2020, https://nypost.com/2020/09/16/remote-learning-is-a-disaster-and-terrible-for-children/.

"Normal Attention Span Expectations By Age". Brain Balance Achievement Centers, 2020, https://blog.brainbalancecenters.com/normal-attention-span-expectations-by-age.

Punchoojit, Lumpapun, and Nuttanont Hongwarittorrn. "Usability Studies on Mobile User Interface Design Patterns: A Systematic Literature Review." *Advances in Human-Computer Interaction*, vol. 2017, 9 Nov. 2017, www.hindawi.com/journals/ahci/2017/6787504/, 10.1155/2017/6787504.

Sherwin, Katie, and Jakob Nielsen. "Children's UX: Usability Issues in Designing for Young People." Nielsen Norman Group, 13 Jan. 2019, www.nngroup.com/articles/childrens-websites-usability-issues/.

"Social Development In Children". *Scan Of Northern Virginia*, 2020, https://www.scanva.org/support-for-parents/parent-resource-center-2/social-development-in-children/#:~:text=Social%20development%20refers%20to%20the,people%20and%20process%20their%20actions.

"User Interface Principles". *Microsoft*, 2020, https://docs.microsoft.com/en-us/windows/win32/appuistart/-user-interface-principles.

Widdicombe, Lizzie. "The Great Zoom-School Experiment". *The New Yorker*, 2020, https://www.newyorker.com/news/our-local-correspondents/the-great-zoom-school-experiment.