Milestone 4: Prototyping & Testing

Cheesy Bread

Members: Nikola Dimitrov, Annie Lim, Paul Arnett, Rachel Long, Will McDaniel

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A. High-Fidelity Prototype

A.1) Adobe XD files:

Prototype (Teacher):
https://drive.google.com/file/d/1O_ISelByG_tODwlV5KBEK7v523YkPD4X/view?usp=sharing

Prototype (Student):
https://drive.google.com/file/d/1QD377owbUF6XcNRrCE3se5TrrSl3Isu-/view?usp=sharing

A.2) User Stories:

1. As a teacher, I want to be able to distinguish types of messages within the chat, so that I can identify time sensitive information from general messages.
    i. Design Explanation: For this user story, our team decided that the best way to distinguish different types of messages would be by highlighting the color of the background of the message. We decided on three different types of main messages: questions, highlighted in red, answers, highlighted in blue, and general comments, with no highlighted background. We decided on using

color for two main reasons. Firstly, color was the best way to distinguish messages without reducing the readability of the message. Secondly, color has strong emotional connections. For example, we highlighted questions in red. Questions are typically going to be the most important messages that teachers will look for in the chat, and the color red is typically associated with urgency, or warning, which will cause the teacher's attention to immediately switch over to the question.

ii. Video: https://youtu.be/luEq3odGdqQ

2. As a teacher, I want the ability to share interactive presentations with my students, so that I can keep them engaged with the presentation.
    i. Design Explanation: For this user story, our team decided that the best way to increase interactivity and engagement with students would be to implement a "White Board Mode" in Zoom. This mode allows for both teachers and students to have an interactive area that they can perform classroom activities in. This can be solving math problems where students can show their work, drawing a picture, or playing games. By having the students do more activities other than listening to the teacher, they will be more engaged with the content, have a better learning experience, and have increased interactivity with the classroom.
    ii. Video: https://youtu.be/yOAd6wBxSOY

3. As a teacher, I want to be able to view all students screens' (video or image) during a breakout session, so that I can see which groups/individuals are engaged and on task.
    i. Design Explanation: For this user story our team decided that each breakout room needed to be immediately visible to teachers along with the individual students in them. We decided to separate the rooms into desk-like clusters similar to simulate the physicality of a real classroom. The shape and size can change dynamically, but they will always appear as separate clusters. Additionally we added colored borders to each group so teachers would have more visual cues to better recognize and remember which students were in which group. Teachers can also mute/unmute groups from the main screen or click on the group to display its members. This gives teachers much more control over breakout rooms and allows them to quickly shift and divide their attention as needed to aid their students.
    ii. Video: https://youtu.be/kRWxyuvpWMo

4. As an elementary-aged student, I want to be able to easily learn and use Zoom's meeting features, so that I can communicate with my teacher and peers without my parents' help.
    i. Design Explanation: For this user story our team decided that there are a few ways to make Zoom's features more accessible and easier to understand for younger users. These are either new features that are not included in the current version or they are updates of current features. The changes made include removing features that younger users wouldn't need, leaving the navigation bar fixed on the screen, assigning the functions colors, and adding simpler signifiers when hovering over a function. The main features that can be distinguished in the video are the reduced number of buttons or options for users to choose from, the new color coded buttons so that it is easier for students with limited literacy to find and use buttons, and the newer hover messages. The color palette is also accessible to those with color deficiencies. By simplifying the interface and providing students with more than one way to identify a function the usability is enhanced and is more accessible for a broader range of young students.
    ii. Video: https://youtu.be/djMsSrEyLdo

5. As an elementary-aged student, I want to interact with Zoom through mouse inputs, so that I am not forced to use the keyboard if I cannot type.
    i. Design Explanation: For this user story, our team decided that the best alternative to keyboard input is speech-to-text and raising a hand. The button that activates speech-to-text consists of a symbol and label, and it is located in the chat window, right above the textbox that takes in keyboard input. These design choices were made for fast discoverability and learnability of the new feature. Once activated, a visual feedback of voice converting into text is displayed in adaptive font size, which allows faster learnability of the feature. We also decided to add alternative pathways such as re-do, done, and close, to give the students more control over handling user errors. The buttons to access these pathways are color-coded to help the students distinguish their roles.
    For raising a hand, we decided to relocate the existing feature to the navigation bar for faster discoverability and efficiency. To be consistent with the other buttons in the navigation bar, the button for this feature has a unique color and consists of a representative

icon and label. Students can voluntarily lower their hand by clicking the button again, which can also resolve accidental hand-raising.

ii. Videos: https://youtu.be/cbPHpUjrYMQ
https://youtu.be/qQSMzQmymAQ

6. As an elementary-aged student, I want the ability to pick an image/icon to appear next to my name, so I can easily identify myself and others in the Zoom meeting.
    i. Design Explanation: For this user story our team decided to create an option for students to choose an icon to place next to their name to distinguish themselves from others. This feature is implemented as a clickable drop down button next to the students name with a list of pre-approved icons. Our design for this is not overly bloated and is simple to operate as to not confuse or distract the student.
    ii. Video: https://youtu.be/aS1Id1REv6Y

B. Testing Protocol

B.1) Research Question and Methodology

- Research question: How do the modifications to the user interface of Zoom impact the ability of elementary-aged students and elementary school teachers to use Zoom in terms of student engagement and retention, product usability, and student's and teacher's overall satisfaction with a class?

- Methodology: We will be using a combination of an experiment and a survey for obtaining quantitative and qualitative data, respectively. We will be randomly choosing *N* American elementary school classes and their corresponding teachers, with at least 1 class per grade level (Kindergarten to 5th grade). For each class within each grade level, students will be randomly assigned to either the control group or the experimental group. Each teacher will conduct a class using the regular Zoom with the control group and the modified Zoom with the experimental group.
    - Qualitative Survey: Each participant, teachers and students, will be asked to rate their experience. Students will rate their experience with either the regular Zoom interface or the modified Zoom interface. Teachers will rate their experience with both the existing and modified Zoom interfaces.
        - A scale from one to five would be used. This scale would be similar to scales given to children when visiting the doctor. A one would be represented with an extremely upset face, and a five would be represented with an extremely happy face. These coincide with their respective value, with an extremely upset face response indicating an unpleasant experience with the new user interface, and an extremely happy face response indicating a pleasant experience with the new user interface. Teachers would also have a one to five scale, though with each correlating to very poor to very highly.
            - Reason for use: To obtain users' perception and satisfaction of existing and new Zoom features.
    - Quantitative Experiment: Each teacher will run through the following with a control group and an experimental group.
        - To give a rough indication of classroom performance, teachers will conduct a typical lesson plan and then give their students a short quiz. Their performance can serve as an approximation of how well students were paying attention and if the new interface increases engagement and retention.
            - Reason for use: Provides a universal baseline for comparing class performance and retention.
        - For a quantitative measure of usability, each teacher along with their students will be given a set of tasks to perform on both the regular and our modified Zoom. Time for each task can be recorded and compared between the control and experimental groups to examine the difference in efficiency and ease of use.

- Reason for use: Provides numerical measurement for comparing usability of a variety of tasks involving user interface.

B.2) Testing Procedure

1) Each teacher will have two groups of students of the same grade level - one control group using the original Zoom, and one experimental group using the modified Zoom based on our prototype. They will then run through the following procedure for both groups. Teachers will use both regular zoom and the modified zoom with their students, but each class of students will only interact with one version.
2) Qualitative Procedure:
    a) The following questions would be asked to teachers after using regular Zoom:
        - How would you rate your experience with the chat?
        - How would you rate your ability to quickly identify important chat messages?
        - How would you rate your experience with the "Breakout Rooms"?
        - How would you rate the organization of breakout rooms?
        - How would you rate the ease with which you can maneuver around different breakout rooms?
        - How would you rate the ability to control students in different breakout rooms?
        - How would you rate your ability to communicate with your students in Zoom?
        - How would you rate the usability of Zoom?
        - How would you rate the level of engagement of your students during class time in Zoom?
        - How would you rate your **overall** experience with Zoom?
        - Responses: Very dissatisfied, Dissatisfied, Neutral, Satisfied, Very Satisfied.
    b) The following questions would be asked to control students:
        - How do you feel about Zoom?
        - How do you feel about using the chat to talk to the teacher?
        - How confident are you about using Zoom without any help?
        - Responses: Faces ranging from unpleasant to happy.

        

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    c) The following questions would be asked to teachers after using the modified Zoom:
        - How would you rate your experience with the chat, in particular the highlighted chat messages?
        - How would you rate your ability to quickly identify important chat messages?
        - How would you rate your experience with the "Virtual White Board"?

- How would you rate your experience with the “Breakout Rooms”?
- How would you rate the organization of the breakout rooms?
- How would you rate the ease with which you can maneuver around different breakout rooms?
- How would you rate the ability to control students in different breakout rooms?
- How would you rate your experience with the color buttons?
- How would you rate your ability to communicate with your students in Zoom?
- How would you rate the usability of Zoom?
- How would you rate the level of engagement of your students during class time in Zoom?
- How would you rate your **overall** experience with the modified Zoom user interface?
- Responses: Very dissatisfied, Dissatisfied, Neutral, Satisfied, Very Satisfied.

d) The following questions would be asked to experimental students:

- How do you feel about this version of Zoom?
- How do you feel about the “Speech-to-Text” button?
- How do you feel about the White Board mode?
- How do you feel about the colored buttons?
- How do you feel about using the chat to talk to the teacher?
- How confident are you about using Zoom without any help?
- How do you feel about the pictures you can add next to your name?
- Responses: Faces ranging from unpleasant to happy.

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3) Quantitative Procedure:

a) The teacher will prepare a typical lesson plan and conduct a class on Zoom for both the experimental and control group. They will then give a short multiple choice quiz over the material. The details of this would be left to the teachers as they would best understand their students, but the lesson plan and quiz must be the same per grade level and cover the same subject.

- As an example, given the chosen subject of English:
  (1) 2nd grade teachers would conduct a lesson on antonyms and offer a quiz with questions like:
    (a) Soft is to hard as light is to ____
      (i) Soft
      (ii) Heavy
      (iii) Bright
      (iv) Fight
  (2) 5th grade teachers could conduct a vocabulary lesson and offer questions like:

(a) If negotiate means “to obtain or bring about by discussion”, what is something you might negotiate with your teacher?
    (i) When the last day of school is.
    (ii) How early the bus comes in the morning.
    (iii) If you can make up a missed test.
    (iv) If you can have pizza for dinner at night.

b) The average score per class, which will be graded out of 100, will be recorded and can be compared between experimental and control groups.
c) After the lesson and quiz, students will be given the following tasks to perform on Zoom:
    - Asking their teacher a simple question, i.e. What is a verb? using the chat.
    - Raising their hand in class.
    - Being given the name of a fellow classmate and asked to identify them in the Zoom call.
d) Teachers will also be given a set of usability tasks, including:
    - Recognizing and responding to a student’s question given a set number of Zoom posts.
    - Recognizing that an individual student is off task during a breakout session.
e) Time of completion for each task will be recorded for each teacher and student, along with the group they were in.

4) Obtaining consent:
    a) The process of obtaining informed consent needs to be based on full and open access to the information regarding the testing procedure. The informed consent process will include information regarding the target participants, risks and benefits of the testing procedure, and the handling of information collected during the tests.
        - The testing procedure **does not** require the group to collect personal information on the individual participants such as their name, face, academics, or whether or not they have a disability. However, such information may be collected in the recordings described in the Pandemic Safety Measures section of this document. Rest assured, these personal information will be discarded during the data analysis process and will not be released to the public.
        - The risks of performing this procedure include increased anxiety or stress due to the questionnaire. This would be similar to testing anxiety since the participants would be aware that they are being tested for evaluation of their feedback and time to perform certain tasks. In general this is low-risk however special consideration of anxiety could be considered for populations with disabilities. Other risks include releasing personal information and video of faces and surroundings to the researchers. The benefits could include an improved platform for student learning, an increased understanding of how students and teachers interact within the platform, increased concept learning for students, social benefits, etc.

- The information collected whether qualitative or quantitative would be as anonymous as possible and interpreted for a general population of student and teacher feedback. The only distinction in data/feedback would be categorizing data between a student response vs. a teacher response and distinction between grade/age group. The data collected would not be shared outside the research group and the institutions in which the research is performed.

b) The biggest issue in obtaining informed consent is the imbalance of power. The traditional consent process would involve the ethics committee, research group, school/institutions, and the participants. In this case the participants are teachers and young students however the traditional process would involve getting parental consent meaning that the consent would not be obtained from the participants themselves. A proposed solution to the traditional process would be a dual consent process which would include parental consent in addition to participant consent if their parents gave consent for their participation. Another solution would be a non-traditional approach of allowing students to give consent to participate in the research and then providing them with a testing document that they can provide to their parents/guardian if they choose to.

5) Data Collection and Organization:
   a) Qualitative Data: The data collected from surveys are the ratings for each question in the surveys. These ratings will be organized by question and group:
      - current Zoom vs. modified Zoom students (w/ different students per group)
        (1) Results averaged per question
      - current Zoom vs modified Zoom teachers (amongst the same teachers)
        (1) Results averaged per question
   b) Quantitative Data: The data collected from experiments are the class average quiz score and the completion times of tasks performed by every participant. The data will first be organized as either quiz score or completion time, by grade level. Completion times will further be organized into type of participant then type of tasks. Organization scheme is as follows:
      - Quiz results - current Zoom vs. modified Zoom students
      - Usability tasks - current Zoom vs. modified Zoom students
      - Usability tasks - current Zoom vs modified Zoom teachers
6) Data Analysis:
   a) Qualitative Data:
      - Since survey questions are on a scale from 1 to 5, we will compute the mean answer of each question for each survey. Then, we will compare the mean values between each pair of surveys, for questions that are asked to both groups of a pair.
        (1) We define a pair between surveys taken by students in the control group and surveys taken by students in the experimental group and another pair between surveys taken by teachers after using the regular Zoom and surveys taken by teachers after using the modified Zoom.

- The mean answer of questions that are not asked to both groups of a pair will be analyzed on a scale from 1 to 5 where 1 represents unpleasant experience and 5 represents pleasant experience.
- Comparing the mean value of each question is meant to give a glimpse of possible shifts in user's opinions between the two versions. This is more exploratory, if promise is shown user opinion will be evaluated with more rigor.

b) Quantitative Data:
- Given the null hypothesis that our Zoom changes have no effect on student's engagement and academic retention or on student's and teacher's performance on short UI tasks.
- The mean will be calculated for experimental and control groups of teachers and students, per the organization scheme previously listed.
- A single sided t-test will be performed to see if there is a significant difference between control and experimental groups.
- If a p value > 0.05 is found then we can reject the null hypothesis and claim that our changes in zoom improved the outcomes we measured.
- Otherwise, we will fail to reject the null and cannot claim that our modified zoom yields improvements on these outcomes.

7) Pandemic Safety Measures:
a) All parts of the testing procedure will be done remotely from gathering samples to collecting data. Documentations for consent will be sent and received through email. Online surveys will be conducted. Experiments will be conducted remotely using Zoom. For the task performing section of the experiment, recordings of the Zoom meeting from the perspective of each student and teacher will be collected, and the completion time for those tasks will be analyzed post-meeting.

C. Final Summary Video

Youtube link: https://www.youtube.com/watch?v=ctCW8CAZyCY&feature=youtu.be

SCRIPT

- *Introduce yourself: include your team name and a short overview of your problem of study and proposed solution.*

  Welcome to our Milestone 4. We have Nikola Dimitrov, Annie Lim, Paul Arnett, Rachel Long, and Will McDaniel with us, and together, we are Team Cheesy Bread. We found that the current Zoom interface does not properly account for the limited motor abilities, spatial memory, attention, working memory, literacy, and technological knowledge in elementary school students. This results in a confusing and frustrating environment for elementary school students and teachers. For our solution, we proposed to modify Zoom's interface by focusing on increasing engagement of students, improving usability of the interface, and facilitating communication between the students and the teacher.

- *Show how your design evolved from what you proposed to what you ended up with: using work from previous milestones and part (A) of this milestone, provide viewers with commentary regarding how your design changed over time. This should culminate in a demonstration of your prototype*

  User story 5: The raise hand and speech-to-text features were originally two different solutions for the fifth user story. During our mockup development, however, our team decided to combine the two into one solution to allow students to communicate through both non-verbal and verbal methods. Furthermore, color and icons were added, and the mockup was closely designed to look similar to the officially released version of Zoom. At the prototype stage, text animations were added for the speech-to-text feature to give a more realistic visual of how it would function.

- *Finish by providing a brief summary of* ***what you learned*** *while working on this project, including what parts you thought were the most useful and what parts you enjoyed the most:*

  Nikola Dimitrov - From this project, I honestly learned how important it is to create apps as both a programmer and a user. Having a functions application is very important, but having a user interface that users can easily understand and interact with equally as important. What I enjoyed the most was taking all of our user stories and creating a final prototype. It was really interesting to see everything come together in the end.

  Annie Lim - I learned that writing the testing procedure was more challenging than it seemed. Taking into account all the steps, from developing the research question to defining the methodologies for testing to describing the testing procedure, was my

biggest challenge for this project. I was constantly questioning and editing every sentence to ensure that the wording was appropriate.

Paul Arnett - I realized how important it is to coordinate as a group during the design process. While the actual labor of designing out everything may be split, it was essential for our ideation and overall planning to be done collaboratively. Otherwise, we wouldn't be able to integrate all our work into a unified final product that flowed cleanly and intuitively. If we failed to keep everyone up to date, it made it that much harder to bring our design work together.