Introduction

For my capstone project, I am trying to solve the problem of elementary students and teachers navigating the landscape of virtual learning they were thrust into due to the COVID-19 pandemic. Young students learn products quickly, but often do not learn the relationships between different products or how to navigate them. Many companies have tried to retro-fit their products for the needs of students and teachers, but many fall short providing these users a delightful user experience. Google Meet/Classroom, Microsoft Teams, and Zoom provide video conferencing and work tools which many schools have used to teach students, all with different levels of success. My heuristic analysis will focus on these products from both teachers' and young students' perspectives.

Google Meet / Classroom - Google Meet is a video conferencing app with chat capabilities that replaced two previous google products, Chat and Hangouts. It integrates with other Google productivity and education products like Jamboard and Classroom. Google classroom is a learning management software (LMS) in which teachers can post announcements, assign work or tests, and manage grades. Video conferencing features lets users participate in the meeting through chat, screen-sharing, and through limited user-based reactions.

Microsoft Teams - Microsoft teams is a hub in which users can schedule and host video conferences, collaborate through chat, calls, and file sharing. Teachers can create assignments using any available Office 365 tools. Microsoft Teams also integrates other apps which will work with its platform. It offers mobile and tablet apps. It also lets users work through a web-based portal or through apps installed directly on a user's computer. Video conferencing features lets users participate in the meeting through chat, screen-sharing, and through user-based reactions.

Zoom - Zoom is a video conferencing platform which allows users to host video meetings and webinars. Meetings offer users the ability to participate in the meeting through chat, screen-sharing, remote screen control, and through user-based reactions.

Rating Systems

Teacher Rating	Definition
Good	Little to no usability problems.
Average	Minor usability problem, fairly easy to overcome.
Needs Improvement	Usability problem that should be given a high priority to fix.
Poor	Major usability problem that must be fixed.

Student Rating	Definition
👍	I can use this program and it is easy to move between the different programs my teacher assigns me to use.
👌	I can use this program, but it is not easy for me to get from one tool to another and sometimes confuses me.
👎	I do not like using this program. It is hard to use and does not let me do what my teacher wants me to do with it.

Heuristic Evaluation of Google Meet / Classroom

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1. **Match between system and real world**
   - Use words, phrases, and concepts familiar to the user, rather than internal jargon.
   - Follow real-world conventions, making information appear in a natural and logical order.

Teacher Rating Good Student Rating 👍

Google Meet and Classroom both have a minimalistic presentation similar to its search engine. The Classroom app has four headings for each course for teachers and three for students. The headings are Stream, Classwork, and People, for both teachers and students, teachers have a fourth heading labeled Grades. The Classroom dashboard has each class shown as a button with a header the teacher can customize. The classwork section follows a logical presentation of assignments and shows teachers what to do to create an assignment. The labels for creating an assignment are simple and use real-world language illustrated in Figures 1 and 2.

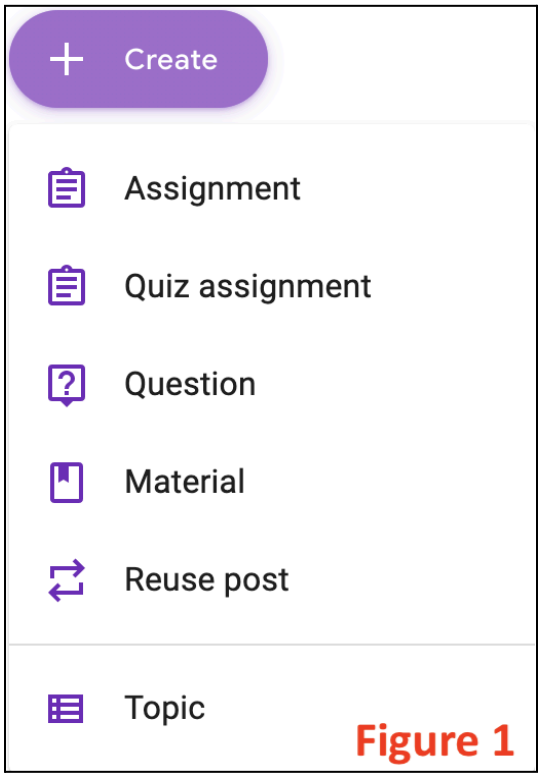


Figure 1

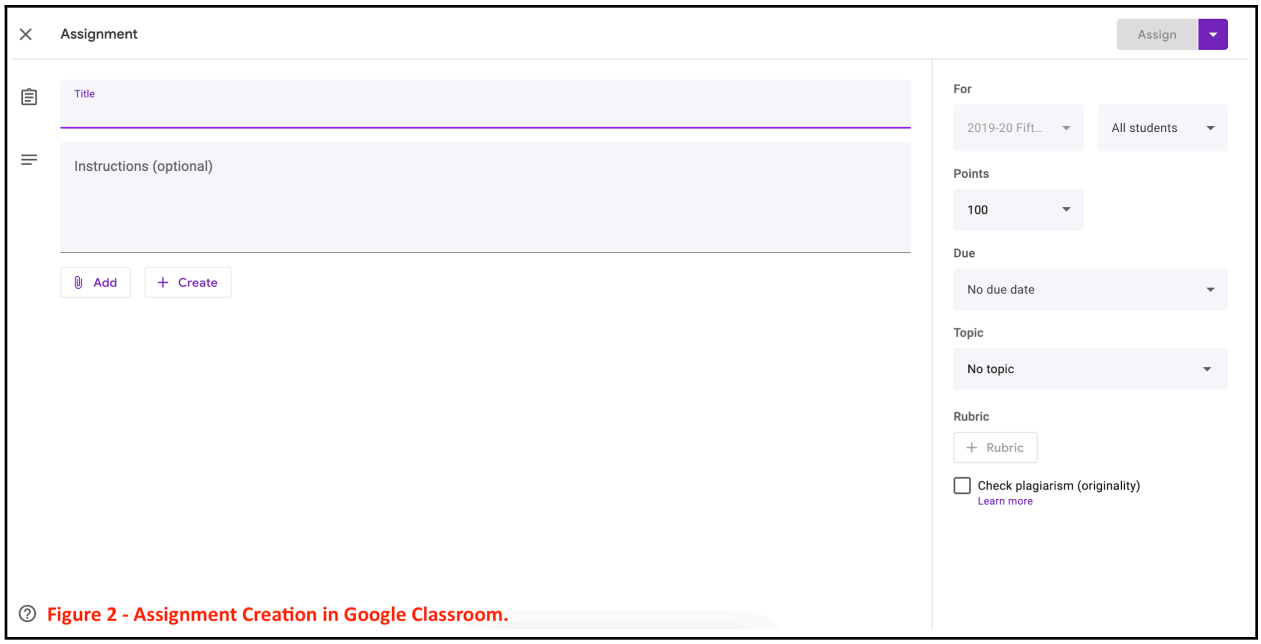


Figure 2 - Assignment Creation in Google Classroom.

The Google Meet app clearly tells users how to start meetings using language they understand. Teachers can also choose to link their google meeting to their Classroom making it seamlessly communicate across platforms. The video conferencing uses simple language labels (see figure 3). It also labels clearly what using phone audio means, unlike Microsoft Teams and Zoom. Meet also explains technical jargon like “open a jam” by making “whiteboard” black text and the header.

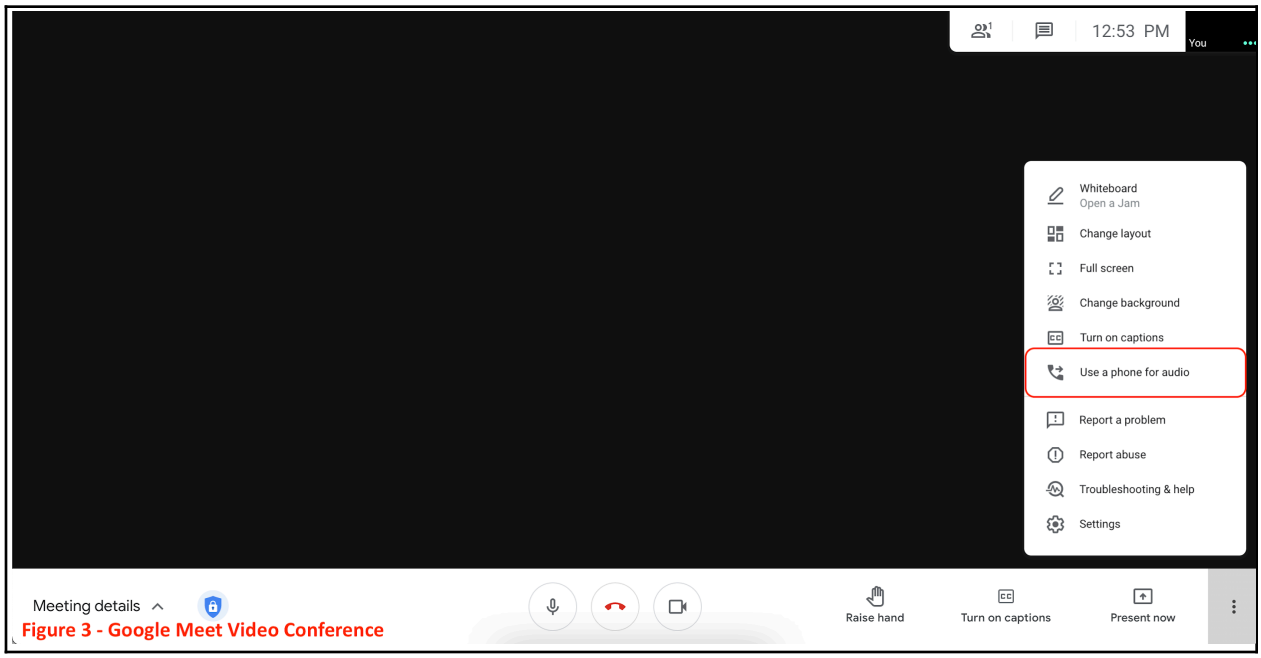


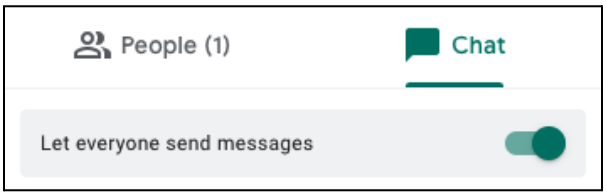
Figure 3 - Google Meet Video Conference

2. **Consistency and standards**
    - Users should not have to wonder whether different words, situations, or actions mean the same thing.
    - Follow platform and industry conventions.

Teacher Rating Good Student Rating 👍

The header at the top of Google Classroom clearly and simply labels the different sections of the LMS. Each goes to a different section of the course. The one label that detracts from the usability is the stream section. Although easy to understand after announcements are posted, relabeling the stream section to announcements would help users clearly understand what this heading contains.

Google Meet has a taskbar at the bottom consistent with other video meeting platforms. It uses industry standard icons to denote the microphone, raise hand, end meeting, and camera. The chat feature is standard and provides users with an easy toggle switch for a teacher or moderator to allow or not attendees to use the chat.



3. **Aesthetic and minimalist design**
    - Interfaces should not contain information which is irrelevant or rarely needed.
    - Every extra unit of information in an interface competes with the relevant units of information and diminishes their relative visibility.

Teacher Rating Good Student Rating 👍

Both Meet and Classroom have a minimalist design. Classroom contains only the elements most essential to the needs of a classroom displayed These elements are displayed in an unobtrusive way that maximize the screen space for the content and elements teachers or students need for the particular class (see figure 5). Less commonly used icons are tucked behind a hamburger menu. This menu also allows users to toggle quickly between different classes easily.

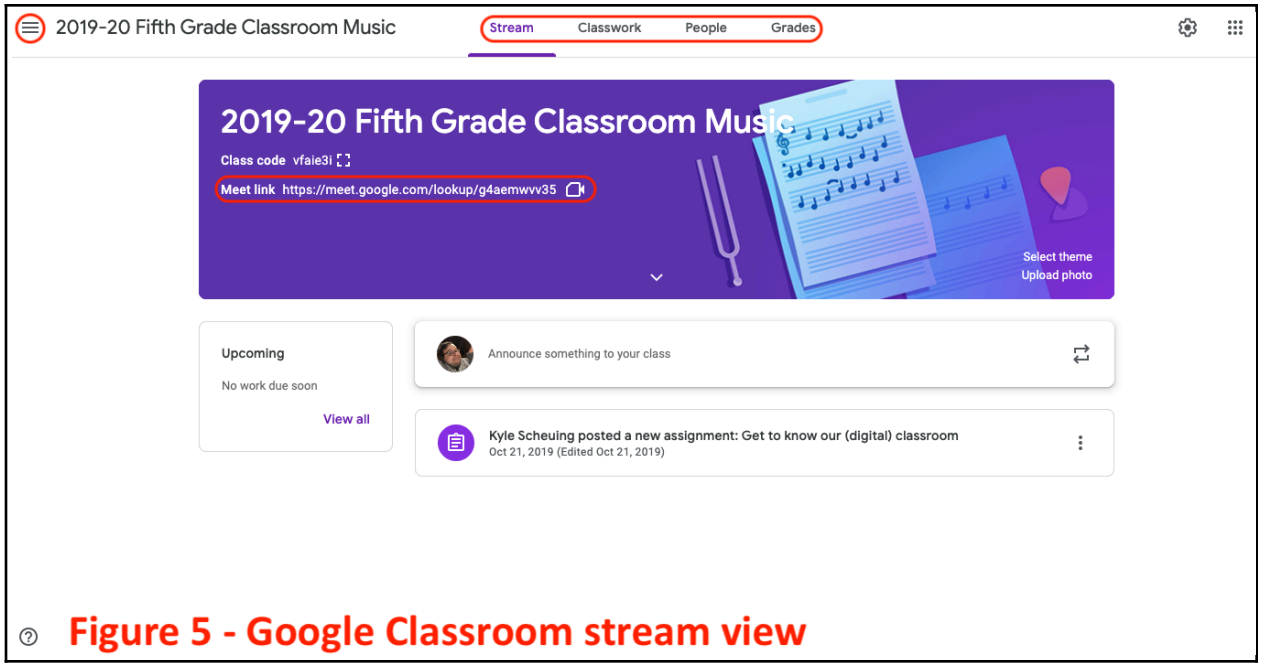


Figure 5 - Google Classroom stream view

Meet similarly has a simple design. It hides less used options behind a popup menu. Keeping a majority of the screen open for video users or screen sharing.

Heuristic Evaluation of [Microsoft Teams]

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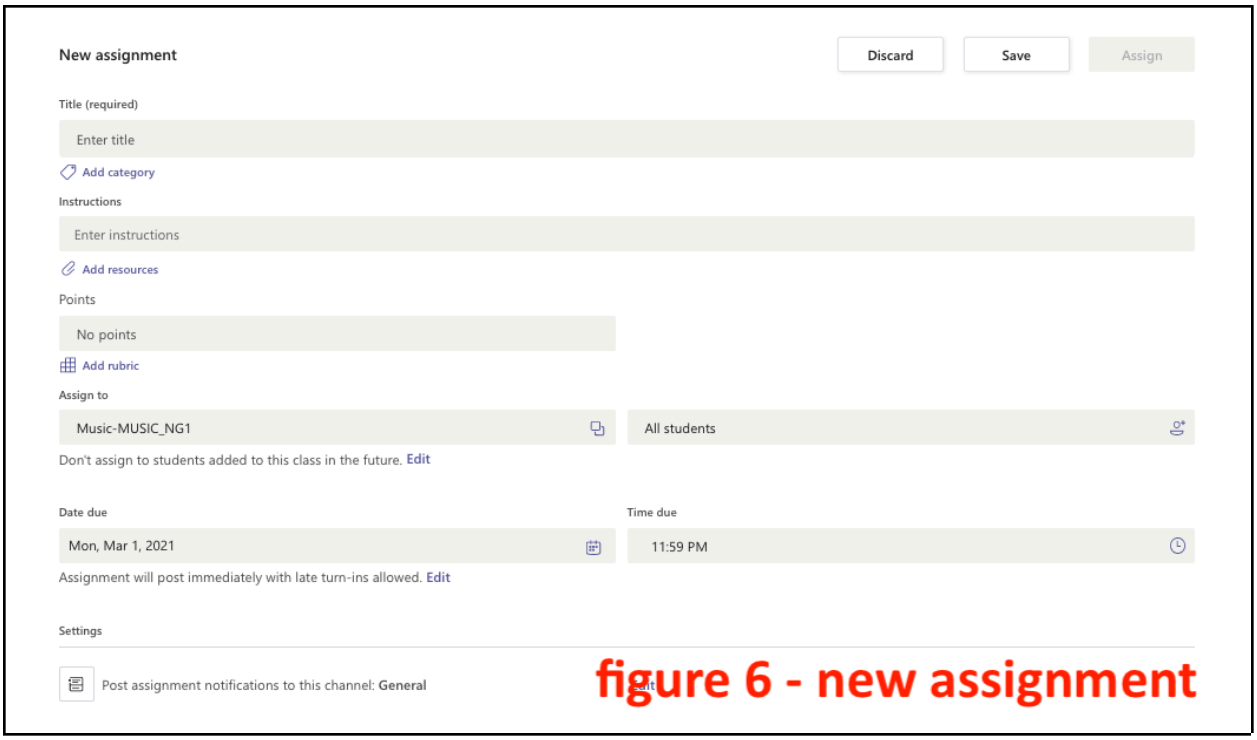
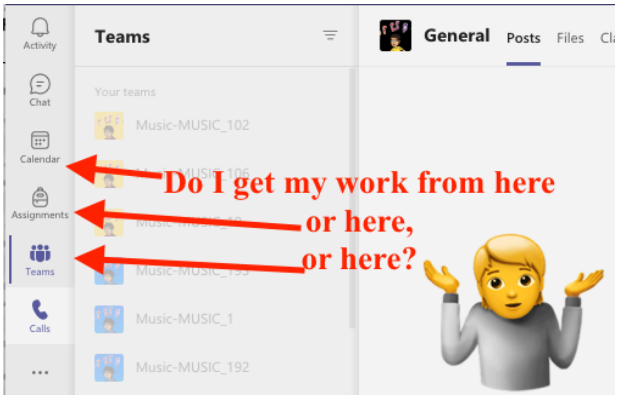
1. **Match between system and real world**
    - Use words, phrases, and concepts familiar to the user, rather than internal jargon.
    - Follow real-world conventions, making information appear in a natural and logical order.

Teacher Rating	Needs Improvement	Student Rating	👎

Microsoft Teams puts the most commonly used buttons on the left side of the screen. It uses common language for everything except its namesake, teams. This label is confusing at best because many types of organizations (including schools) use this software. It would be more clear to the user to call it ‘groups’ or something similar. The chat menu is set up in a familiar way, but each meeting a user creates opens a new chat topic which could overwhelm users, especially those who attend many scheduled meetings, but for which there is no dedicated team. The assignments tab uses a standard convention and uses terms teachers would be familiar with when setting up an assignment or project (see figure 6)



Microsoft Teams is a comprehensive and robust program, which lends to its power, however this also makes it difficult for users to know where their workflow is. Different categories that will take a user the same place lead to overwhelming the user. This is especially true for young learners who do not think as abstractly about where to go to access their work.



2. **Consistency and standards**
    - Users should not have to wonder whether different words, situations, or actions mean the same thing.
    - Follow platform and industry conventions.

Teacher Rating Average Student Rating 👎

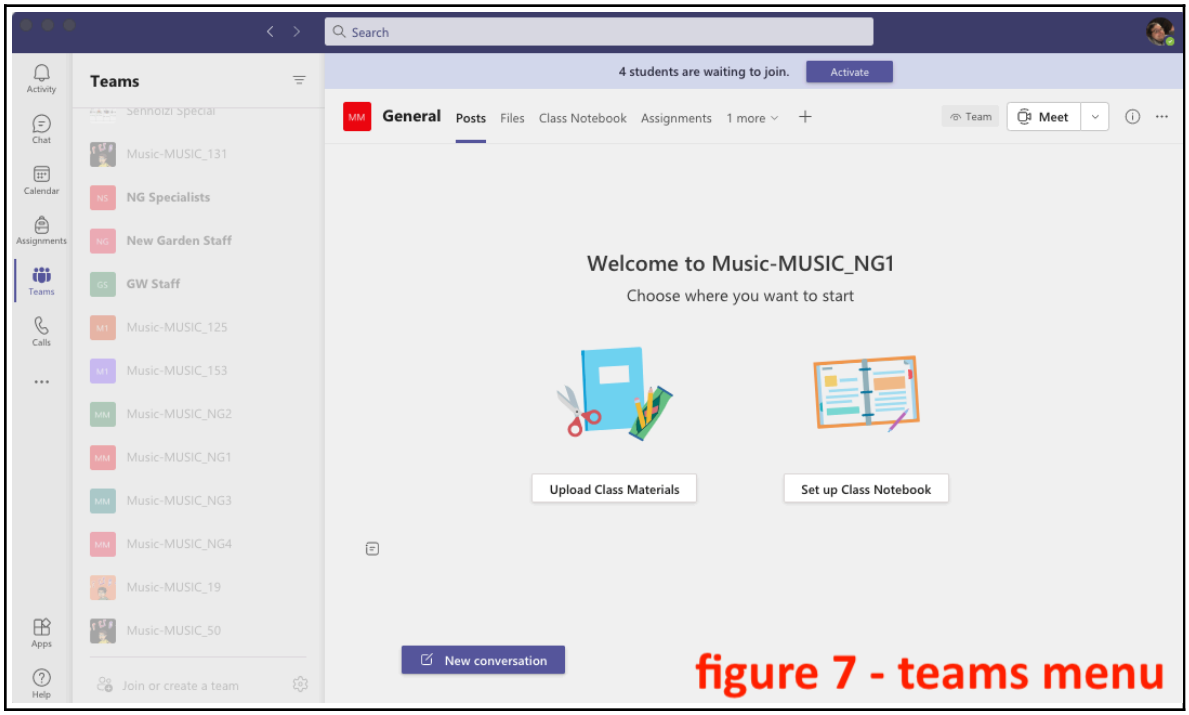
Microsoft Teams uses standard icons for their video conferencing software. The challenge with its video conferencing lies in its ever changing tile of users when a user turns off or turns on their camera the tiles inevitably change and a user may appear in a different tile space or not on the large screen at all. The maximum standard view for Microsoft Teams shows only 9 participants, which complicates things for the average class size for a K-12 classroom teacher. Students are also unable to see anyone except for the teacher, which limits peer-to-peer interaction.

One area of interest that positively sets apart its conferencing software is its ability to call people into a meeting they may have otherwise forgotten to attend. This can be especially useful for teachers with forgetful students or who give students independent work for a set amount of time and want to call the class back together.

3. **Aesthetic and minimalist design**
    - Interfaces should not contain information which is irrelevant or rarely needed.
    - Every extra unit of information in an interface competes with the relevant units of information and diminishes their relative visibility.

Teacher Rating	Needs Improvement	Student Rating	👎

Microsoft Teams initial view is minimally designed, but when a user is in a menu like the teams menu, they must choose from yet another menu taking up more of their screen space. Each team can expand also further leading to a very busy viewscreen (figure 7).



Heuristic Evaluation of Zoom

1. **Match between system and real world**
    - Use words, phrases, and concepts familiar to the user, rather than internal jargon.
    - Follow real-world conventions, making information appear in a natural and logical order.

Teacher Rating Average Student Rating 👌

Zoom is a wunderkind in the video conferencing marketplace and has attracted the attention of educational users and decision makers. It differs from Google and Teams in one distinct area, it has no learning management software to which it is inherently attached. The software itself uses some clear terms to describe the different processes users can do on the onboarding screen, but its “share screen” and “chat” options are vague and don’t clearly identify what they do outside of a video meeting space (see figure 8 & 9).

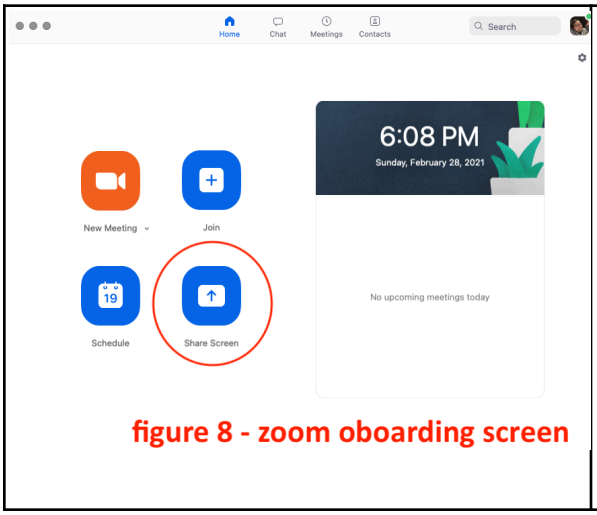


figure 8 - zoom oboarding screen

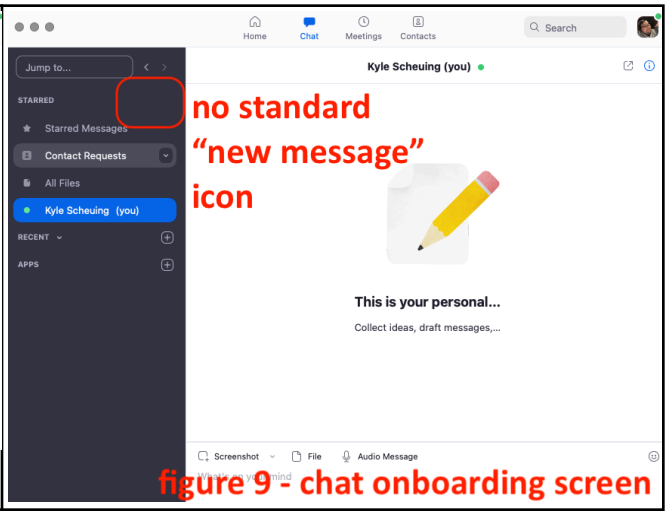
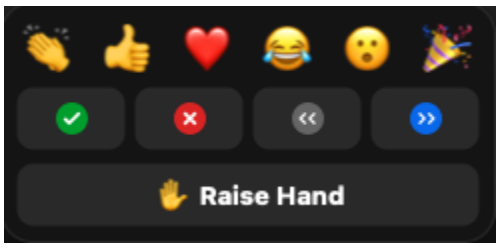


figure 9 - chat onboarding screen

A zoom meeting room is clearly labeled and although the reactions menu are unclear about what these actions or buttons mean, it empowers a user to use them or not for their meeting as they see fit. They are also neatly tucked away in a menu, but easily accessible for even young learners.



2. **Consistency and standards**
    - Users should not have to wonder whether different words, situations, or actions mean the same thing.
    - Follow platform and industry conventions.

Teacher Rating Good Student Rating 👍

Zoom uses icons consistent with other video conferencing softwares. Its screen share is clearly labeled and users do not have to guess about which screen they are sharing or whether their sound will or will not work. These tools and toggles are similar to other softwares, but Zoom's share feature is well structured and groups the whiteboard as well as the ability to share other devices (such as phones or tablets) easily. Advanced options are clearly labeled for users who would like that type of control as well (see figure 10 & 11).

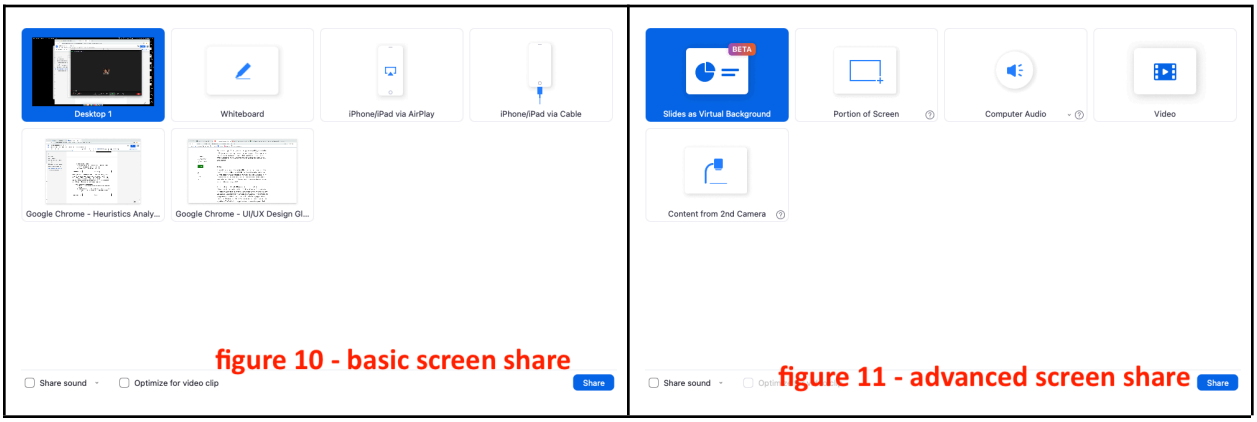


figure 10 - basic screen share

figure 11 - advanced screen share

3. **Aesthetic and minimalist design**
    - Interfaces should not contain information which is irrelevant or rarely needed.
    - Every extra unit of information in an interface competes with the relevant units of information and diminishes their relative visibility.

Teacher Rating Average Student Rating 👍

In a meeting, zoom clearly labels all users and shows on the video image who is and isn't muted so users can easily see without looking at the participants

menu. Users show up in a grid formation and in the educational upgrade version of the software video blocks can be rearranged into a “seating chart.” Zoom’s simple design does cause one area of confusion for users in its menu labeled security. A common user may misunderstand what security means from this term, it would more clearly be labeled “host settings” or management to better inform users of the contents of this menu.