



## *Team*

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## *Problem and Solution*

It can be difficult to learn how to dance. If someone is trying to learn alone, it is difficult to personally see where one is dancing incorrectly. It can also be slow and inconvenient trying to learn on one's own, but sometimes, learning around others can be distracting and discouraging if they are surrounded by more advance dancers. Our solution focuses on creating an environment that encourages the users to efficiently learn and practice the dance in their personal space. We came up with a mobile app that downloads and displays the videos onto a smart mirror to which the user can follow along. We used an app to allow the users to easily search videos while connecting to other dancers, and the mirror is an essential component to any dance practice.

## *Research Goals, Stakeholders & Participants*

### **Research Methods:**

We conducted two types of research methods: contextual inquiry for individual participants and observational study for group interaction.

**1) Contextual Inquiry:** This method studies how users learn to dance on their own. To do this, we conducted the inquiry in an environment where the participant usually holds individual dance practice. During this session, we wished to investigate the participant's current methods for learning how to dance when no instructor is around, by asking them to demonstrate their usual self-learning process. The focus of our study associated with some key components of self-learning, such as: 1. How the participant acquires and sophisticates a dance skill; and 2. How the participant evaluates their dance skills. In addition, we want to detected any challenges that the participants face with their current style of learning. We also estimated the participant's level of commitment toward improving their dance skills.

**2) Observational Study:** We planned to study how the instructor and learners interact through an observational study. Our goal is to improve the dance learning process, and through this study, we can better understand the benefits and challenges involved in the real-world dance learning environment. We visited one practice session of a dancing group, observed the environment, and recorded the teaching and learning behaviors from both instructors and learners perspectives.



### **Participant descriptions:**

We target the participants to be people learning how to dance. These participants can be categorized into two main groups: **beginner** dancers and **experienced** dancers.

**Participant A** (Contextual Inquiry) - *A* is a junior at Yale. *A* started dancing by learning kpop dances in 2014. Prior to Yale, *A* only danced by themselves in her room, but *A* participated in a dance organization at Yale from Fall 2016 to Spring 2018. Since then, *A* started dancing more frequently in a group environment and eventually started directing dances, as in teaching other people the dances. *A* still considers themselves as “new” at teaching, and is not as confident in that aspect. *A* was learning the dance while sitting down in a booth in Silliman buttery. The studio was not available and *A* was previously doing homework, so it was just a convenient location although it was not the best for dancing because it restricted *A* to a sitting position.

**Participant B** (Contextual Inquiry) - *B* is a junior at Yale. *B* has not taken formal classes, but has done traditional dancing since a young age, which *B* says has helped with technique and control; however, *B* only properly started dancing once they entered Yale, on average, 7-8 hours a week. *B* was learning the dance in the Silliman dance studio. The front of studio has full length mirrors that spanned the entire width. It has a very large TV on the right wall; it is above eye level and *B* was able to mirror their laptop on the screen during the contextual inquiry. *B* was learning the dance with another person, so both parties would learn and go over the moves together. There was another person sharing the studio doing their personal practice.

**Participant C** (Observation) - This was a large group setting with two people acting as the instructor. *C* is a group of individuals in one organization practicing together. About half of the members in this group are new members of the dance organization. We chose this group to observe how people of different skill sets learn. Many of the new members can be considered beginners, and the other members are more experienced--one or two have had formal training. Many of the Practice was held in Silliman dance studio. There were much more people this time, so some participants had a difficult time seeing themselves in the mirror. *C* had to practice formations, so practice was very dependent on everyone working together.

### ***Research Results & Themes***

For our research, we were able to conduct contextual inquiries on two participants and one observational study on a dance group, with members having varying backgrounds in dancing. We followed their practice process closely in a studio environment. All of the inquiries were done using a master/apprentice model, followed with designed interview questions. The key findings and themes from the research are summarized as below.

- Main procedure involves taking a short section of a song (10~30 seconds) and drilling it at 0.5x
- Main method is learning from Youtube performance videos, displayed on laptop or TV screen
- Motivations for dancing are college performances
- Some people learn with beats, others with lyrics
- Constantly replays video and changes the speed of the music/dance when practicing
- During individual practice, most of the evaluation is based on how it ‘feels’
- Very fixated on getting the correct moves
- It was not difficult to establish rapport or ask permission for taking photos or recoding videos, because the task of dance itself is a performance art

**Mirror:** The significance of the mirror in learning how to dance was a recurring theme for the inquiries and observations we conducted. For individual practices, a mirror is an important tool for evaluating one's dance. However, individual learners usually only looked at the mirror after they felt like they acquired the dance move from the video. On the other hand, the observational study suggests that mirrors play a more substantial role during group practice, where students often follow the instructor through the mirror (rather than looking at her directly). Furthermore, the mirror helps instructors check whether each student is following, helping her better pace the practice.

**Dance Video:** Existing dance videos on platforms such as Youtube are the main source of learning for all participants. They display the videos on laptop or TV screen to learn the moves. One major problem is that video streaming platforms such as Youtube are not suitable for replaying a short section at a slower speed; learners have to control the video every time to rewind it to the beginning of a section. Similarly, instructors have to walk to the computer every time to drill a certain section with students. These extraneous movements take up a significant portion of the total practice time.

**Skill Difference:** It became clear from the research methods that the difference in skills levels among dancers leads to different conclusions about the optimal learning method. For beginners, the most effective way of learning is under supervision of an instructor and interaction with other dancers. On the other hand, experienced learners say they find it more efficient to practice individually.

**Interactions:** Interaction is a key theme in learning how to dance. In a dance group, some people serve as instructors while others as students. The instructor, who has expertise, can guide others by analyzing the moves and demonstrating them. When one student asks instructor for clarification on a dance move, it benefits other members of the group as well. It is also common that two people interpret the move from a dance video differently. In this case, learners debate on what the correct move is. Finally, for a group dance, coordinating the formation between members is an important aspect of learning how to dance.

## *Task Analysis*

### **1) Who is going to use the design?**

The design is for people with general interest in dancing. This include both experienced dancers who already has established a habit of dancing, or beginner dancers who are relatively new to dance and require more time to practice. There may be different motivations for users, such as performances, exercising and entertaining. The later ones may attract more beginners.

### **2) What tasks do they now perform?**

Currently, people learn dances by watching Youtube videos on devices and copying the movements from them. Some group beginners learn by directly attending lessons.

### **3) What tasks are desired?**

The primary desired task is to improve the dance learning rate. Through our inquiries, we found seven main tasks that might help to do so:

- **Task 1: Controlling video/music while dancing**
- **Task 2: Displaying Dance Videos**
- **Task 3: Dividing the dance videos into pieces, enabling speed control and repeating**
- **Task 4: Interactive system for peer dancers**
- **Task 5: Acquiring correct and accurate dance moves**

- **Task 6: Capturing and evaluating dancer movements in real-time**
- **Task 7: Motivation for practice**

#### 4) How are the tasks learned?

Tasks should be learned intuitively by physical knowledge plus the general knowledge to control videos on devices. Additionally, the user may need to have a fundamental familiarity with the music. We may want to create some tutorials for the first walkthrough if new forms of devices are designed. We also want to make sure the beginners can easily follow the practice process.

#### 5) Where are the tasks performed?

Tasks are performed in empty spaces with screen to display videos (preferred to have a TV screen) and a mirror. A private environment may be required, depend on user's habit and confidence levels. Tasks are performed anytime when people want to practice.

#### 6) What is the relationship between the person and data?

There are two possible relationships: an individual user will have data on a personal device, including one's personalized performance tracking and feedback. Or, a user may have shared data on cloud with more people, such as dancing videos as learning resources.

#### 7) What other tools does the person have?

Other than videos, there are plenty of software that user can use, with platforms varying from mobile apps to game boxes. The person may have a recording device for one's practice.

#### 8) How do people communicate with each other?

Most commonly, people communicate with peer learners and instructors by attending lessons or drilling together. There are many offline organizations that people can attend. Users can also communicate via sharing data online, for example, uploading one's cover videos and learning from other's videos.

#### 9) How often are the tasks performed?

Tasks can be performed on a daily basis, weekly basis or a monthly basis, based on user's motivation and capabilities. Experienced dancers tend to perform the task more frequently.

#### 10) What are the time constraints on the tasks?

There is usually no strict time constraint for people for perform dance practices. However, because it is a learning process, the user may want it to be as efficient as possible. It is also likely that there is a performance date, so the user may set goals and finish preparing by that date.

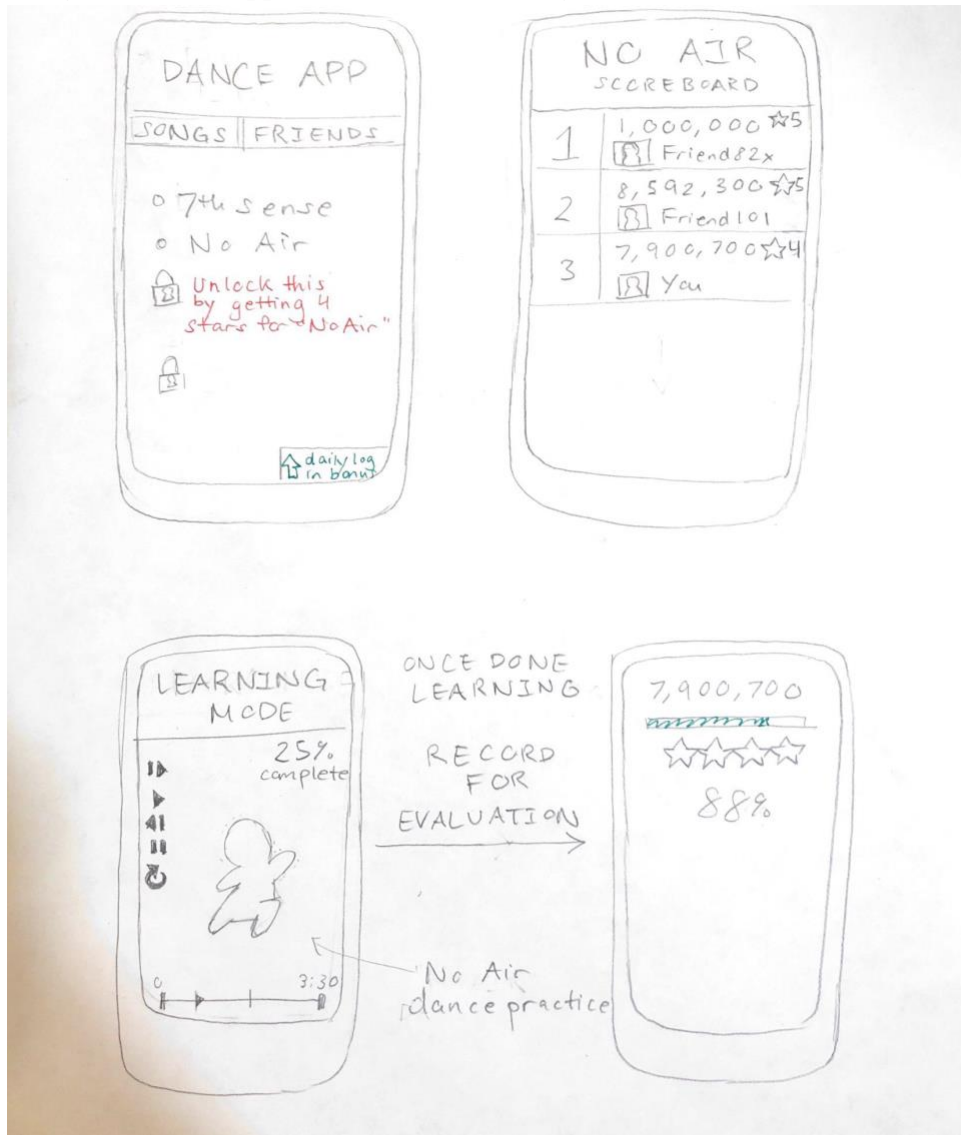
#### 11) What happens when things go wrong?

There are multiple scenarios when things go wrong:

- If there is tech error such as network problems and the video can't load, the user won't be able to learn by oneself
- If the movement learned are incorrect, the user may need to adjust oneself or with a group later on
- If the movement learned doesn't match the music or if there is a formulation mistake, the performance may not be satisfying
- There might be physical injuries in the practice process

## Proposed Design Sketches

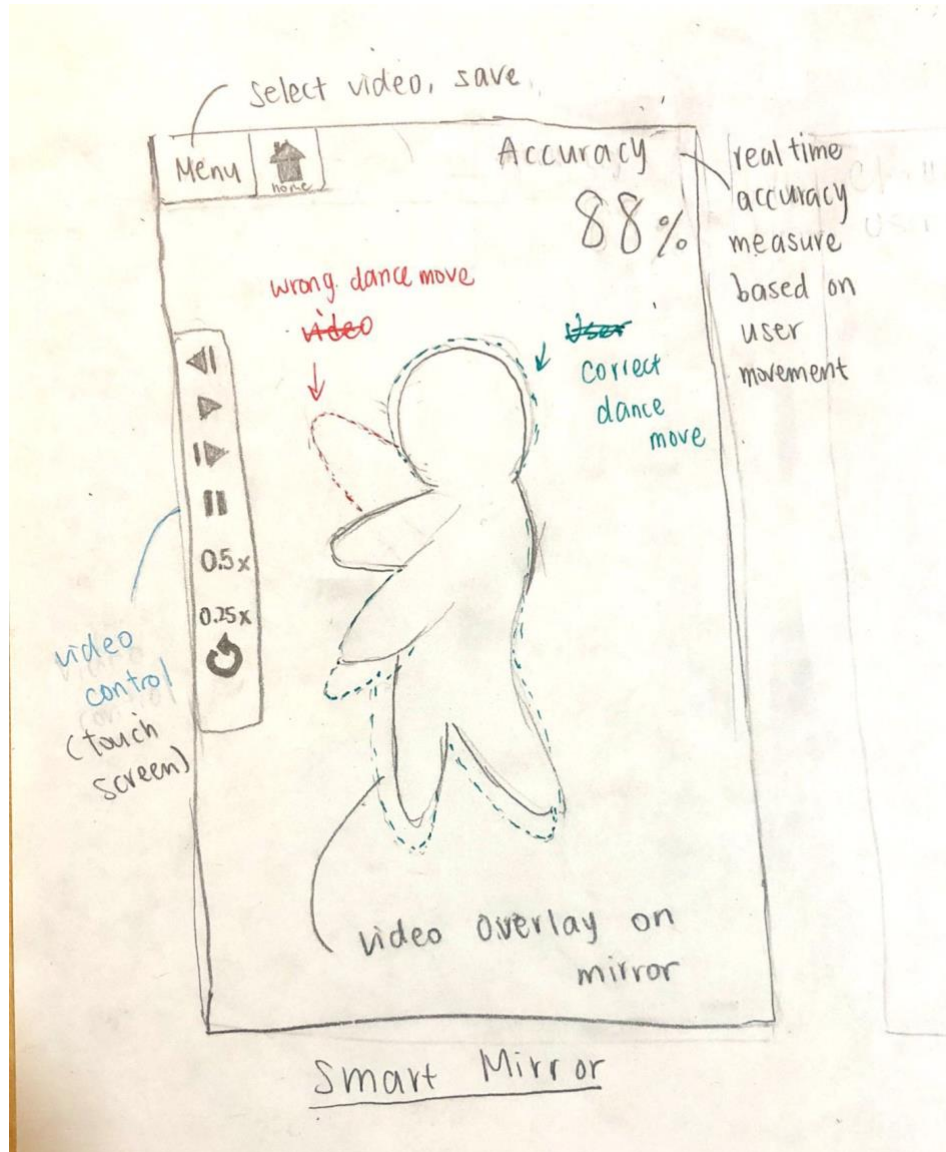
### Design 1: Mobile Application with Recording



The first design is a mobile app which provides a platform for the user to access dance videos and to meet and compete against other users dancing to the same song. For **Task 2**, the user can access dance videos by selecting the dance on the app. For **Task 3**, the app's Learning Mode organizes the video into

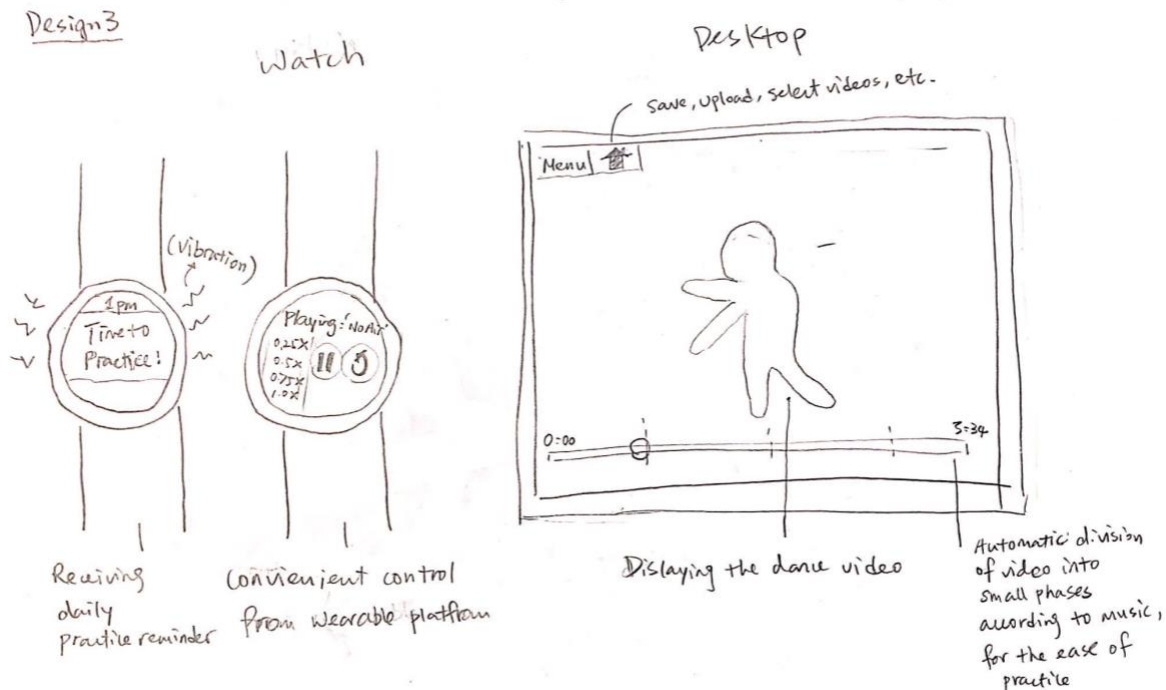
structured small phases with additional features that helps them control the speed and repeat sections. For **Task 4** and **Task 7**, the user can record their performance with app and receive evaluations after uploading. Once the user receives a certain score or complete a certain number of a dances, they can unlock new dance practices. Users can also add their friends or meet new dancers and compete against them in the dances. The advantage of this design is that it is easier to develop and involves lower cost. It is also very accessible, which makes it effective in connecting and motivating dancers.

## Design 2: Interactive Smart Mirror



The second design is a full-sized smart mirror that is capable of overlaying a dance video on the mirrored image of the user. For **Task 2**, the mirror allows the user to refer to the video and check self in the mirror at the same time. Similar to the first design, the mirror can organize the video into phrases for **Task 3** and the user can manipulate the video either by gesture (from further distance) or touching the mirror. For **Task 5**, based on the level of synchronization with the video, the mirror gives an accuracy score for the user's dance. For **Task 6**, the mirror captures user motion through camera and compares it with that of the motion in the video, providing the user with real-time feedback. There will be more features in the menu, including the selection of video and the recording/saving of the user's dance.

### Design 3: Wearable Watch & Desktop Application



The third design combines a wearable platform and a display platform together in a synchronized application. For **Task 1**, the watch app enables users to easily control the video while dancing. For **Task 2**, the desktop application displays the dance video on a large screen. There is also a built-in function of desktop application allows users to follow the organized learning phrases for **Task 3** and make online friends for **Task 4**. For **Task 7**, the watch app allows the user to receive practice reminders, in forms of a vibration or a sound. The advantage of this design is that it makes both controlling and viewing very convenient, and there is no limitation in user-device distance in comparison with the first two designs.

### Chosen Design and Tasks

Our group decided the major tasks to be providing an interactive system for peer dancers and capturing and evaluating dancer movements in real-time. The accomplishment of the first task helps motivate dancers of all levels and also supports coordination between members of the dance group. The accomplishment of the second task is crucial for beginner dancers to accurately acquire the dance moves, as they often suffer from lack of feedback. It also helps experienced dancers learn more efficiently. With these two major tasks, we decided to combine the smart mirror and mobile app for our final design. The mobile app is synced with the smart mirror, so any videos the user downloads on the app can be displayed onto the smart mirror. Once the video is displayed, the user can follow along to the video without redirecting their view to look at their movements at the same time. This design has low usage barriers for dancers because mirrors take a form natural to the dance practice setting.

## *Written Scenarios*

A description of the steps a person will go through to accomplish each of the chosen tasks based on the chosen designs

### **Scenario 1:**

Tiffany is a college student who enjoys dancing as a hobby. Instead of joining a dance club, she wishes to individually practice at her own pace. However, she finds it difficult to consistently motivate herself to practice. One evening, her friend Henry sends her a message through iZone, inviting her to a multiplayer challenge mode on iZone. She accepts the offer and prepares to dance in front of her iZone. Meanwhile, Henry is at a dance studio also preparing to compete. After selecting the song, the dance video is overlaid on both of their iZones. As they dance to the music, their accuracy scores are displayed at the top of the mirror. After the dance is over, Tiffany sees that she received an accuracy score of 76%. But she quickly realizes that Henry has beaten her with a score of 95%. She is motivated to practice more and take revenge on Henry.

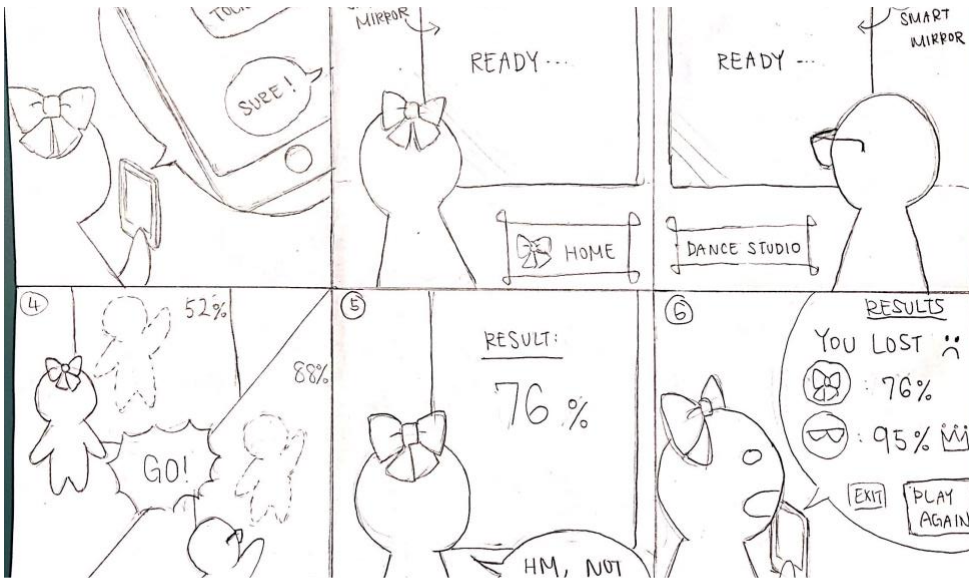
### **Scenario 2:**

Jeff, who is a first-year in college, made it into an intensive dance group through an audition. He is excited but quickly realizes that there are many expert-level dancers in the group. To make up for the difference in skill level, he practices at home by displaying the dance video on his desktop screen and checking himself in the mirror at the same time. But even after many hours of practice, the instructor points out that he has not acquired the dance accurately. One day, Jeff decides to try out iZone. As he overlays the dance video on the mirror, he no longer has to look back and forth between the desktop screen and himself. Moreover, iZone captures Jeff's movement in real-time and detects his mistakes. With iZone, Jeff can notice his errors immediately and focus on fixing them by manipulating the video control. The next day, the instructor is impressed that he has acquired the moves very accurately.

## *Storyboards of the Design*

### **Storyboard 1: Interactive system for peer dancers**





**Storyboard 2: Capturing and evaluating dancer movements in real-time**

