



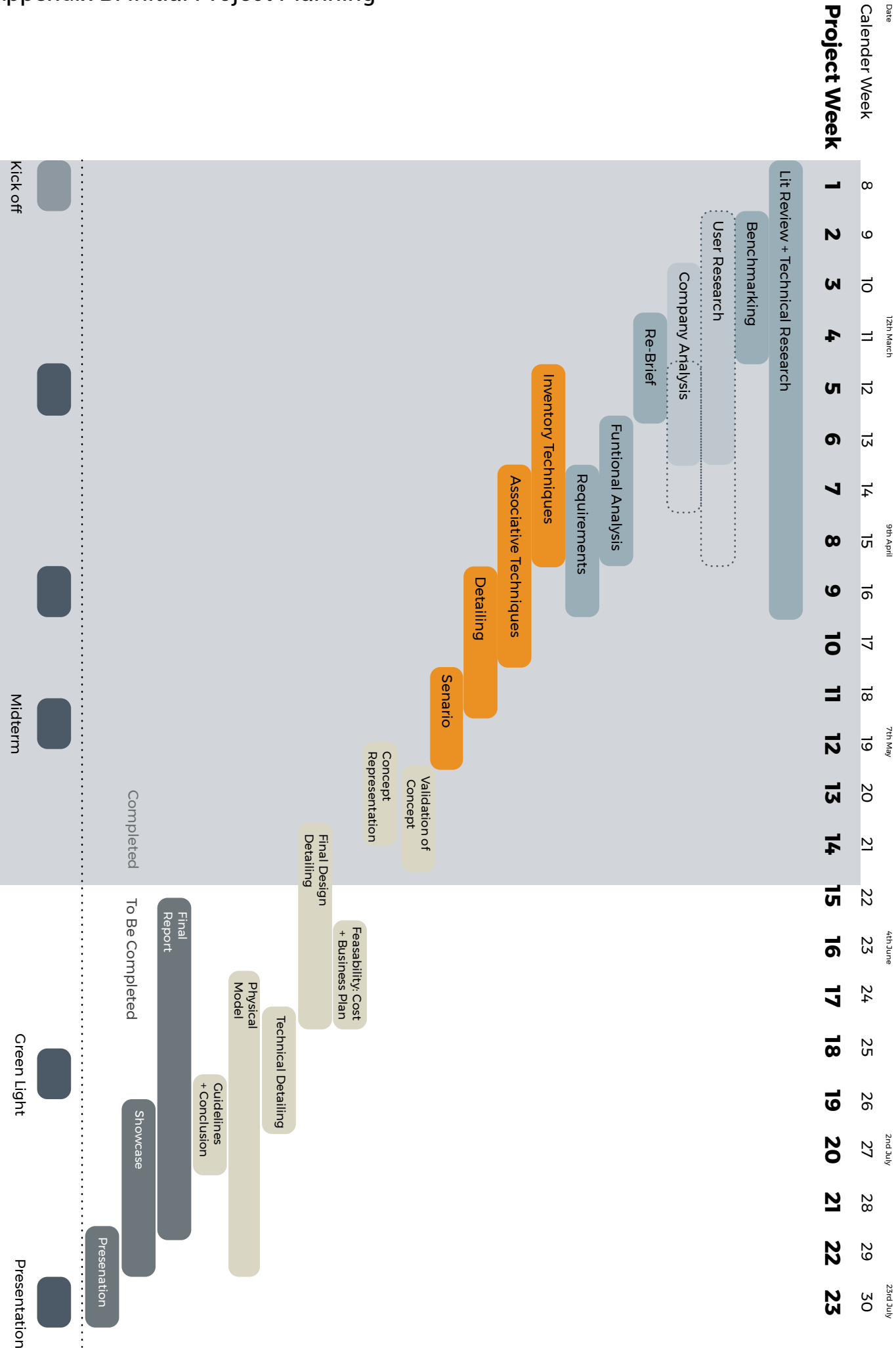
PUTTING HEART IN CPR

APPENDIX
AMY COLLINS

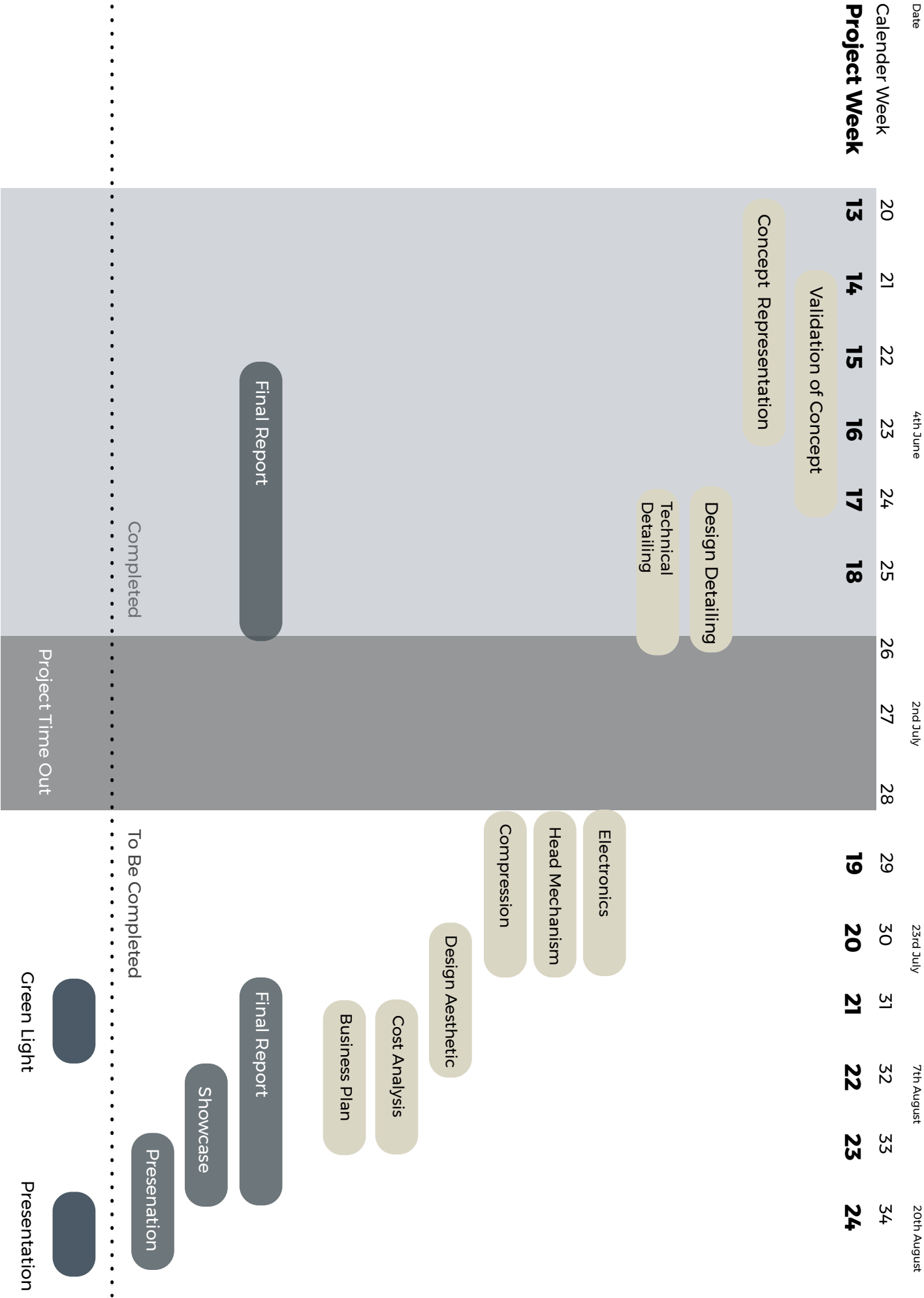
livis

TU Delft

Appendix B: Initial Project Planning



Appendix C: Revised Project Planning



Appendix D: Outline of CPR Sequence

HOW TO PERFORM CPR ON AN ADULT

If you see someone collapse or find someone lying on the ground:



- 1 ASSESS THE SCENE**

 - Quickly check the area for safety hazards, you can't help anyone if you become a victim yourself.
- 2 CHECK THE VICTIM FOR A RESPONSE**

 - Tap or shake the victim on the shoulder.
 - Shout: "Are You OK?"
- 3 IF THE VICTIM IS UNRESPONSIVE**

 - Yell for help.
 - Instruct a specific bystander to call
- 4 CHECK THE VICTIM FOR BREATHING**

 - Open the victim's airway. Gently tilt the victim's forehead back with one hand, and lift the chin with the other.
 - Scan the victim from head to abdomen for breathing. Do this for no more than 10 seconds. Gasping or gurgling is NOT breathing and CPR should be performed immediately.

CPR - Cardiopulmonary Resuscitation

- The victim must be on a firm and flat surface and facing upwards

- 1 30 CHEST COMPRESSIONS**

 - Draw a line, with your hand, from the armpit to the center of the chest.
 - Place the heel of one hand on the lower half of the sternum or breast bone and place other hand over the first. Interlace fingers.
 - Straighten your arms and position your shoulders over the victim's chest.
 - Push down to give 30 deep chest compressions in 18 seconds or less. It helps to count out loud.
 - Push down hard and fast, 2 inches (or 5 centimeters) deep at the rate of at least 100 compressions per minute.
 - Lift your hands slightly off the chest between each compression to allow for full chest re-coil.
- 2 GIVE 2 RESCUE BREATHS**

 - Ensure head is tilted back and the chin is lifted.
 - Pinch the nose closed and cover the victim's mouth, with your mouth, forming a complete seal.
 - Blow in for one second and look for the victim's chest to rise.
 - If chest does not rise, re-position if needed.
- 3 REPEAT STEPS 1 & 2 AND CONTINUE THIS PROCESS UNTIL:**

 - The victim begins breathing.
 - Another trained responder arrives and is ready to take over.
 - You are physically unable to continue.

After 5-cycles of CPR, if help is not available and the victim has not resumed breathing, call

9-1-1



CPR Certified
INDIGO MEDICAL TRAINING

Sources: cprcertified.com



Basic First Aid Training Experience

EXERCISE BOOKLET

"Name"

INTRODUCTION:

My Research:

Bystander cardiopulmonary resuscitation (CPR) is an important factor of survival from out-of-hospital cardiac arrest (OHCA), yet rates of bystander CPR can be low. In practice, people don't seem to feel adequately prepared to intervene. Current methods of CPR instruction may not adequately prepare bystander rescuers for the various challenges of resuscitating a victim of cardiac arrest.

The focus of this project will be to explore these opportunities to improve how people obtain CPR skills and focus on the possible bystander CPR rescuer. This project aims to develop a solution which contributes positively to people's ability to perform CPR and enable people to feel confident in an emergency situation, especially those who are most likely to be called upon to use CPR knowledge.

How to Complete the assignment?

In the workbook we ask you to do 4 small exercise spread over 4 days (ideally complete one exercise each day). Each exercise will take a couple minutes of your time. The assignments will generally start about understanding you and your daily life and then will go a little deeper on a subject of Basic First Aid training.

I would like to emphasize that the booklet can not be filled in incorrectly, as it concerns your insights and experiences, so feel free to do this according to your own judgment. The more information the better for my research.

I would like to thank you in advance for your time and effort. I hope that the exercises are clear, but if there are any questions I will be happy to answer them for you. And don't forget to bring this booklet to the session!

Amy

TU Delft Industrial Design Engineering Student, conducting Graduation Project at Livis.

e-mail: amy.collins@livis.nl

Phone: +31 6 21658990



ABOUT YOU:

Name:

Age:

Gender:

How many weeks/months ago did you complete the Basic First Aid Course?

Are you confident to intervene in an emergency situation and use your CPR skills?



EXERCISE 1: YOUR NETWORK OF CARING

What and Why?

Caring is something which is natural in our lives and we tend to care for those around us in some way. This exercise will show who you care for and their relationship to you.

How to complete the assignment:

Step 1: Think about the people in your life such as family, friends, work colleges. Think about how you care and help them and how much you value this relationship

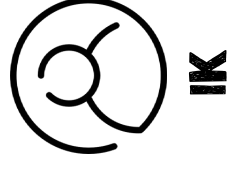
Step 2: Write the name each of each person you care for in a circle and state how you care for them. The closer the person is to the center the more important or time consuming this caring is in your life.

Note: Please try to label the relationship the person such as grandparent, life long friend, partner, etc.



Example:

Grandmother
I visit her every Sunday to
drink coffee with her to offer
emotional support. I complete
some household tasks as these
can be difficult for her .



EXERCISE 3: PAINS AND GAINS

What and Why?

The activities you mentioned in the previous exercise had an effect on your experience gaining your skills. I would like to know more about your experience with one positive and one negative activity/action.

How to complete the assignment:

Step 1: Think about all the activities you mentioned in the previous exercise leading up to the training course, during the training course and even immediately after the course.

Step 2: Select one positive activity you experienced and one negative activity you experienced and describe it. Please state why it was negative or positive.



Name the positive activity/event:

Describe the activity and state why it was positive:

Name the negative activity/event:

Describe the activity and state why it was Negative:

EXERCISE 4: JUST ONE QUESTION

What and Why?

Completing BLS course can express a responsibility to provide an adequate help to better someone's situation or life. We want to know the responsibility you feel relating to your newly acquired Basic First Aid skills and how you would express the importance of these skills to others.

How to complete the assignment:

Step 1: Think about why you completed this Basic first aid training. Was it to care for someone else? A sense of obligation? Did you experience an emergency situation in your life? Also think about how you feel now you have these skills.

Step 2: Fill in the heart with a quote (one or two lines) which expresses your opinion about the importance for others to Complete the Basic First Aid training course.

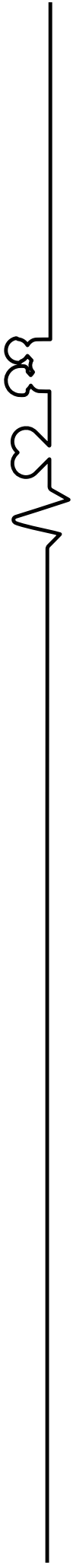


Note:
It may be easier if
you imagine you are
discussing this topic with
a friend and you wish for
them to have Basic first
Aid skills.



**EXTRA SPACE/
ROUGH WORK**

**QUESTIONS/
REMARKS**



DANK U WEL

TOT ZIENS

**I LOOK FORWARD TO
MEETING YOU!**

Appendix F: Exercise Given in Session

NAME:

Place Completed
Exercise 2 Here

HOW DID YOU FEEL?**WHAT COULD YOU HAVE DONE IMPROVE YOUR EXPERIENCE?**

Appendix G: Session Outline

Introduction (10 min)

13:10-13:20

- Take Coffee + Tea orders
- Thank you for filling in the booklet and explain the importance of this in relation to the booklet
- About the research (filming/ consent form to sign)
- About us (roles): Age, student (occupation), my project
- In the interview we will ask a lot of questions if at any point you are uncomfortable then do not feel obliged to answer

Warm Up (10 min)

13:20-13:30

- Select a Postcard which represents you and an aspect of your personality which you are proud of? (10 seconds, go)
- Take out your last exercise and I will ask you to state and explain your motto after you introduce yourself
- Ask participant to introduce themselves and explain their choice behind the postcard
- State the reason behind their answer to the final question

Instructions Timeline Feelings “before, during and after training” (5 mins)

13:30-13:35

If you could please open your booklets to exercise 2. In this exercise I wanted you to remember not only your experience with BLS training but also the events which preceded it. I wanted to know your full journey and this journey contained highlights and some lowlights. This exercise will allow you to pin point these events and explain your feelings around them.

Why timeline:

- Helps to grasp when your journey and if there are any relationships between events.
- Also helps understand the relationship with these feelings to events before and after.
- Helps you to communicate your story.

Ask participants to take out their second booklet exercise. And stick this page onto the A3 sheet provided.

Using the smiley faces mark if each event was positive or negative.

Then use the timeline under exercise 2 to mark your emotions and how they changed over time.

The final aspect involving a bit of thinking with regard to what you think could have been done to change your experience.

What would you have done differently to improve your experience?

Complete Timetable (20 mins)

13:35-13:55

Trigger questions:

Think about why you attended the training course, how did you feel about this event?

How you felt during the training and at different stages of training?

Are there changes in your mood at different parts of the training?

What was the effect to you and your ability or your perceived ability?

Look to your exercise 3 for inspiration on what you would improve?

Present Timeline (25 min)**13:55-14:20**

1. What parts of it do you particularly like? Dislike? Why?
2. What did/do you enjoy about this event?
3. What was especially satisfying to you about the process?
4. What did/do you find frustrating about it?
5. Did you meet feel your meet standards?
6. What were your goals during this experience?
7. Did you meet your goals?
8. Did this experience reveal anything about you as a learner?
9. What did you learn about yourself as you worked on this piece?
10. Any comments on what we just heard....
11. Are there any aspects which your agree or disagree with....
12. Have you changed any ideas you used to have on BLS training?
13. What does that tell you about yourself and how you learn?

Break (10 min):**14:20-14:30**

Take coffee + tea orders

Show where the bathrooms are

And thin else you would like to discuss with m about this process or my research feel free

Group discussion “ideal training experience” + Inspirational objects (20 min):**14:30-14:50**

1. One thing I would like to improve upon is ...
2. What would you change if you had a chance to do this piece over again?
3. What will you change in the next revision of skills?
4. As you reflect on your skills, what's one thing that you would like to try to improve upon?
5. What's one goal you would like to set for yourself for next time?
6. What would you like to spend more time on during training?
7. Is there anything you felt was missing during training?
8. What things you might want more help with?
9. What work would you show her to help her understand those things?
10. What do you think would need to change for more people to attend a course?

Show design Sketches (40 min)**14:50-15:30****Closing Comments (5 mins)****15:30-15:35**

Would like to thank you all for your time and for being so open with your experience. It is incredibly valuable to my research.

I have learned a lot form this experience and I thank you for being honest and open.

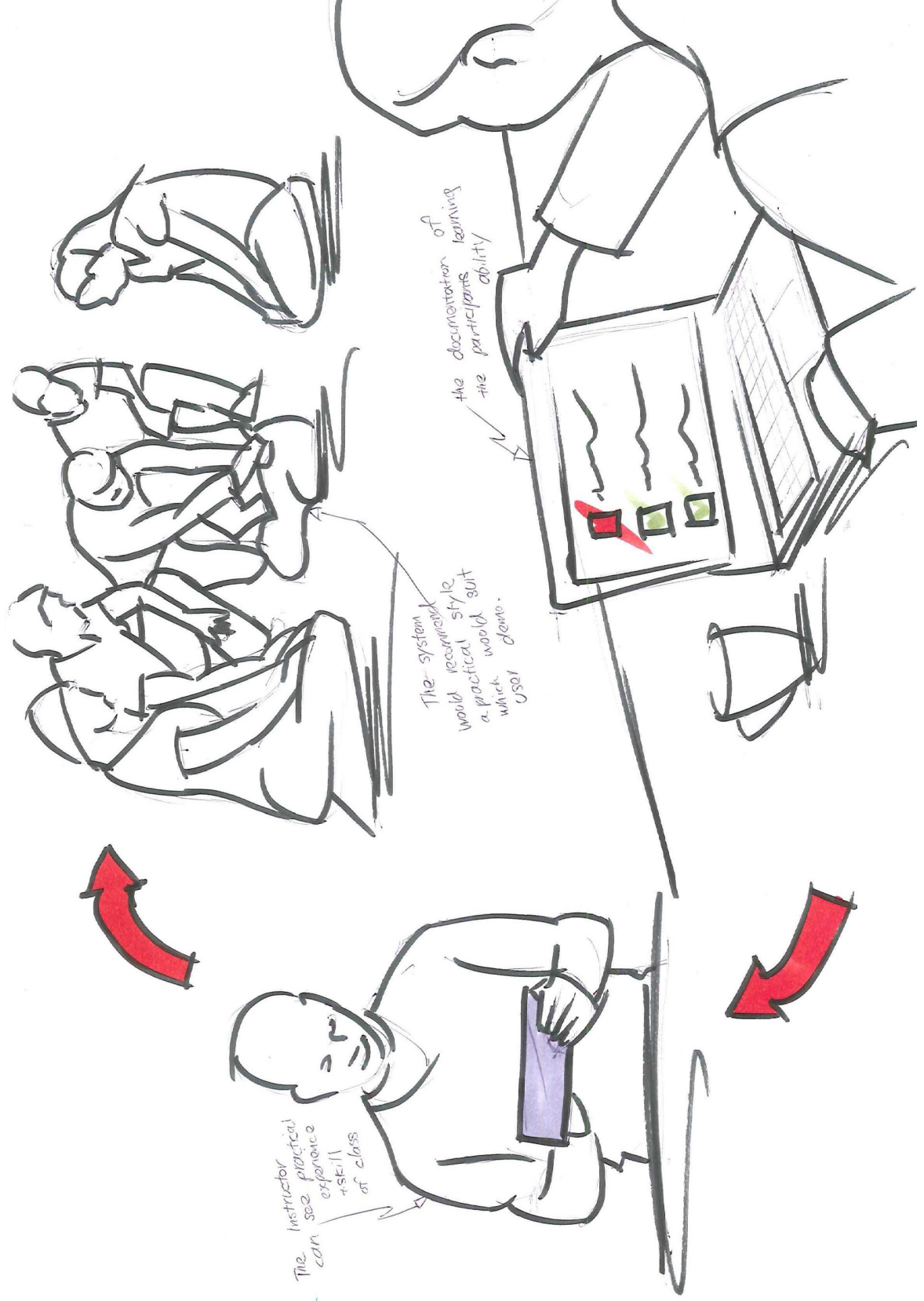
The session is officially concluded as I promised you to try to keep in time. However. I am still available now to discuss some more aspects you feel are important or for you to ask some more questions.

I will be -mailing the vouchers as a token of my gratitude to you within the next week. However I do need your declaration forms in order for you to receive the reimbursement. Please send them to me as soon as you can.

Time	Action	Checklist
10 min (13:10 – 13:20)	Introduction + Consent Form	Who am I and what am I doing?, Goal: to gain insights into your experience, “you are the expert”, Basic Rules. Must sign Consent form. Take coffee orders
10 min (13:20-13:30)	Warm-Up With Postcard (or Empathy Map ?)	Images of postcards: each participant selects a picture with which he can identify most and presents the picture and himself to the group
5 min (13:30 – 13:35)	Instructions for making Timeline	Ask participants to take out their second booklet exercise. This exercise is to make their feelings at points of their journey obtain the skills and after. Use this to create a Customer journey
20 min (13:35 – 13:55)	Timeline Feelings “before, during and after training”	Think about why you attended the training course, how did you feel about this event?, how you felt during the training and at different stages of training? Are there changes in your mood at different parts of the training, What was there effect to you and your ability?
25 min (13: 55- 14:20)	Present Timeline	Explain your timeline to the group and react to others stories
10 mins (14:20 – 14:30)	Break	Take coffee Orders
20 min (14:30 – 14:50)	Group discussion “ideal training experience” + Empathy Map	What would be your ideal training experience? What do you think training could be like in the future?
40 min (14:50-15:30)	Presenting and discussing my ideas	Present sketches of my training ideas, ask for comments and concerns, discuss how my ideas differ or are similar to their ideas.
5 min (15:30- 15:35)	Closing Comments	
(15:35-15:45)	Walk out	

Design Direction 1: Personalised Learning

The online learning assess your knowledge after completing e-learning. Participant can document their preferred learning style. The Instructor can view this assessment and understand how to style the practical session. The system can even recommend a style of practical which would suit all members in the group.

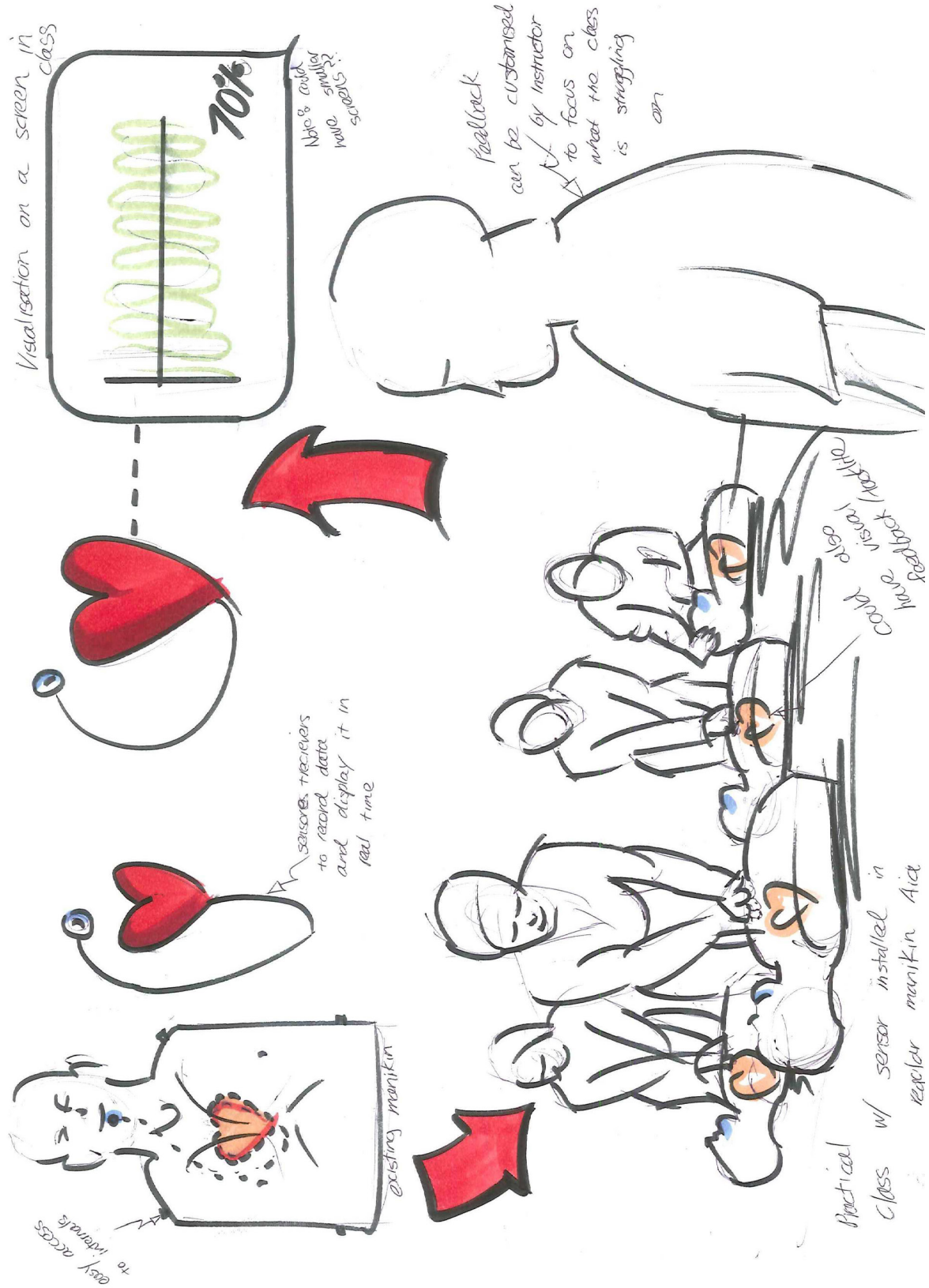


The practical session would have feedback devices and the means which the feedback is communicated is in terms of a common goals for all of the participants. This will promote team work and motivate others to perform better due to team mentality.

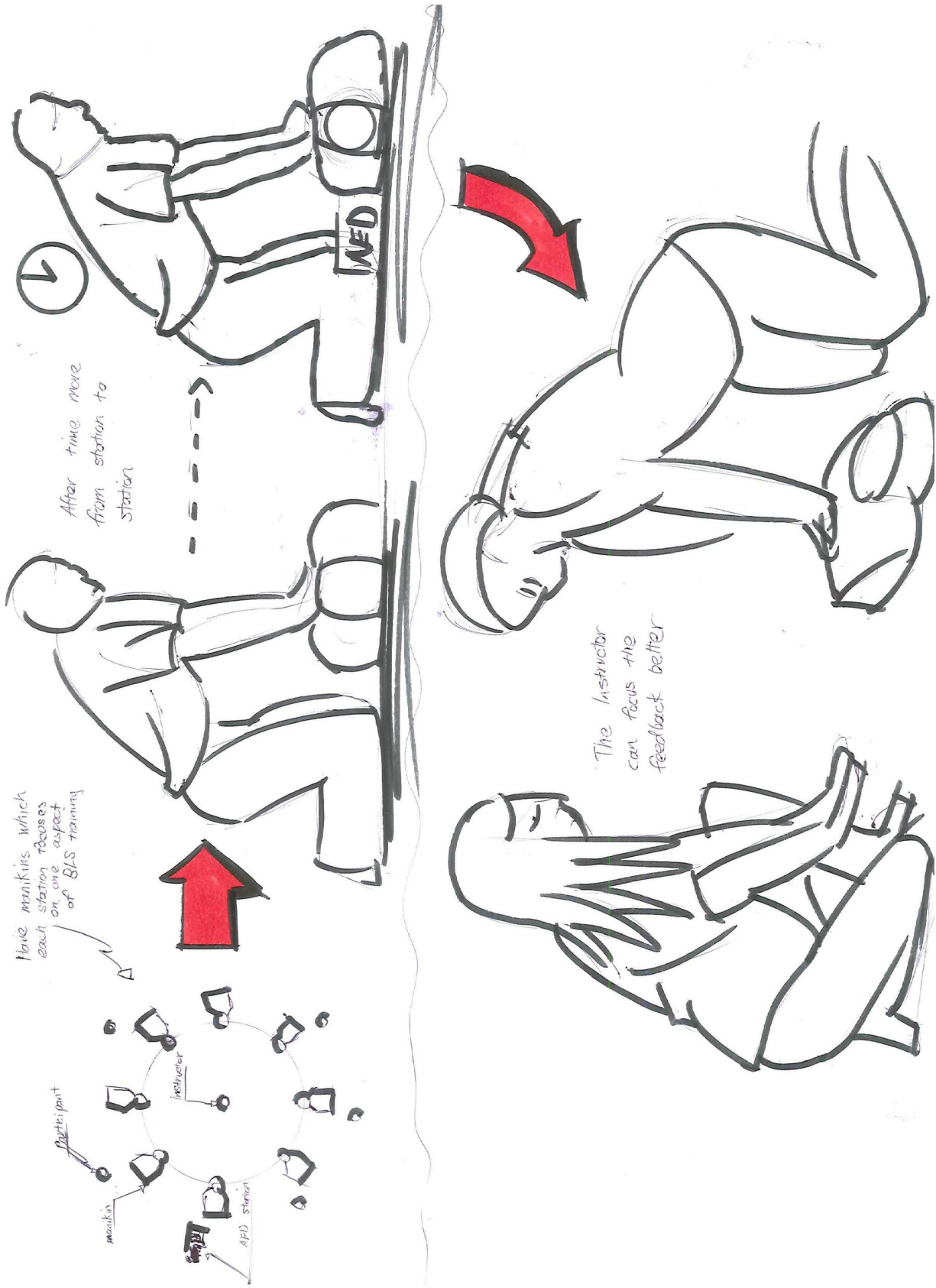


Facilitate community

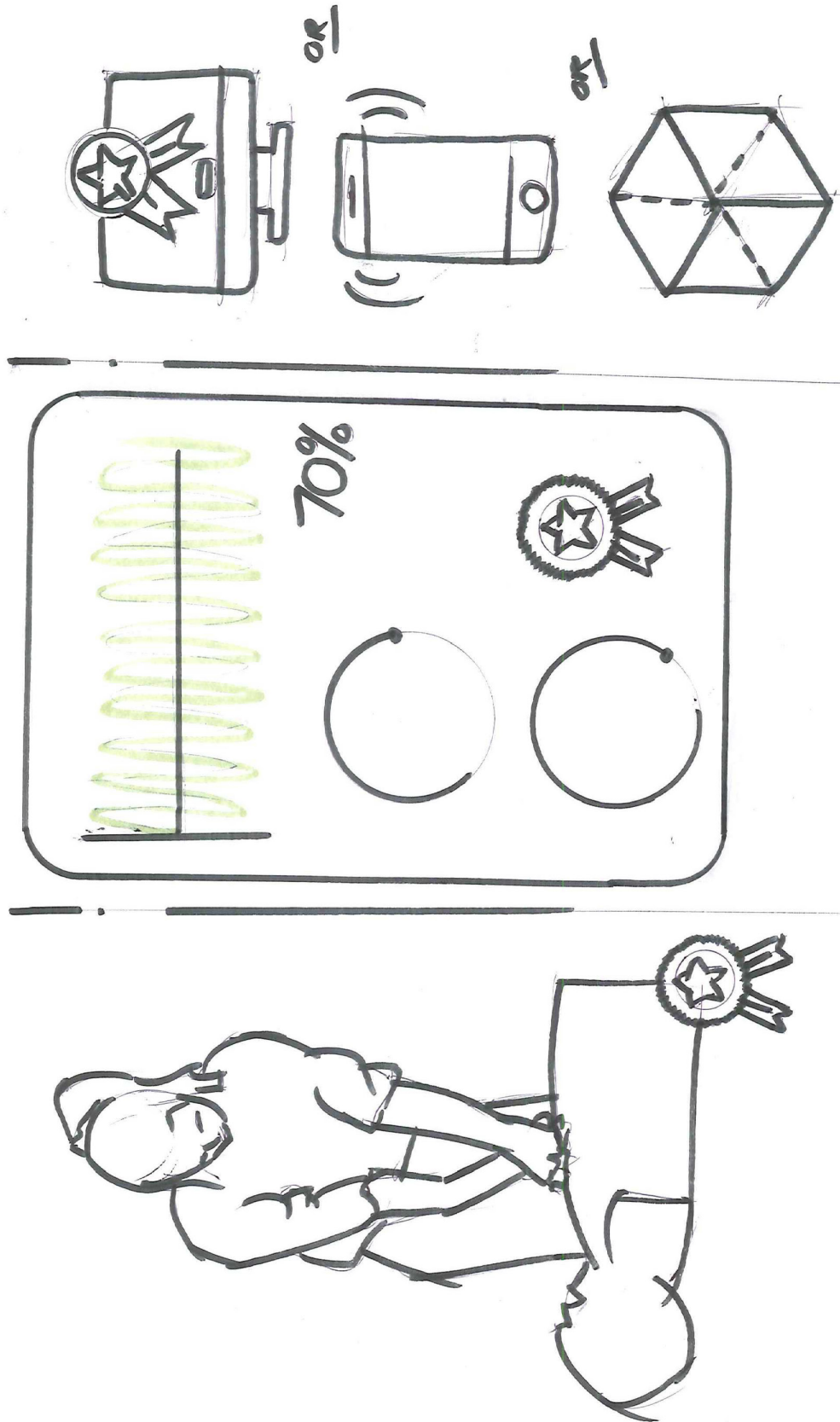
The practical would use an existing manikin that is easily dissembled for hygiene purposes. A retro fit sensor and receiver would be developed and placed in the existing manikins. Feedback can then be customized for the needs of the class and for Livis courses. The feedback could be more tactile and realistic to a real situation then existing feedback devices.



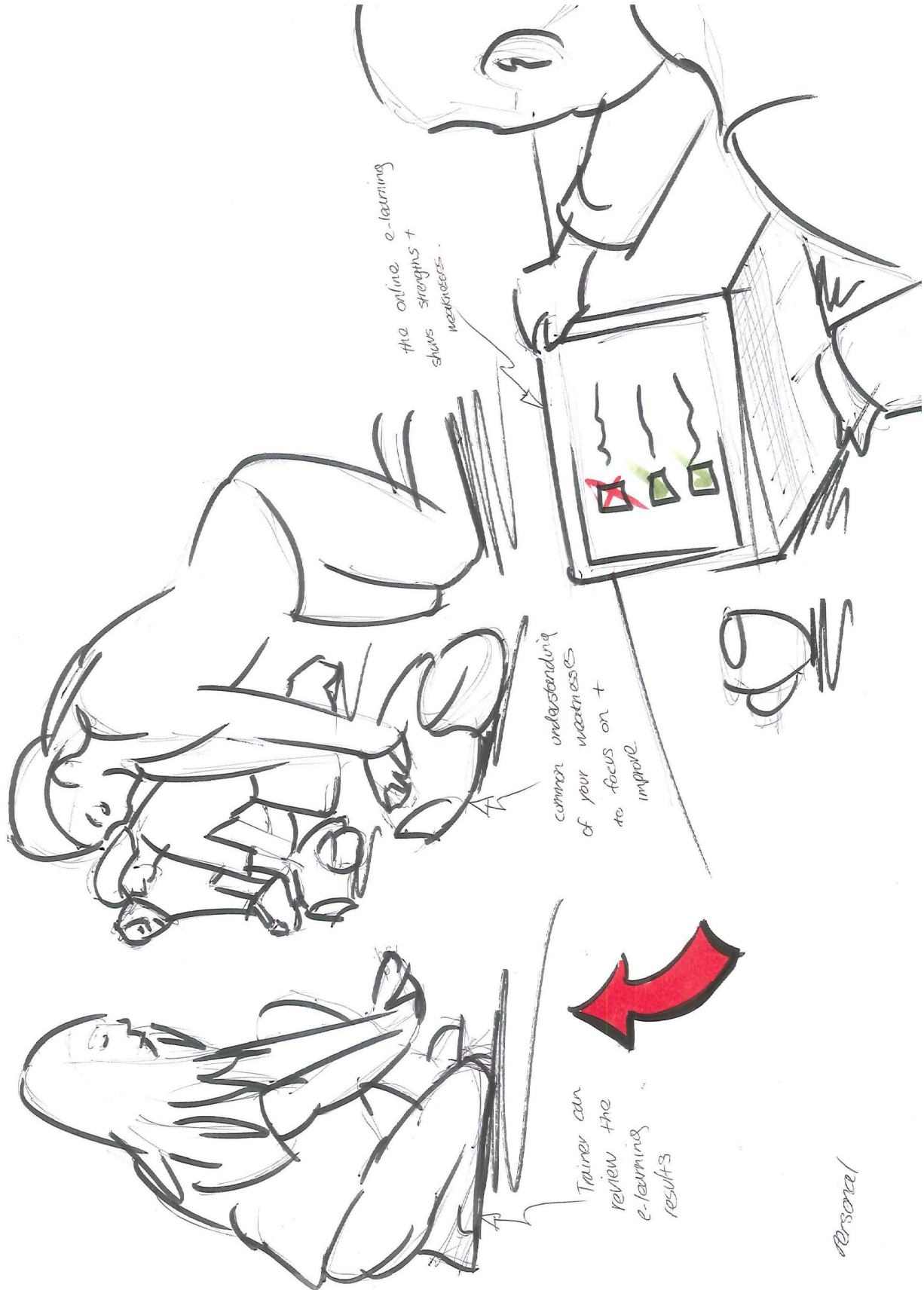
There would be several manikins places in different locations in a session. each manikin is focused with one since aspect of the BLS training. The person stays on a station until they master on skill and move to the next and finish with an assessment of all skills together. The instructor not has more of a management role and extra advice role as each manikin would be customised for the specific feedback.



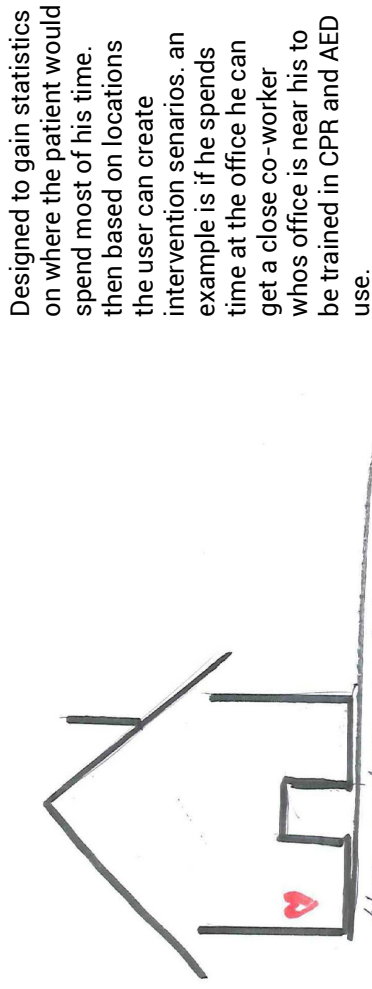
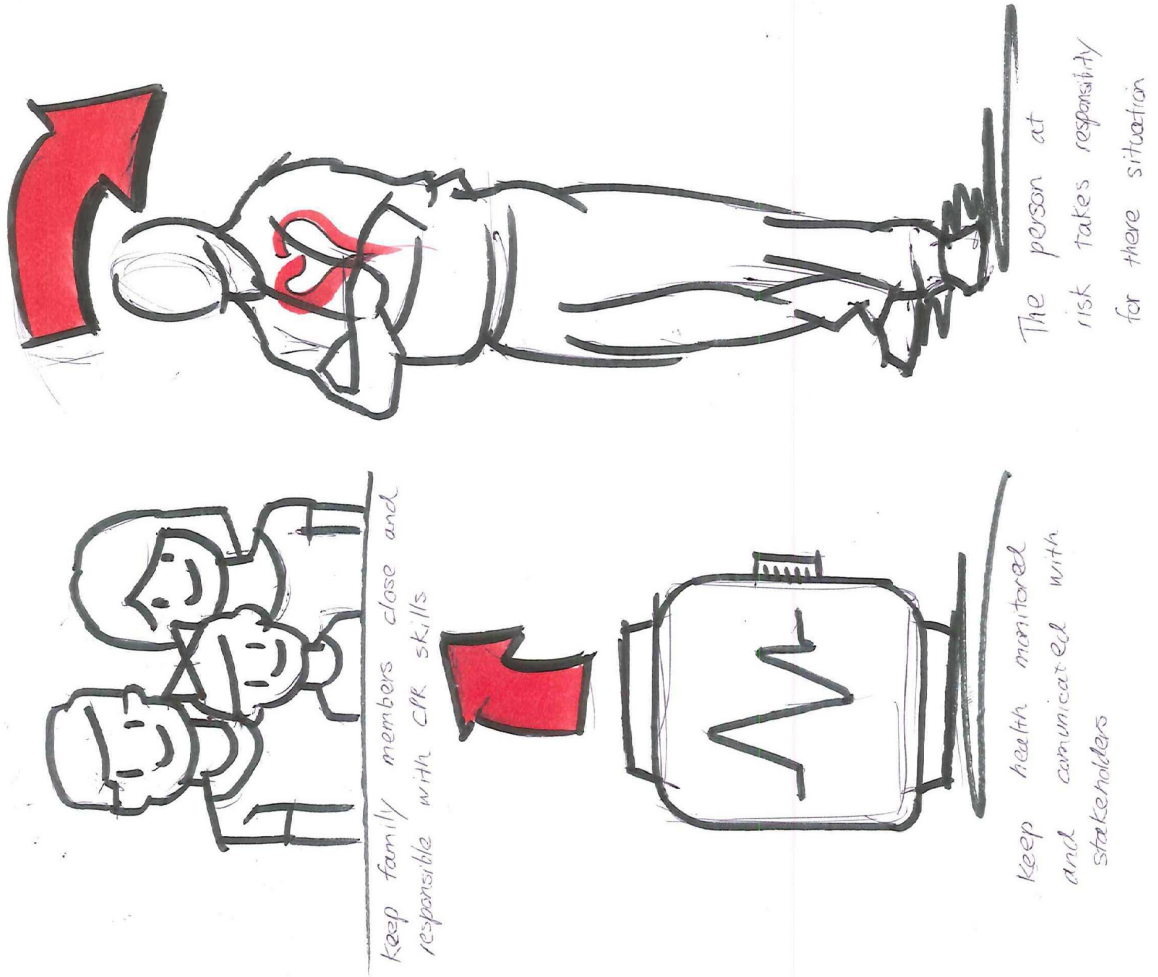
The person completes the practical similar to existing practical sessions. Instead of receiving a certificate you receive an assessment which states what aspects you struggled with and how to improve in the future. products could then be promoted and development which would be used for the user to further enhance skills.



The assessment of the online e-learning will show strengths and weaknesses and then recommend a customized class for you to attend. Other participants would struggle on the same aspects and the instructor can tailor the course to the learners needs.



Design Direction 2: Family Focused

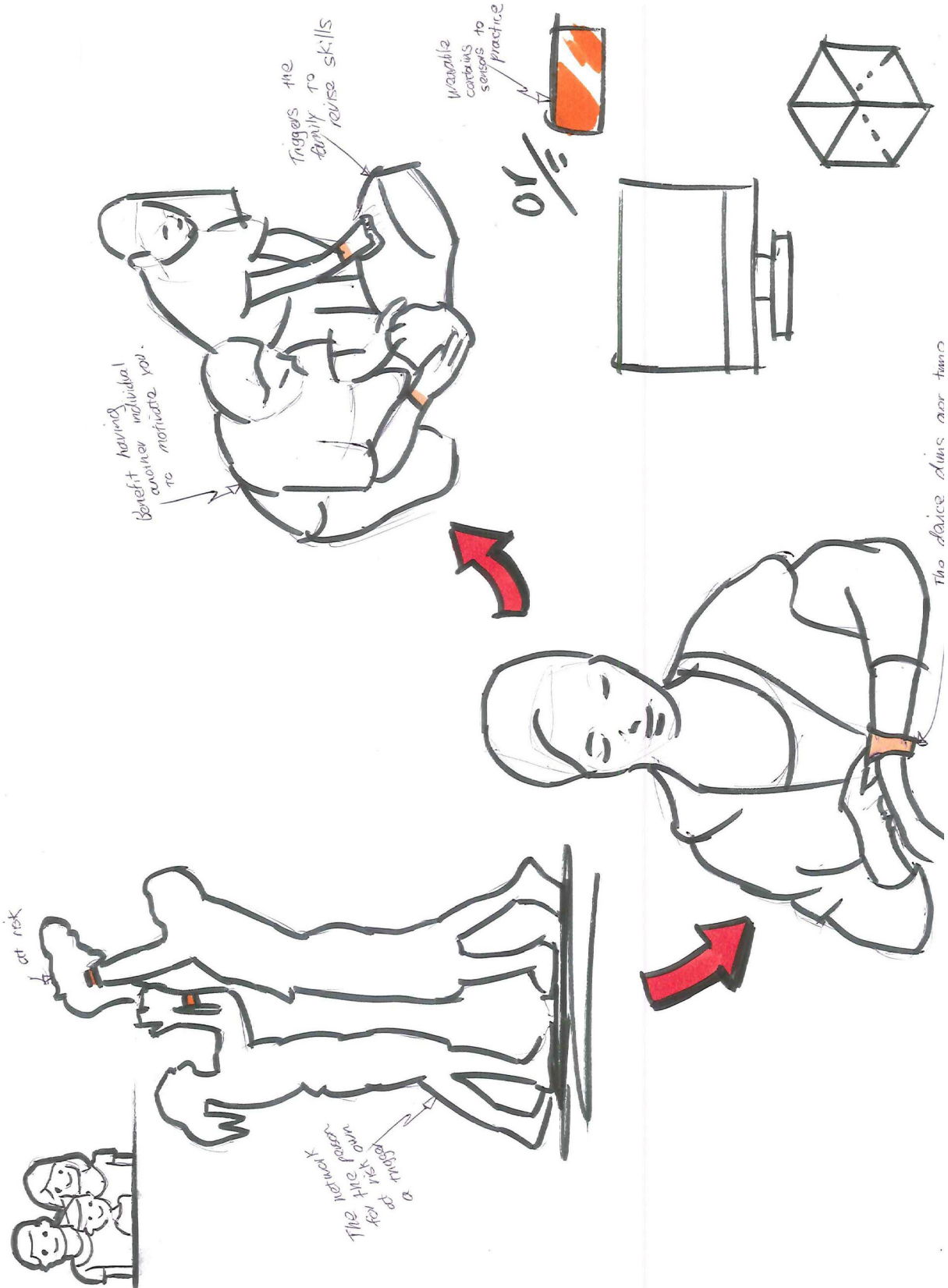


Designed to gain statistics on where the patient would spend most of his time. then based on locations the user can create intervention scenarios. an example is if he spends time at the office he can get a close co-worker whose office is near his to be trained in CPR and AED use.

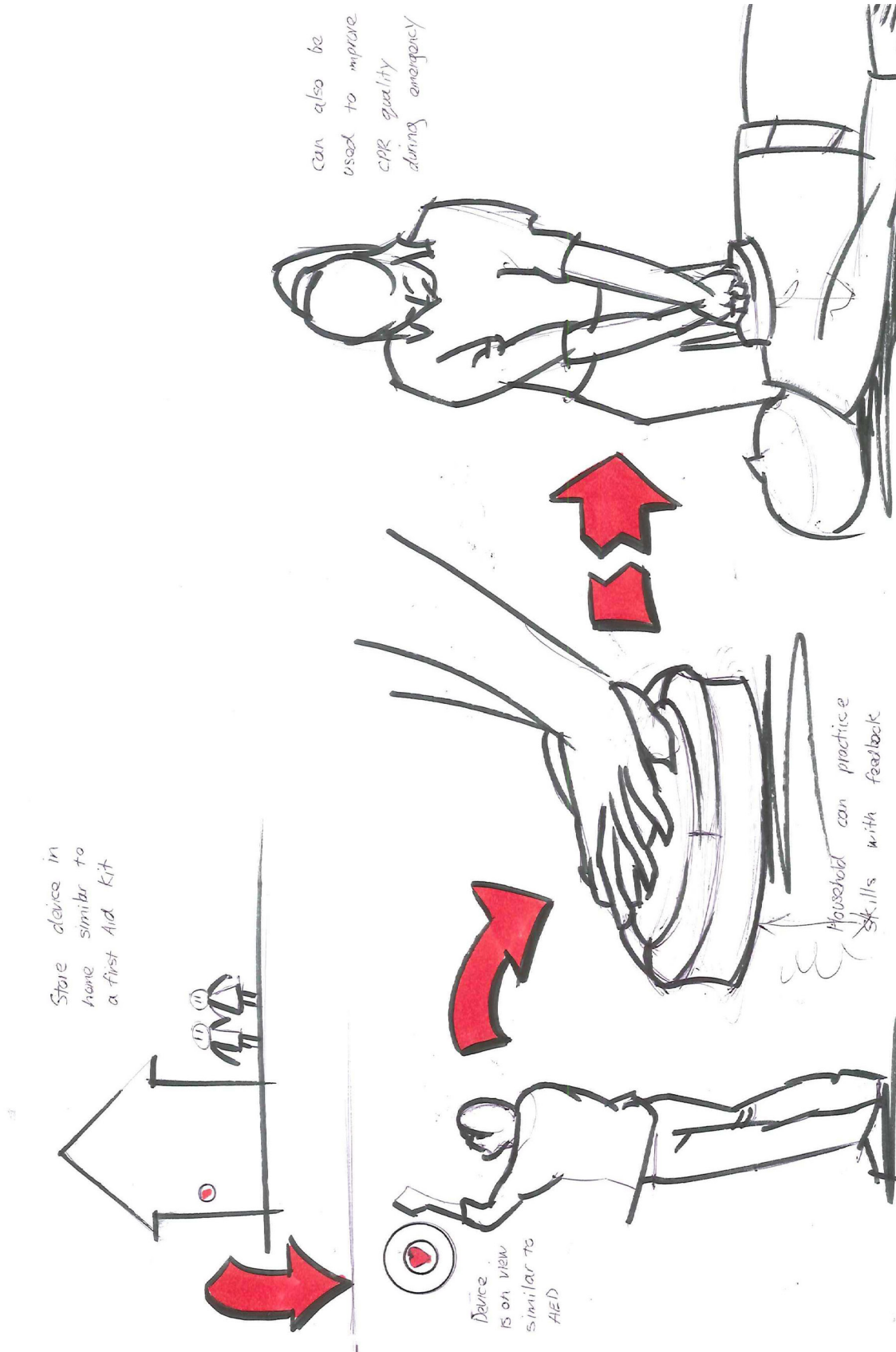
If the home is located far from an AED machine then there would be protocol on who would drive to collect AED and who would start CPR.

Training can be customized to simulate these scenarios.

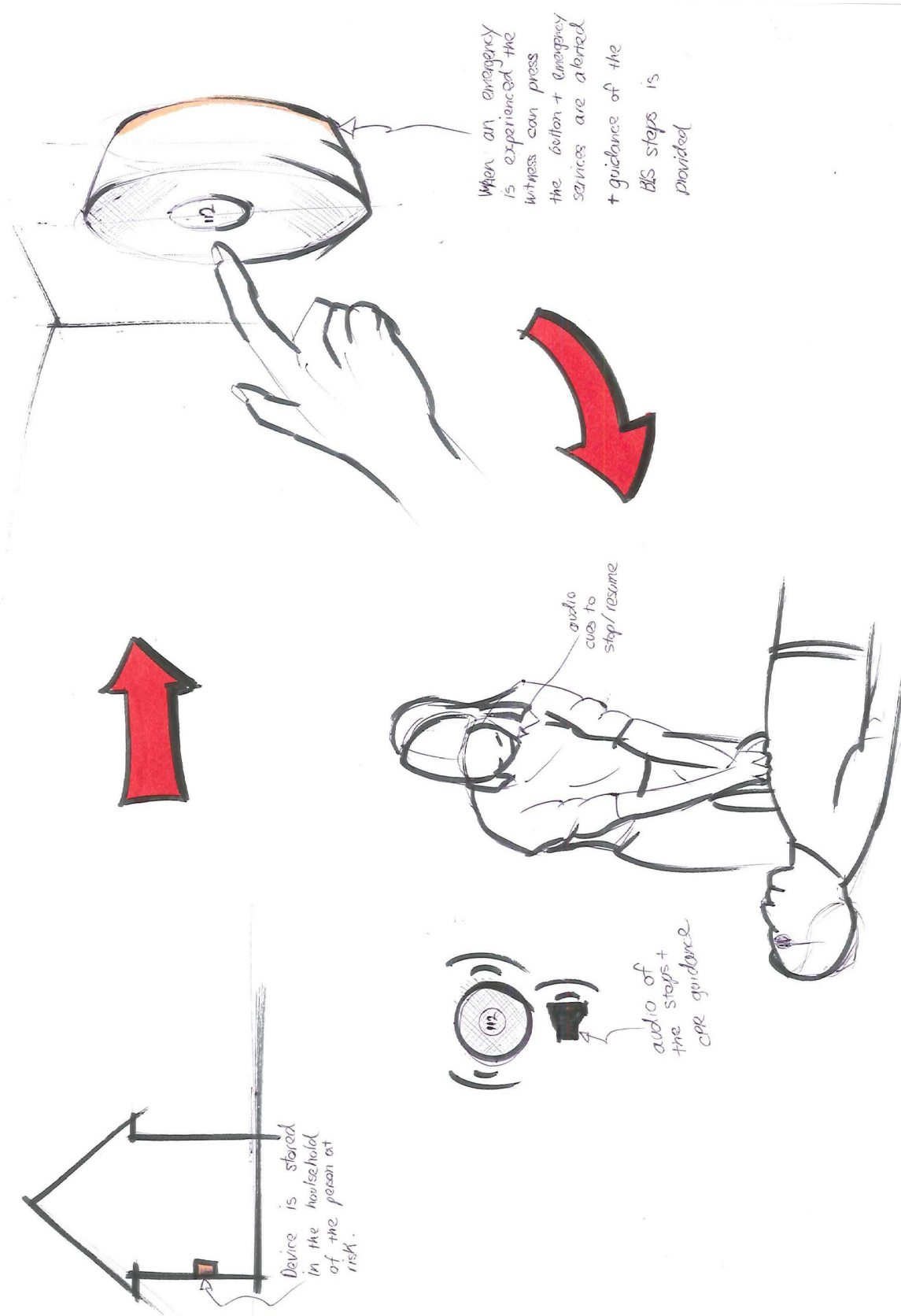
The desired user could be parents of a child at risk (premature baby). They would motivate each other to update their knowledge and train more frequently. The idea could be a wearable that has the electronics to track CPR and then will give you feedback as you train and engage in online learning. Over time the wearable could notify the user to train as skills may have deteriorated. Every time training would be completed with a buddy to have the support and motivation.



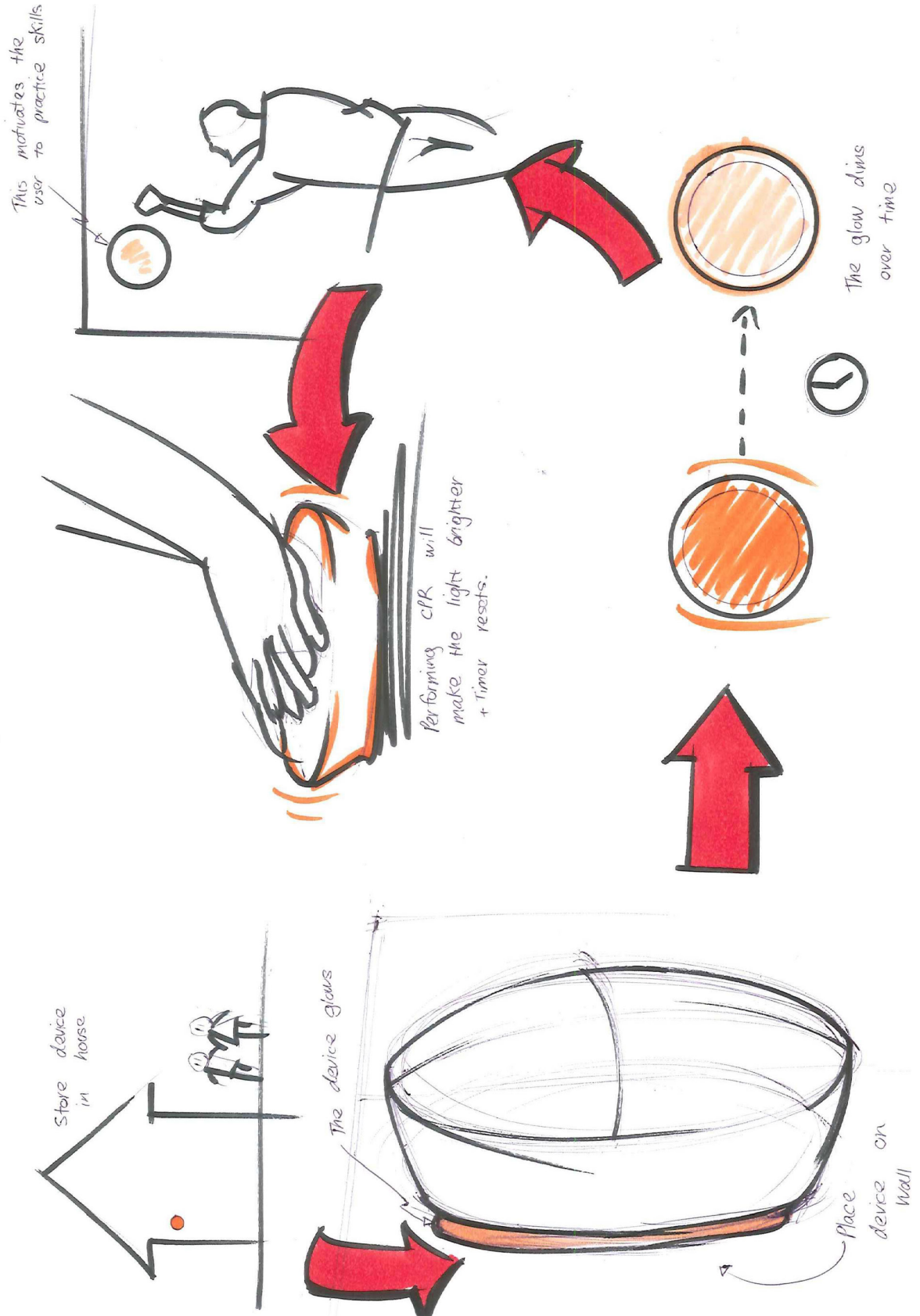
The device would be stored in the home similar to a first aid kit. On view when it is needed it can be removed from the wall. then it can be set to be used for practice and if an emergency was to happen it can be placed on the chest to help with compressions



The device can be stored in the house of a person who is at risk of a cardiac event. When an emergency is experienced the witness can press a button which would in turn link to a phone to call 911. Then the phone would act as a speaker to give audio cues on how to complete CPR steps.

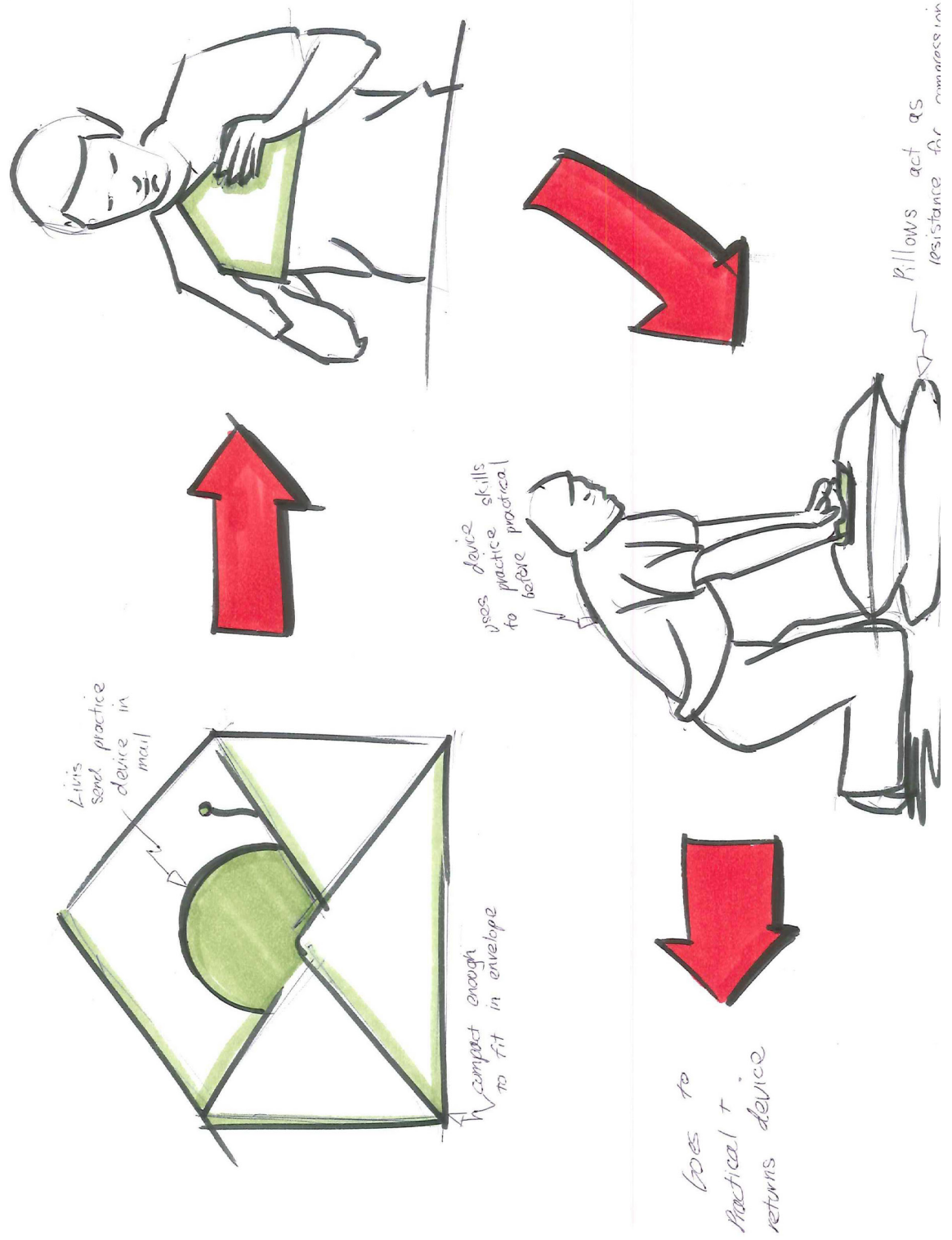


The device would be stored within the home on display similar to a light fixture. The device would glow bright and dim over time as it is not in use. The user is triggered to perform CPR using the device and revise skills while giving audio visual feedback cues. Once training is complete the device is glowing brightly again



Design Direction 3: Self-Learning

Person would apply for the Livis course. Instead of online learning material the user is sent the device sensors to train with before the practical. The user practices skills with some informative feedback and the device could even be used with a firm pillow for compressions. Then the user is more prepared to practice in the practical.



A personal device the user owns and can practice CPR with. it would give tactile feedback as the user practices and link with an App to give a more summative feedback of th users performance. It would be suitable for home use and attractive for a learner to use over going to a BLS session

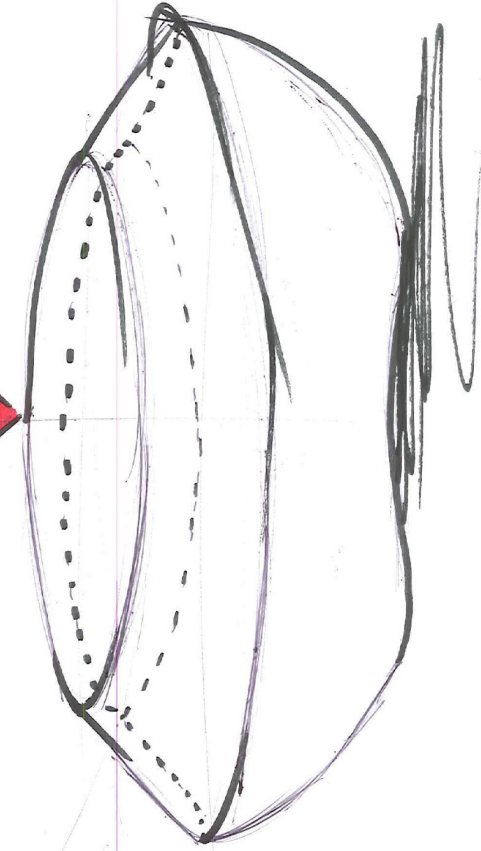


Phone app gives compression feedback + ventilation.

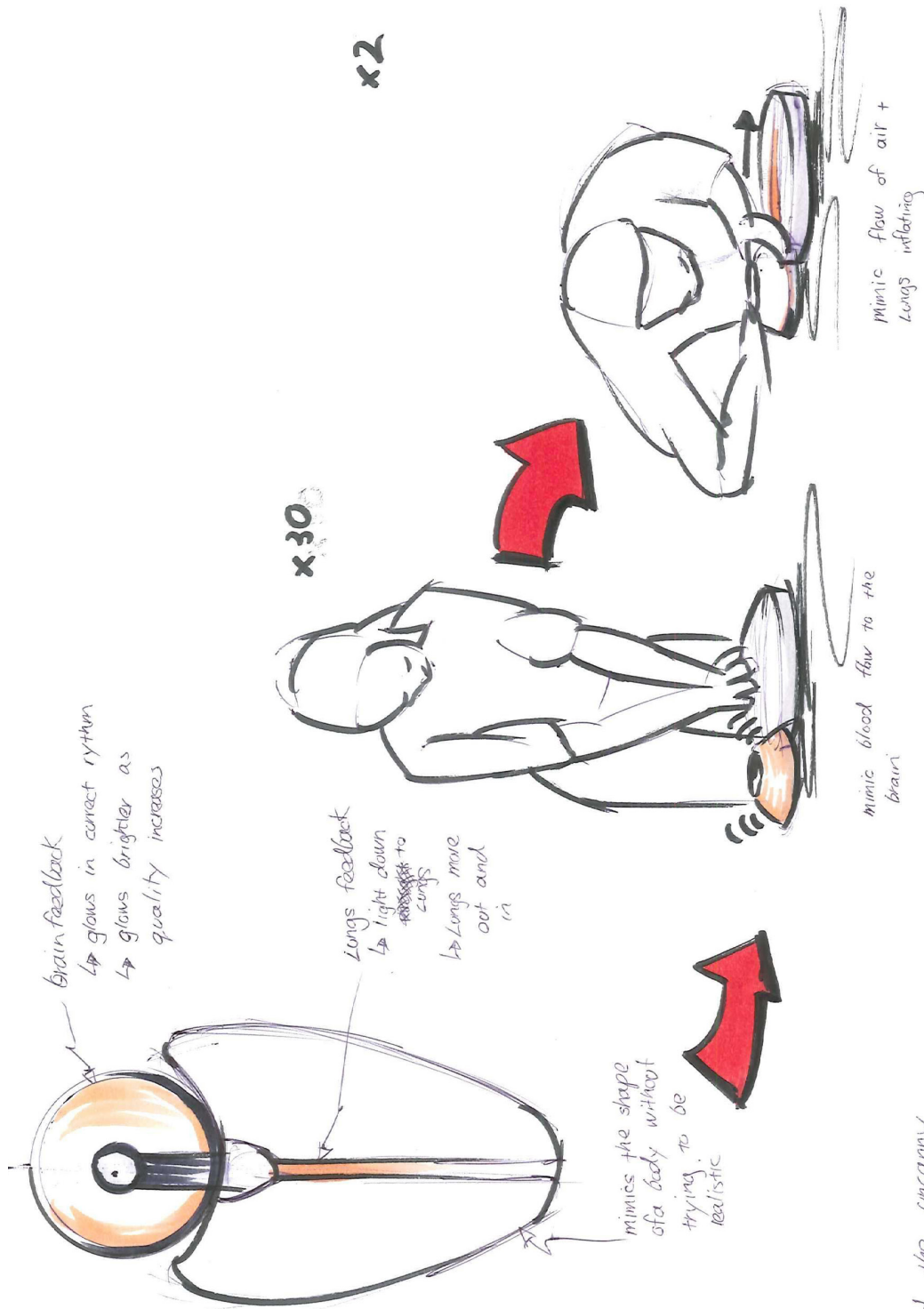
Notes blow on screen could record + feedback.



Mechanism inside gives resistance electronic sensor sends feedback to phone.

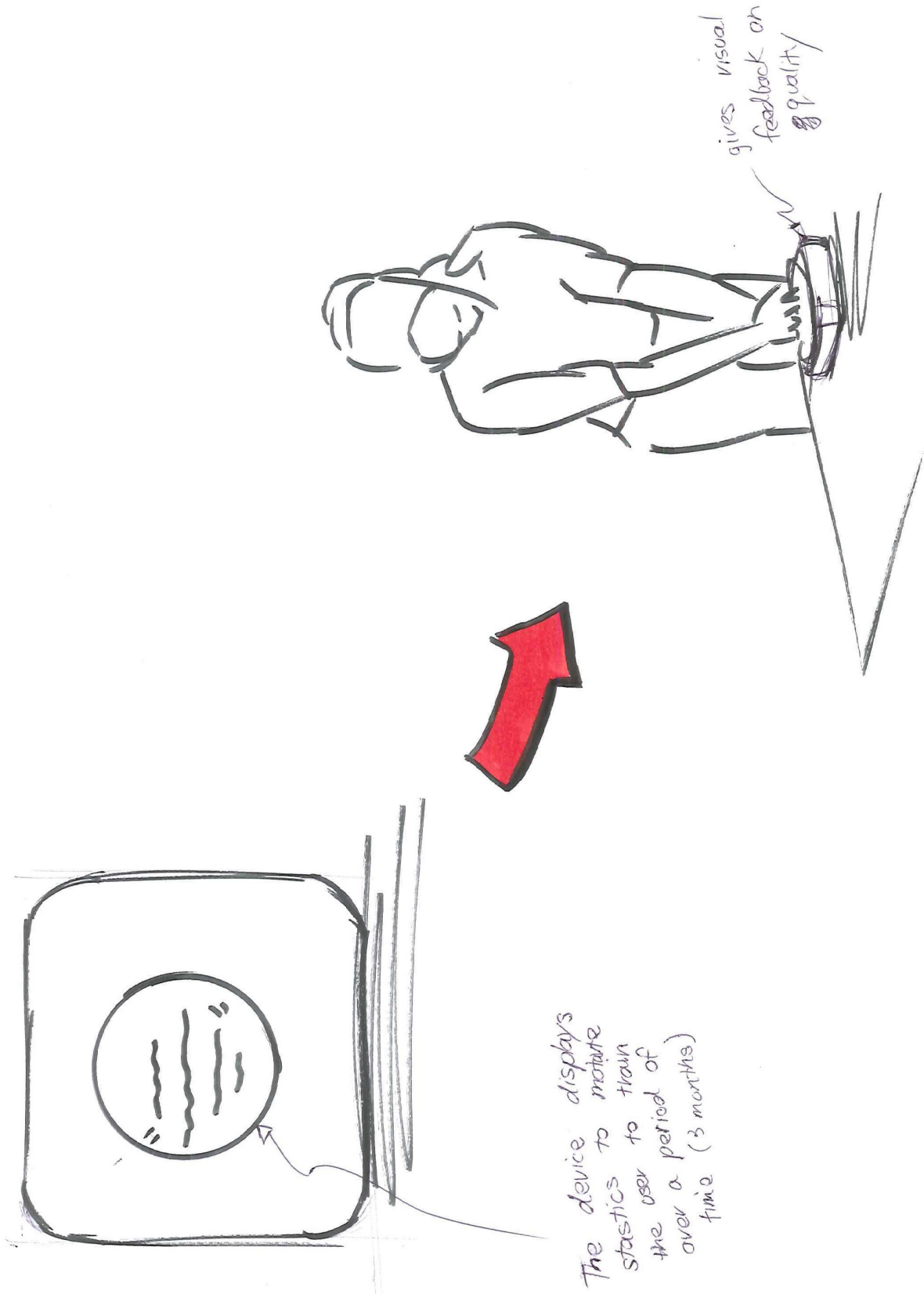


The device would mimic the shape of the body without being to realistic of a human, but still represents the human body by visualizing how the actions performed are helping the victim. The head section would glow when tempo was correct and the color would show the correct depth. Mimicking the blood flow to the brain. a light down the center of the device would mimic the flow of air to lungs during rescue breaths.



Cad's avoid the uncanny effect!
2) Link feedback to real life

The device could be paced in the house and display different statistics about CPR and mortality rates. then over time the user would be triggered to train more often. the trigger could even be personalized. the device would double as a self training aid to allow the user assessable practice.



Appendix I: Questionnaire for BLS Participants

Livis Questionnaire:

Introduction:

Livis (in conjunction with TU Delft) is conducting a survey to determine the attitudes of adults regarding CPR. These question will only take a five minutes of your time, and all answers will be kept confidential. Your response to these question will help to assess how people feel about CPR. This is a graduation project which is being completed with Livis and the Faculty of Industrial Design Engineering at TU Delft.

If you have any questions regarding this survey, please contact Amy Collins @ amycollins1994@gmail.com.

Section 1: Personal Details

1. Your Age:
 2. Your nationality:
 3. What is your English fluency? (Native Speaker, Fluent, Proficient (Advanced Level), Conversant (Intermediate Level), Basic Knowledge (elementary level))
 4. Do you live with someone who has any of the following conditions?
 - ☐ Diabetes
 - ☐ Heart disease
 - ☐ Angina
 - ☐ High blood Pressure
 5. Have you ever witness or experienced any of the following events?
 - ☐ Heart attack
 - ☐ Bypass surgery
 - ☐ Coronary angioplasty
 6. Have you ever been taught CPR?
 - ☐ Yes. If yes, Year? _____
 - ☐ No
- OR
7. What was your motivation for completing Basic First Aid Training?
 8. Would you recommend This CPR training to a friend or colleague? *(1 to 10 netPromotor Score)*

Section 2: CPR Confidence and Self-Efficacy

This section is designed to find out your belief in your ability to apply your CPR skills. For this section, there are no right or wrong answers. Please state your honest belief in your CPR knowledge and skills.

In an emergency situation, I am confident I can always... ***(1 to 5 Likert Scale)***

1. Assess the safety of myself and the victim, in this order, before approaching
2. Assess the victim's level of consciousness within 5 seconds
3. Shout for help while continuing with the "Primary Survey"
4. Open the airway by applying the most effective manoeuvre, depending on the situation
5. Assess for breathing and differentiate between effective and agonal respirations in no more than 10 seconds

8. Provide effective chest compressions (correct hand placement, depth, recoil and speed)
9. Give effective rescue breaths (correct volume of air and speed of breaths)
10. Maintain correct CPR ratio of compressions to breaths until I have a valid reason to stop
11. Switch on the AED and start using it as soon as it is available without delay
12. Follow the AED voice prompts in the right order without getting confused and/or distracted
13. Attach AED pads in the correct positions
14. Ensure nobody touches the victim whilst rhythm is being analysed
15. Deliver a rapid and safe shock to the victim keeping visual check and giving verbal commands
16. Resume, without hesitation, appropriate post-shock actions according to current guidelines
17. Guarantee minimal interruptions in chest compressions during the resuscitation attempt
18. Continue as directed by voice and/or visual prompts from the AED

Section 3: Thank you and Recruitment

Thank you for taking the time to complete this survey. Your participation is greatly appreciated.

We are recruiting individuals to participate in a study on an alternative form of CPR training. Would you like more information regarding participating in this study?

- ☐ YES. I am interested in participating in a study on an alternative form of CPR training.
- ☐ NO. I am not interested in participating in a study on an alternative form of CPR training.

IF YES, Please provide the following Information:

Name _____

E-mail Address _____

Address: City _____

 Zip _____

Phone number: (____) _____

Survey Monkey: <https://nl.surveymonkey.com/r/CFZK25D>

Appendix J: Questionnaire for usability Testing

Preferred Orientation of the screen?

☐ Portrait

☐ Landscape

Circle the 3 most preferred screen location and rank them 1 to 3, where one is the most preferred:

The figure displays six diagrams of a human torso, each representing a different smartphone position. To the right of each torso are two empty circles for ranking the positions from 1 (most preferred) to 3 (least preferred).

- Top Left:** Smartphone is in the upper left corner of the torso.
- Top Right:** Smartphone is in the upper right corner of the torso.
- Middle Left:** Smartphone is on the left side, centered vertically.
- Middle Right:** Smartphone is in the lower center of the torso.
- Bottom Left:** Smartphone is at the bottom center of the torso.
- Bottom Right:** Smartphone is in the upper center, near the neck.

Participants Position

Participants Position

Participants Position

Participants Position

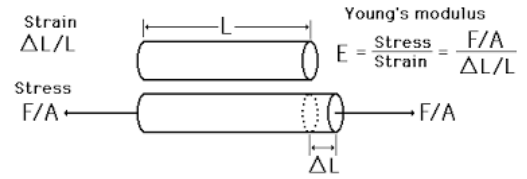
Participants Position

Participants Position

Appendix K: Compression Calculation

$$\text{Young's Modulus (E)} = \frac{\text{Force(F)}}{\text{Change in length(e)}} \frac{\text{Length(L)}}{\text{Area(A)}}$$

$$E = \frac{FL}{eA}$$

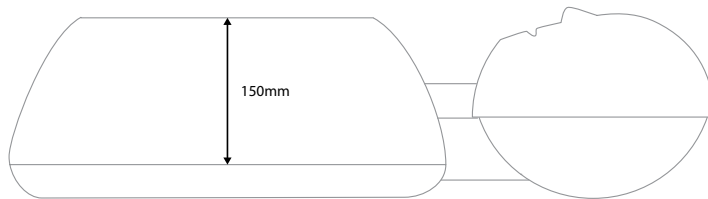


Process:

$$E = ?$$

F = Force is the required force to compress an average human chest to 6cm. From research this force is 600N
600N

L = Overall length of the compression piece



0.15m

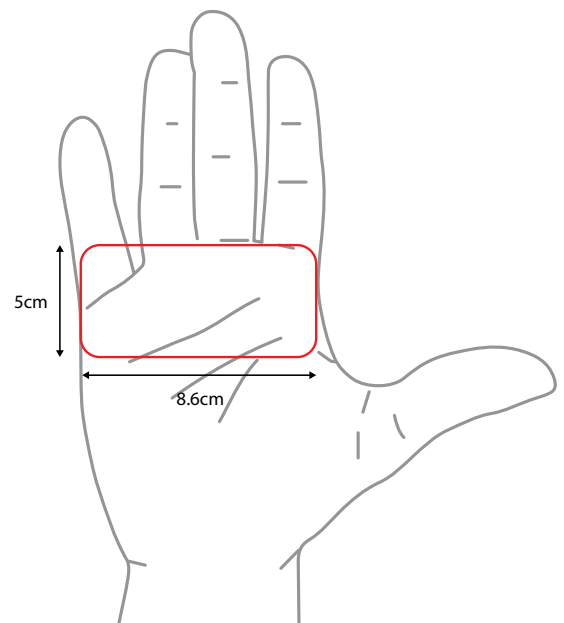
e= The recommended defection of actual human chest,
which is 5cm to 6cm

0.06m

A = Area is the area of the hand which applies the force.
Data for the Dutch Adult population is taken from
Dined website.

$$(0.05)(0.086) = 0.0043\text{m}^2$$

0.0043m²



Calculation:

$$E = \frac{FL}{eA}$$

$$E = \frac{(600) (0.15)}{(0.06) (0.0043)}$$

$$E = \frac{90}{0.000258}$$

$$E = 348,883 \text{ Nm}^2$$

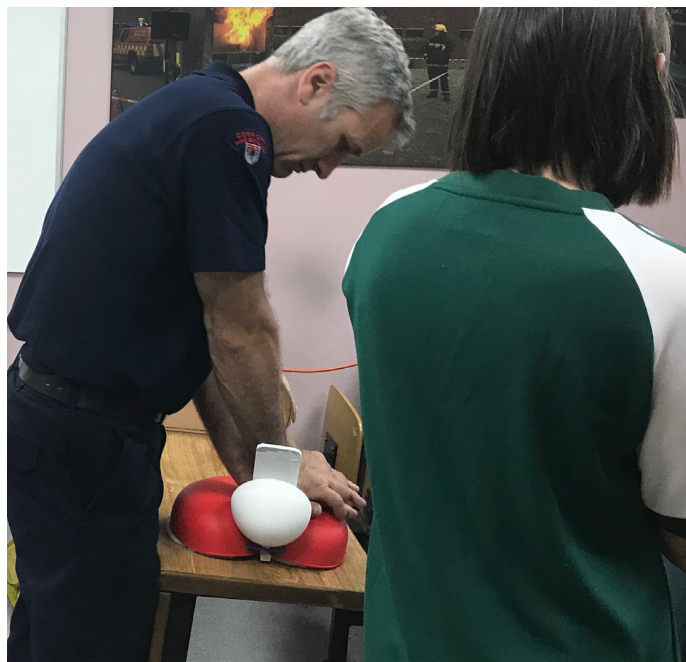
Due to this calculation being a rough estimate a factor of safety was added to the calculation of 1.5 to get a range

$$\text{Factor of Safety} = (348,883 \text{ Nm}^2)(1.5) = 523,324.5 \text{ Nm}^2$$

Answer: A material with a young's modulus within the range of 0.35MNm^2 to 0.52MNm^2 to deform similar to a human chest and this therefore suitable for this product.

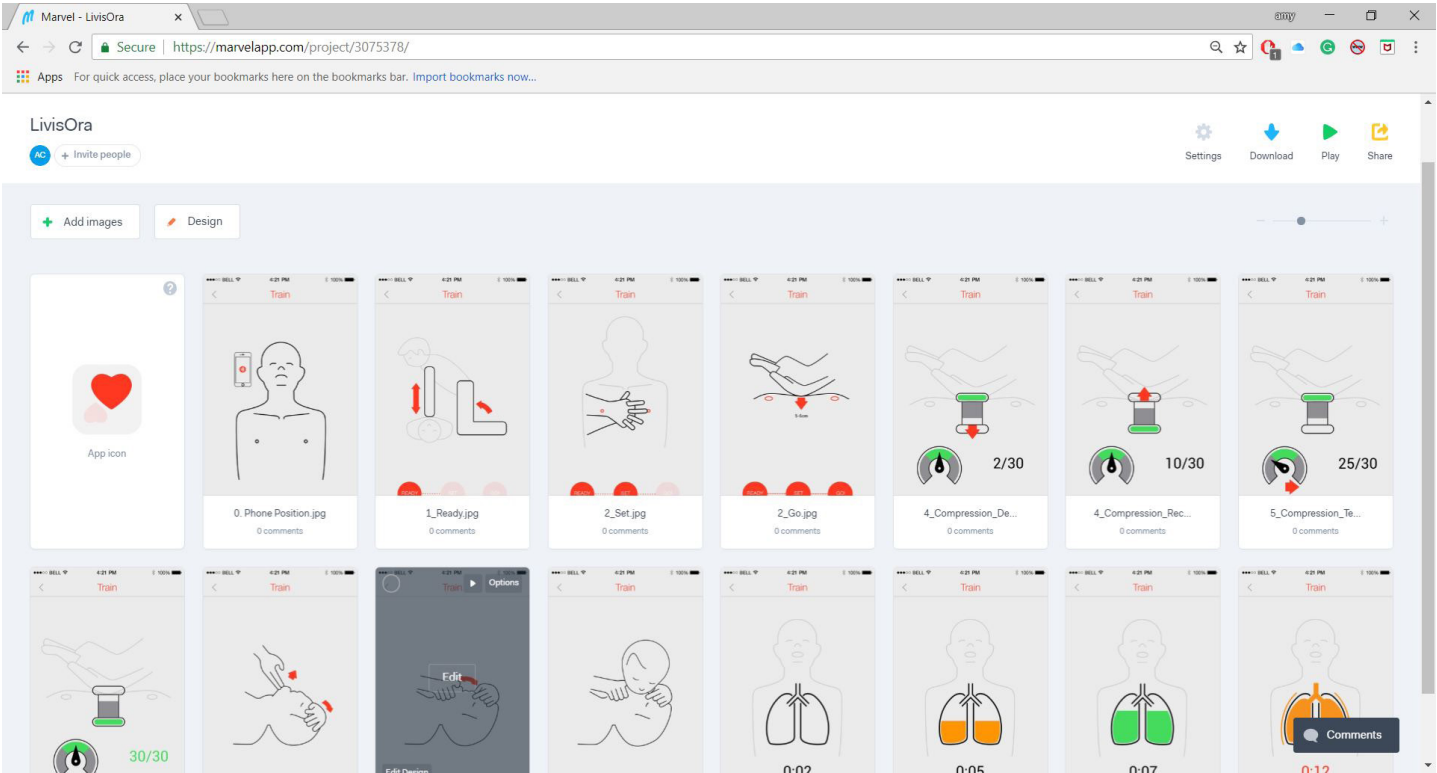
Note: The actual young's modulus needed could be affected by the design and form of the final product. The cavity needed for ToF tracking could effect the strength and modulus needed

Appendix L: Mock-Up Device

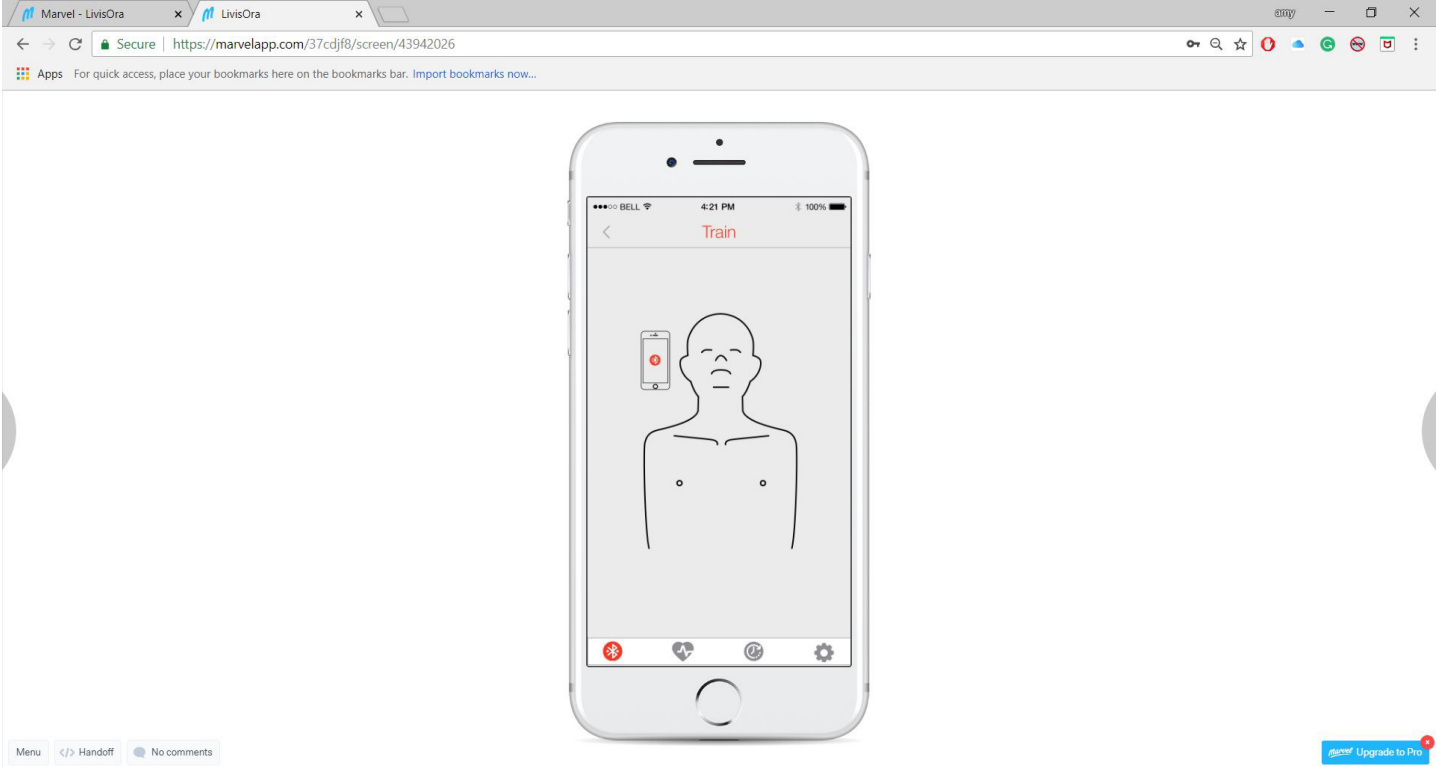


Appendix M: Mock-Up App

App Development



App Prototype



Click Link to interact with App: <https://marvelapp.com/37cdjf8>

Appendix N: Renders of Final Form

