LATRONIC

Problem

Although lacrosse is a team sport, individual members play a major role in the team's overall success. An average team practice consists of drills, reviewing plays, and conditioning; this may leave little time for working individual players' skills. This results in players having to further develop their skills outside of practice, which may be difficult as some may not know where to start (or it may be their first time ever playing). There is little training equipment available for lacrosse, and those that exist are either for experienced players or do not target a wide range of fundamental techniques.

Lacrosse needs a training tool that would help players (of any experience level) further develop their technique outside of practice and enable them to establish a strong foundational skill set.

Research Method

Step 01: Research
- Lacrosse, Equipment/Teaching Competitive Analysis, Sports Technology, Enchanted Objects & Hardware Sensors

Step 02: Empathize
- Questionnaires, User Persona & Expert Interview

Step 03: Define
- Cradling, The Crosse & Goal Statement

Step 04: Ideate
- Feedback Map, How Might We's & Sketches

Step 05: Prototype
- Features & App Screens

Future – Step 06: Implement
- Physical Demonstration Video

Lacrosse Overview

Lacrosse is considered the oldest team sport in North America and was first played by Native American Indians in the St. Lawrence Valley. Today, it is popular in Canada, and in the US it is commonly played in the Midwest and the Northeast. (growing popularity in the Southeast)

"The Fastest Sport on Two Legs"

Types of Lacrosse:
- Field Lacrosse (Outdoors– Smaller playing area)
- Box Lacrosse (Indoors– Smaller playing area)
- World Lacrosse Sixes (fast-paced)
- Intercrosse (indoor and no-contact)
- Polocrosse (combines Polo and Lacrosse)

Mens: Drastically evolved from the game's original rules
- Rules: Limited stick contact & Body checking allowed
- Equipment: Helmet, Mouth guard, Gloves, Cleats, Crosse, Pads
- Players: 3 defenders, 3 midfielders, 3 attackers and 1 Goaltender
- Sticks: Defenders (long poles: 52-72 in) | Midfielders & Attackers (short poles: 40-42 in) | Goalie: (poles: 40-72 in)

Womens: Continues to remain true to the game's original rules
- Rules: Limited stick contact & Prohibited body contact
- Equipment: Goggles/Helmet, Mouth guard, Gloves, Cleats, Crosse
- Players: 4 defenders, 3 midfielders, 4 attackers and 1 Goaltender
- Sticks: Defenders, Midfielders, & Attackers (poles: 35.5-43.25 in) Goalie: (poles: 35.5-52 in)

5 Fundamental Skills:

Cradling   Passing   Catching   Shooting   Scooping

Competitive Analysis (part 1)

B-Lax Blast Solo Training Aid $19.99

Targeted Skills: Passing, Catching & Hand/Eye Coordination

Review: 3 Stars

Comment: "The string kept getting tangled up"

PRIMED Lacrosse Solo Trainer $34.99

Targeted Skills: Passing, Catching, Receptions & Endurance

Review: 1.5 Stars

Comment: "I feel it's a little cheaply made for the need"

Goal Shooting Targets $39.99

Targeted Skills: Shooting & Accuracy

Review: 4.5 Stars

Comment: "Easy to place on the goal and stays put"

Goal Shooting Target Shot Trainer $64.99

Targeted Skills: Shooting & Accuracy

Review: 3 Stars

Comment: "The elastic wares easily in the weather"

Weighted Training Goalie Lacrosse Shaft $79.95

Targeted Skills: Strength

Review: 5 Stars (1 review)

Comment: "Good stick to build arm strength"

Bounce Back Lax Wall Rebounder Target Mat $144.99

Targeted Skills: Passing, Shooting & Accuracy

Review: 4.3 Stars

Comment: "Light and easy to move around"

Shoot-N-Scoop $149.99

Targeted Skills: Shooting, Passing & Scooping

Review: 4.1 Stars

Comment: "Great for solo or group practice"
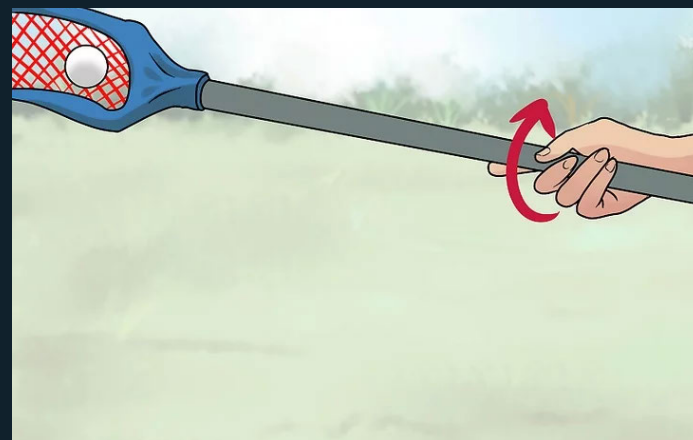
Competitive Analysis (part 2)

Method: "How to" Videos

Example: How to Cradle a Lacrosse Ball // LAX 101 (YouTube)

Pros: Led by a professional & Visual/Verbal instructions

Cons: May use complex terms & Moves through steps quickly

Method: Diagrams & Pictures

Example: How to Cradle a Lacrosse Stick (wikiHow)

Pros: Visual references & Depicts a step-by-step visual

Cons: Can be visually confusing & May use vague imagery

Method: Written Instruction

Example: "Use your dominant hand to curl the stick towards you (by curling your wrist), and then away from you, in one rhythm."

Pros: Can be detailed and list specific motions/examples

Cons: Not practical to read and practice at the same time

"Shoulder to shoulder Kayla"

Method: Verbal Instructions

Pros: Typically given while players are holding the stick

Cons: Wording can be confusing & No visual references

Method: Guided Lessons (with a trainer)

Example: VertiMax Lacrosse Training $499 - $4595 | Rating: 4.9 stars

Pros: Led by a trained professional & Used by professional athletes

Cons: Expensive & Not available to all players (ex. location)

Method: Physical Demonstrations & Drills

Pros: Done with the team, Convenient & Different examples

Cons: Individual player movements may be overlooked & Repetitive

Sports Technology

Sports technology combines engineering science, measurement analysis, and sports science to relate the playing (or characteristics) of sporting equipment.

Mounir Zok, Director of Technology and Innovation for the U.S. Olympic Commission
- Claims that sports technology is so advanced that it can create a 'digital code' for winning the gold medal
- Technology has increased an athlete's prowess simply because it magnifies performance-related actions and events that have been previously unseen

Nike FuelBand (wristband that tracks exercise)
- Contains an accelerometer that senses footfalls and the dwell time of the foot on pavement as you run (allows the band to measure pace and, calculate distance)

Video Assistant Referee
- A team of referees located in a control room analyze and correct missed calls or non-calls in a game, along with goals or penalties.

Performance Technology Examples

"Smart Clothing" (active wear with sensing fibers woven in)
- Track performance in real time (ex. breathing, heart rate, hydration and temperature)

Lasers and GPS
- Measure the exact position, distance, velocity and acceleration of athletes

Heads-up display (HUD)
- Cyclist glasses: Display deliver heart rate, speed, incline and other cycling information

Everysight Raptor AR Glasses

Sensors
- Swimmers/Divers: Map movements like rotational speed, dive angle, leg movement and hydrodynamics

VR (Virtual Reality)
- Places players in simulated environments that mimic in-game situations

Hardware Sensors

Computers can sense: Sound, Light, Touch, Movement, Biometric data (heart rate and fingerprints), Temperature, Proximity, and Location.

Accelerometer
Measures acceleration force (caused by changes in gravity or motion)

GPS (Global Positioning System)
Tracks PNT measurements (Positioning, Navigation, and Timing)

Grip/Touch Reader
Measures and detects the position and force of hand and fingers on/around an object or device

Sensors
Detect and respond to input from the environment (motion, pressure, etc.)

Proximity Sensor
Detect movements or the presence of objects without physical contact

Light-Sensing Diodes
Measures and detects the amount of ambient light, infrared light, ultraviolet light, and sunlight in an environment

LiDAR (Light Detection and Ranging)
Create a 3D model of the surveyed environment (laser + scanner + GPS)

Gyroscope
Measures the rate of rotation around a particular axis

Enchanted Objects

Enchanted Objects: Design, Human Desire, and the Internet of Things by David Rose

Definition: An ordinary thing is augmented and enhanced through emerging technologies (sensors, actuators, wireless connections, and embedded processing) so that it becomes extraordinary.

Abilities: Glanceability, Gestureability, Affordability, Wearability, Indestructibility, Usability & Loveability

Example: Enchanted Toothcap
- Tooth replacement that responds to chewing actions and able to sense texture, temperature, and chemical content of food and drink

Extension: Bluetooth (provides feedback, alerts, and encouragement)
- Sends a text message to your doctor or trainer if you're doing well or poorly (or vibrates to slow down your consumption, emits an embarrassing sound to keep you from eating the wrong thing, or produces a noxious smell that inhibits your social interactions

Feedback Types: Indication of change or to get the users attention

Auditory: Sounds (beeps, chimes, voice, music)
Example: Amazon Alexa (provides vocal feedback when users speak to the device)
Advantages: 1) Allows for Multitasking 2) Increased reaction time 3) Customizable

Visual: Lights, Images, Text, Movement (visual changes)
Example: The Discreet Window (communicates work intensity to both the home-office space and the outside by controlling how much light enters the room)
Advantages: 1) Timeliness 2) Visual Indication of Change 3) Interactive

Haptic: Vibrations, Touch, Air
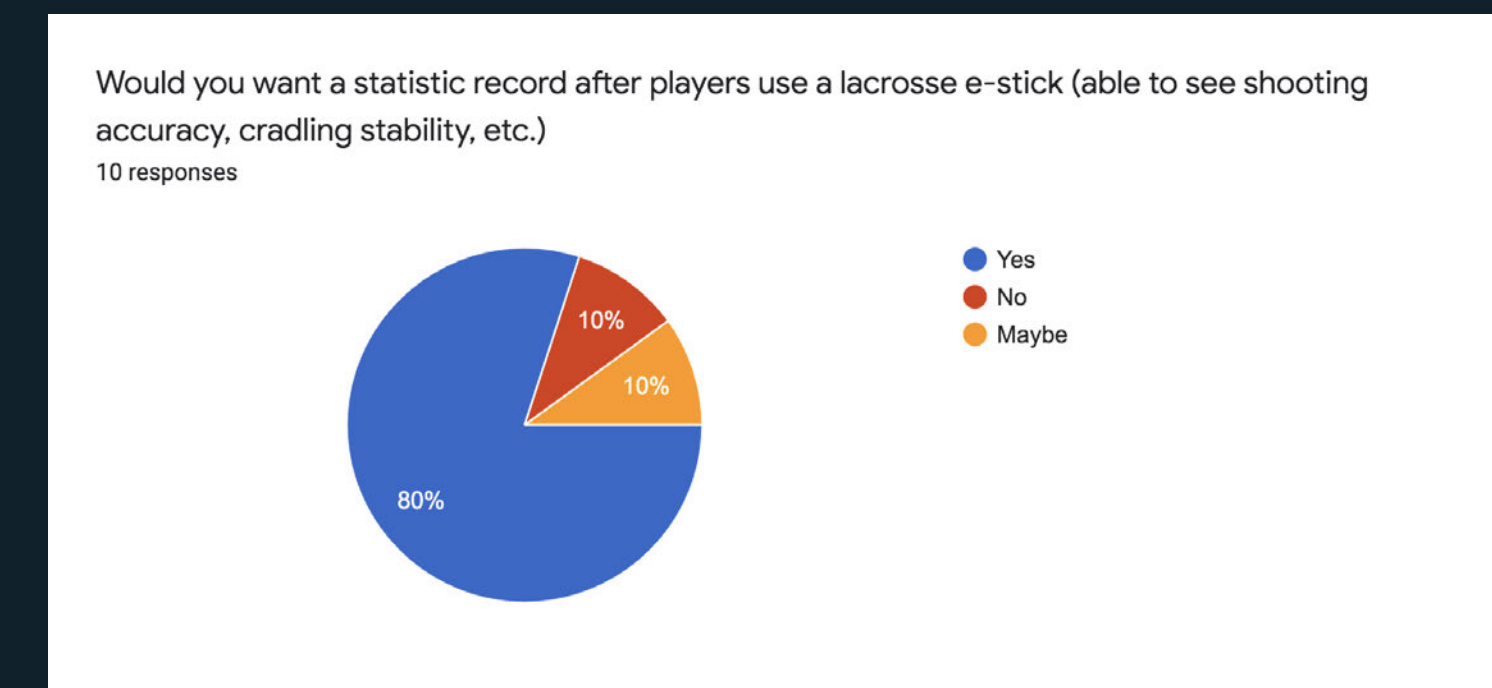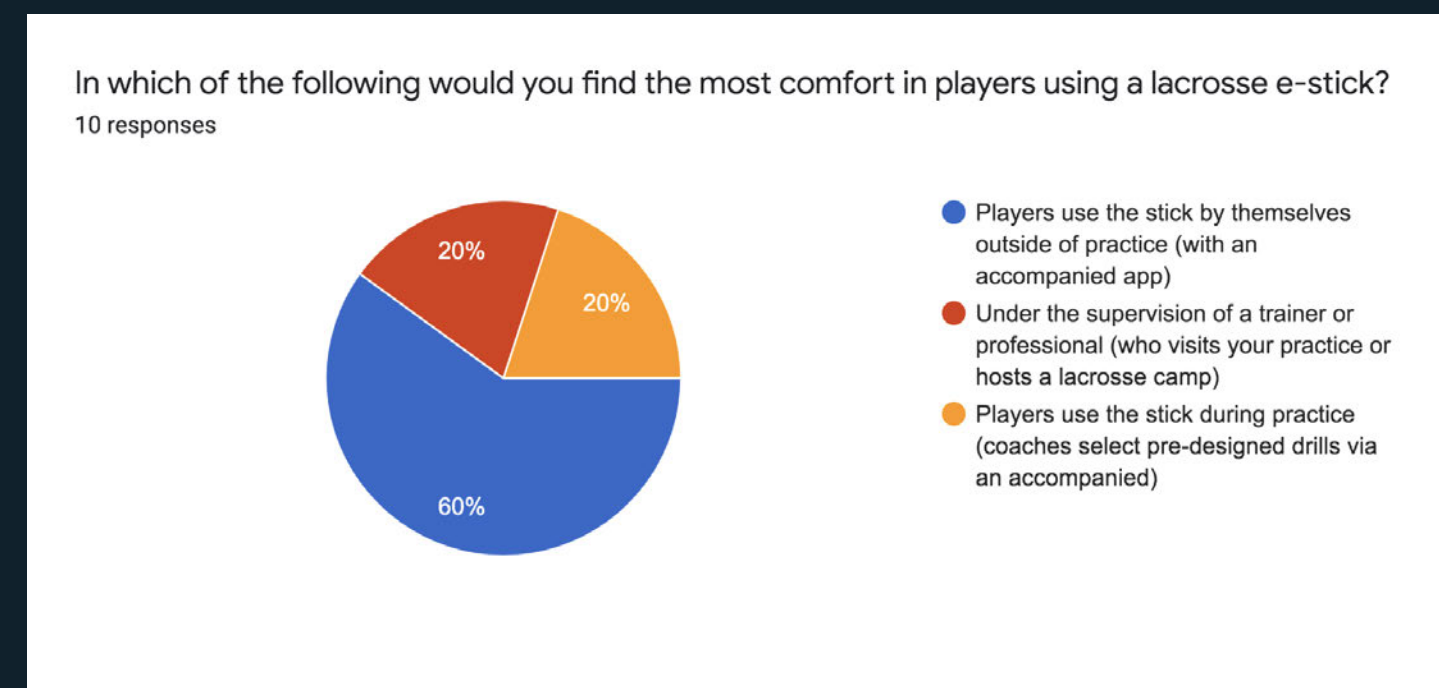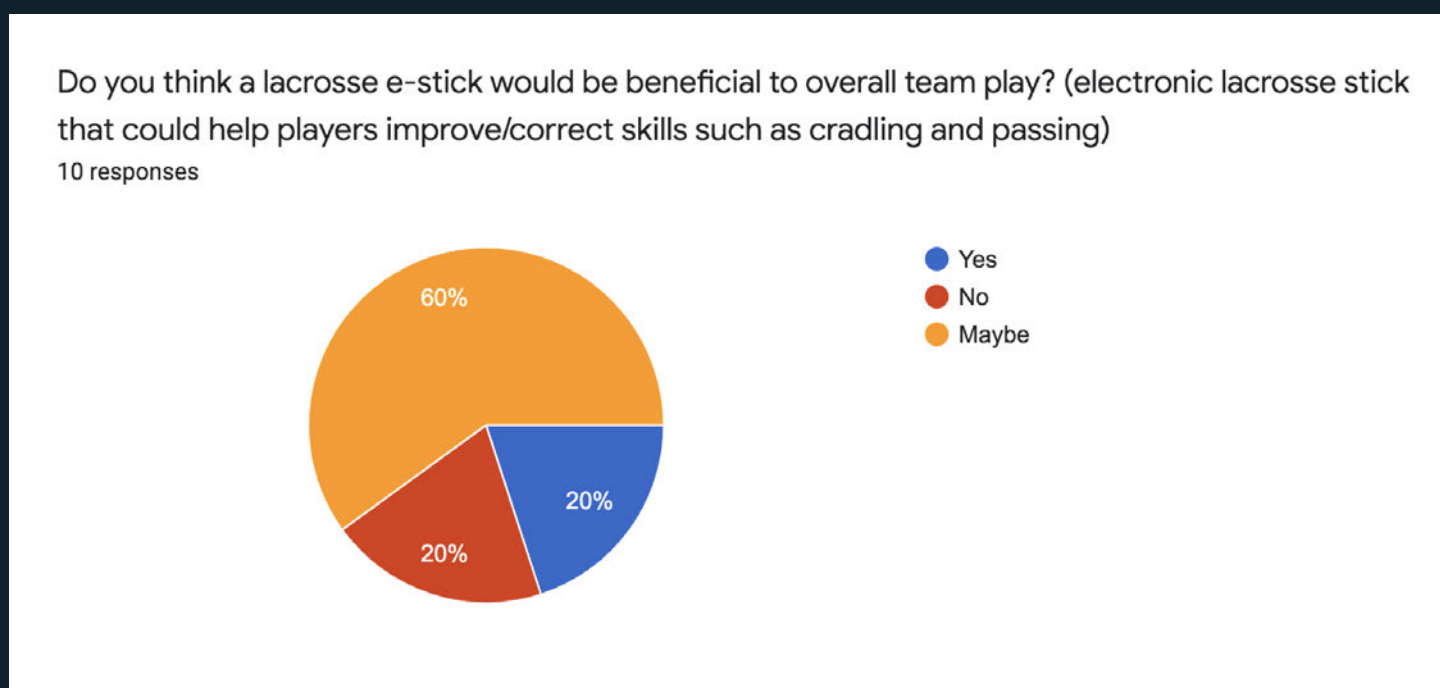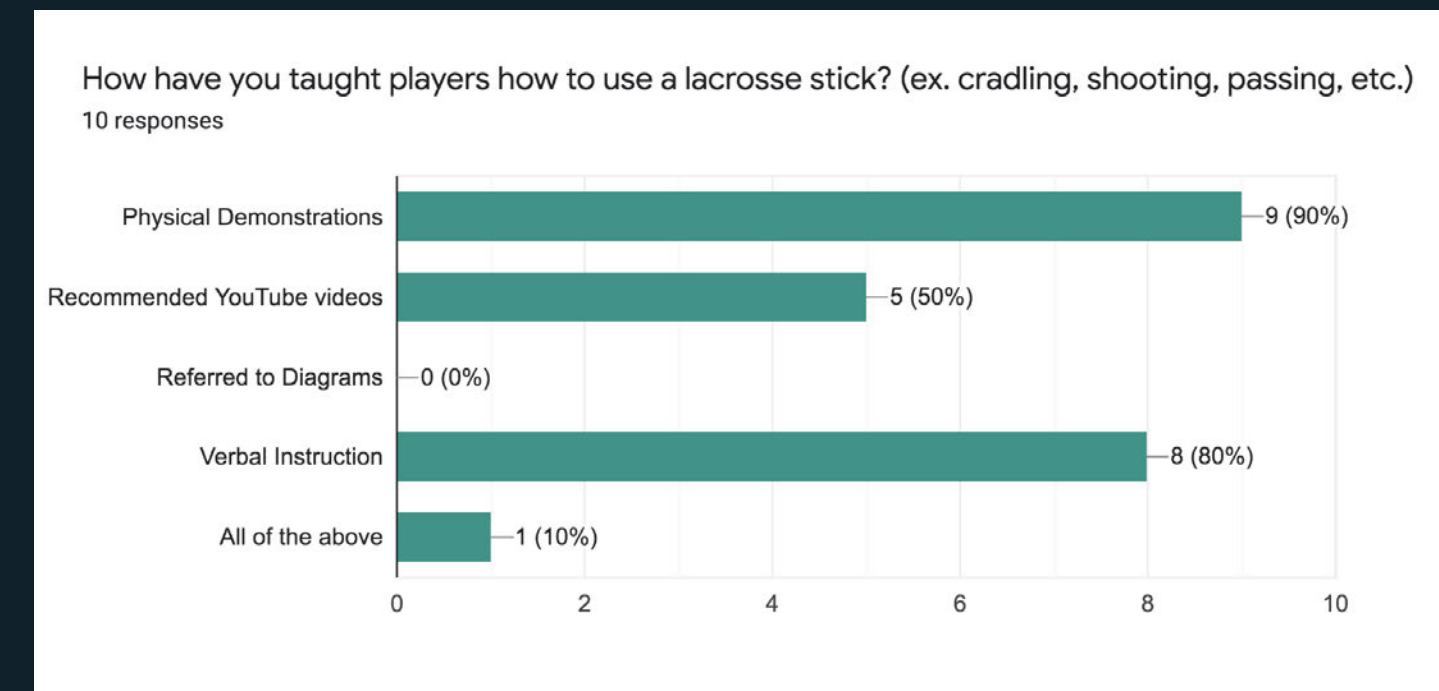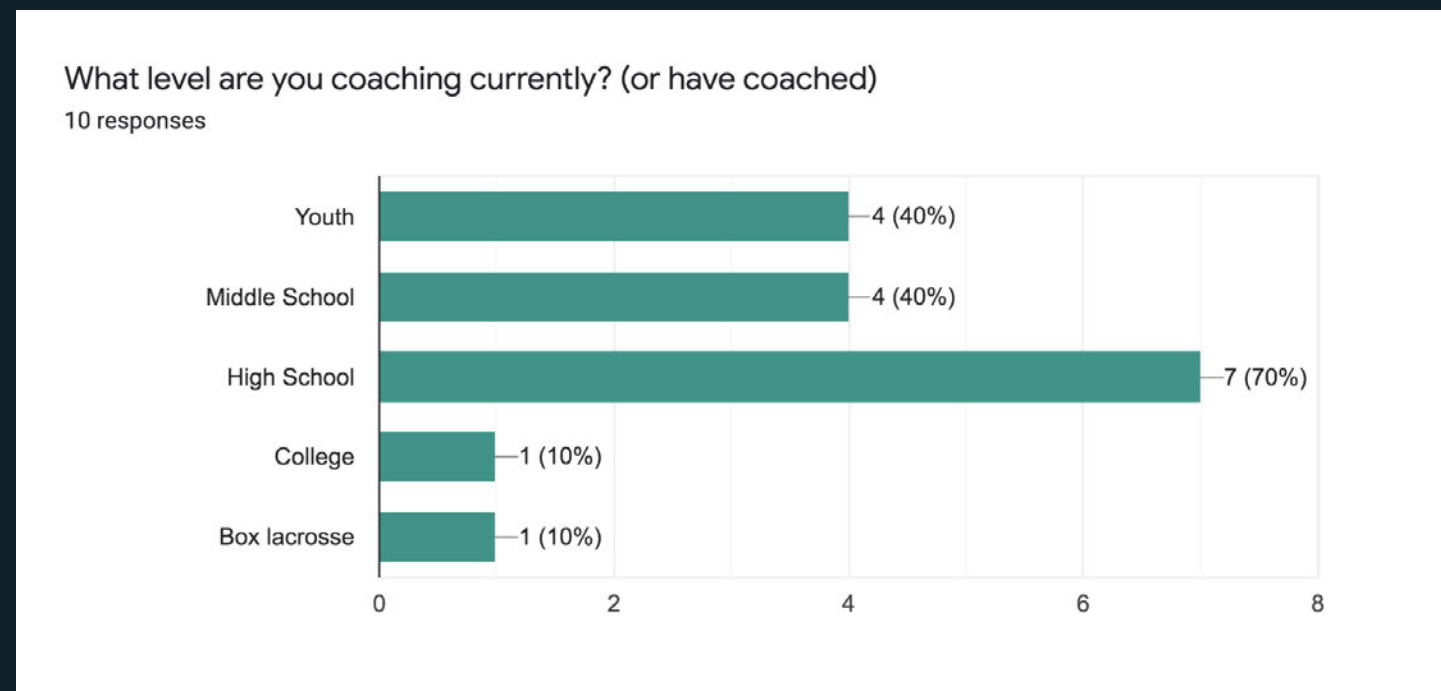Example: Disney's AirReal (shoots a ring of air to enhance gaming)
Advantages: 1) Fast to "read" 2) Embedded in everyday gestures 3) Sense of touch is the best modality to convey human emotion
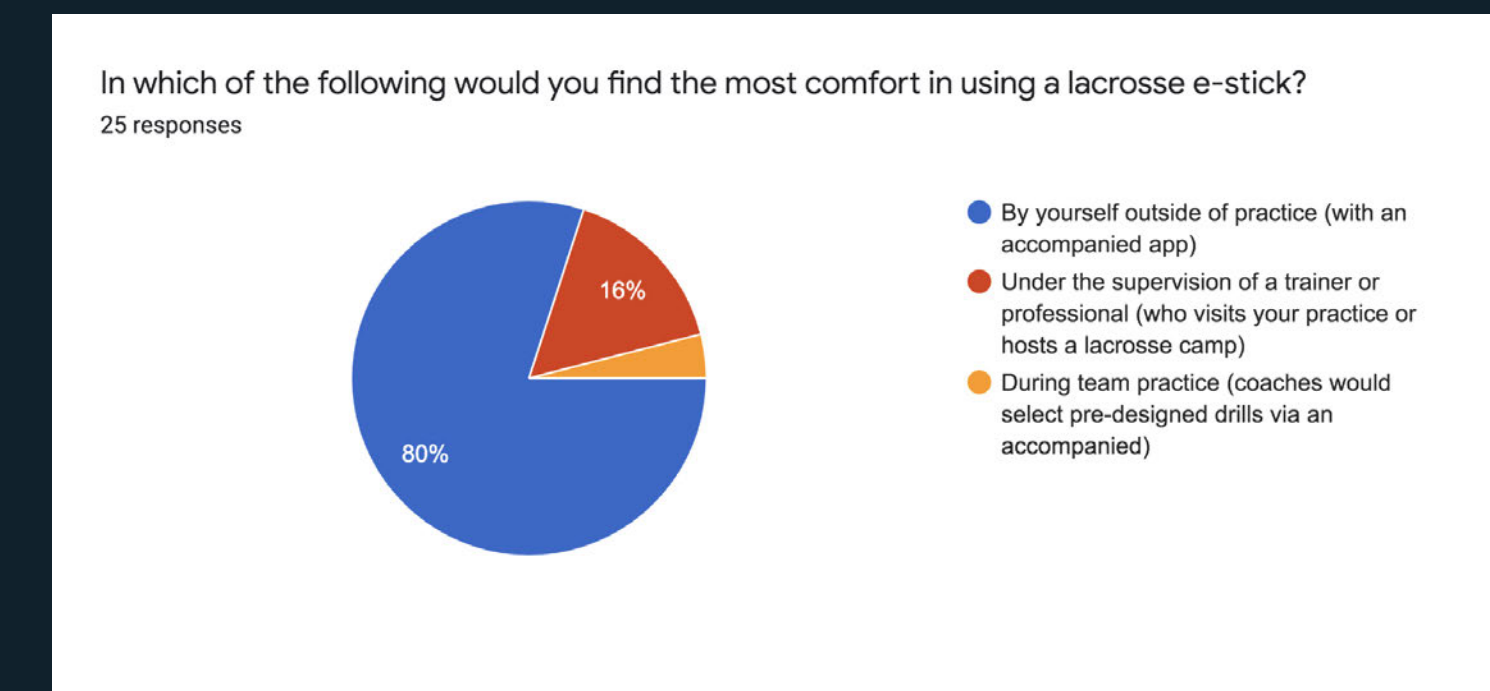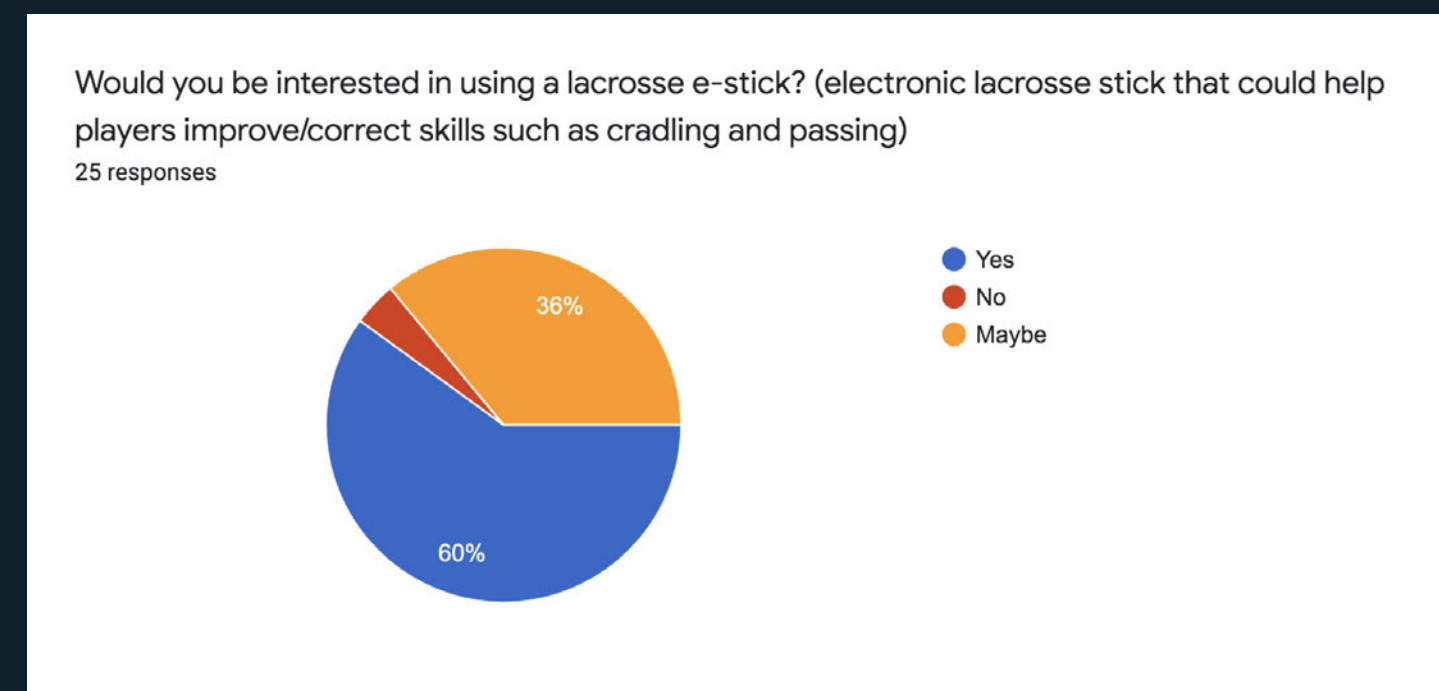
Questionnaires

Average Coaching Experience: 8.5 years

What level are you coaching currently? (or have coached)
10 responses

- Youth — 4 (40%)
- Middle School — 4 (40%)
- High School — 7 (70%)
- College — 1 (10%)
- Box lacrosse — 1 (10%)

How have you taught players how to use a lacrosse stick? (ex. cradling, shooting, passing, etc.)
10 responses

- Physical Demonstrations — 9 (90%)
- Recommended YouTube videos — 5 (50%)
- Referred to Diagrams — 0 (0%)
- Verbal Instruction — 8 (80%)
- All of the above — 1 (10%)

Do you think a lacrosse e-stick would be beneficial to overall team play? (electronic lacrosse stick that could help players improve/correct skills such as cradling and passing)
10 responses

- Yes 20%
- No 20%
- Maybe 60%

In which of the following would you find the most comfort in players using a lacrosse e-stick?
10 responses

- Players use the stick by themselves outside of practice (with an accompanied app) — 60%
- Under the supervision of a trainer or professional (who visits your practice or hosts a lacrosse camp) — 20%
- Players use the stick during practice (coaches select pre-designed drills via an accompanied) — 20%

Would you want a statistic record after players use a lacrosse e-stick (able to see shooting accuracy, cradling stability, etc.)
10 responses

- Yes 80%
- No 10%
- Maybe 10%

Questionnaires (cont.)

Average Player Experience: 6.8 years

What level are you playing currently? (or highest level played)
25 responses

- Youth
- Middle School
- High School
- College
- Netherlands highest club level
- Men's league

60%
32%

How much time a week do you dedicate to practice on your own?
25 responses

- 0 - 2 hours
- 3 - 5 hours
- 6 - 10 hours
- 10+ hours

28%
8%
8%
56%

How did you learn your stick skills? (ex. cradling, passing, catching, etc.)
25 responses

- Verbal Instruction from Coaches/Trainers/Other Players — 20 (80%)
- Demonstrations from Coaches/Trainers/Other Players — 21 (84%)
- Recommended YouTube videos — 11 (44%)
- Referred to Diagrams — 1 (4%)
- Self-taught — 6 (24%)

How would you rank your cradling skills?
25 responses

- 1: 0 (0%)
- 2: 0 (0%)
- 3: 8 (32%)
- 4: 10 (40%)
- 5: 7 (28%)

Would you be interested in using a lacrosse e-stick? (electronic lacrosse stick that could help players improve/correct skills such as cradling and passing)
25 responses

- Yes
- No
- Maybe

36%
60%

In which of the following would you find the most comfort in using a lacrosse e-stick?
25 responses

- By yourself outside of practice (with an accompanied app)
- Under the supervision of a trainer or professional (who visits your practice or hosts a lacrosse camp)
- During team practice (coaches would select pre-designed drills via an accompanied)

16%
80%

User Persona

Jada Brooks
Lacrosse Player

PROFILE

Age:	19
School:	Bates College (NESCAC | Division III)
Level:	College
Position:	Midfielder
Experience:	6 years

FRUSTRATIONS

• Does not have full-time access to a lacrosse field

• Has trouble finding effective single player workouts

• Drills in practice are repetitive and boring

GOALS

• Improve fundamental skills before the season starts

• Win a Athlete Awards in her conference

• Teach youth players the game of lacrosse

BIO

When Jada started playing lacrosse in High School, it was brand new to her as well as her teammates and coaches. Learning the sport was a long process and many of their practices consisted of watching YouTube videos or reading articles on "Lacrosse for Beginners." Whenever Jada has time to practice her skills, she seems lost on where to start and feels like her skills are not improving in ways she hoped they would.

MOTIVATIONS

• Wants to be a successful lacrosse player

• Looks up to Taylor Thornton as her role model

• Hopes to become a youth lacrosse coach in the future

FAVORITE BRANDS

NIKE   WARRIOR   STX

Expert Interview

Dr. Bill Stapleton, Associate Professor at Texas State University | Topic: Sensors and Sensor Networks & Embedded Systems

Takeaways:
During my interview with Dr. Stapleton, I learned about what Sensors do and how effective they would be in my project. We were able to talk about what exactly I wanted the stick to do and what Sensors would best accomplish the task at hand. The major takeaway from this interview was that the main Sensors I would include in my electronic stick would be an Accelerometer and a Gyroscope.

Notes:
- Accelerometer (gravity) + Gyroscope (rotation)
  - Speed + Direction (+ GPS, location)
- Touch Pads = Gloves with Sensors (connect with the stick)
- Calibration = Gloves + Stick + App
- Post-workout Possibilities:
  - Summary (Example: Wrist movements while cradling)
  - 3D Model (plays back player movement in a 3D rendering)
- Feedback Options:
  - Haptic (Vibrations) + Auditory (Pings/Beeps)

New Focus:
We narrowed down the focus of the stick from focusing on multiple fundamental skills of lacrosse (Cradling, Passing, Catching, Shooting, and Scooping), to just 1 skill: Cradling. This would be more effective as the number of tracked inputs would be reduced, and the stick would be able to produce more accurate measurements.
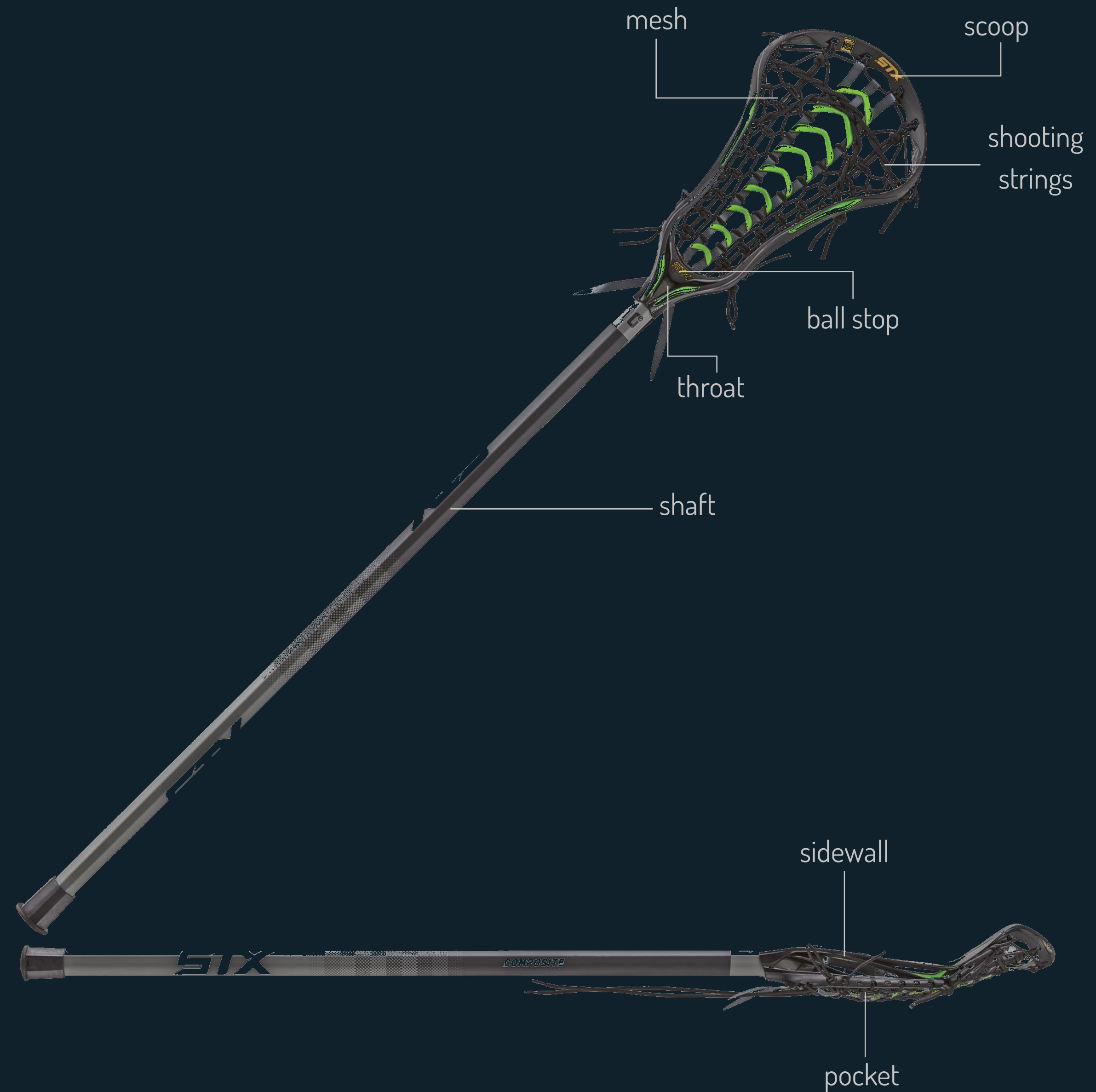
Cradling

Cradling is a technique used by lacrosse players to keep the ball in the pocket of their stick while moving around the playing area. It relies on synchronous movements of the arms and wrists, and becomes more effective when incorporating body positioning and coordination.

Cradling is essential to being able to move around the field while protecting the ball from defenders and handling the ball to prepare for a pass or shot on goal.

Cradling Demo Link

The Crosse

Women's Stick

mesh

scoop

shooting
strings

ball stop

throat

shaft

sidewall

pocket

Goal

My goal is to provide lacrosse players of all skill levels a tool that is designed to teach and improve cradling skills. Because cradling is an essential skill to being a successful lacrosse player, it needs a way to be taught more effectively than means such as physical demonstrations and referencing YouTube videos.

This goal would help players not only in the United States, but also in countries across the world. Lacrosse is a sport that is played in several countries worldwide and this Electronic Stick & App would help all players develop their cradling skills (and even allow them to teach others).

My Electronic Lacrosse Stick & App will allow users to strengthen their cradling skills outside of team practice, which will affect not only their skills, but also overall team play.

Feedback Map

Haptic: Vibrations

- Negative Response
  - The user has incorrectly performed a task
    - Ex. Cradled outside the "sphere"
- Game Simulation
  - Simulates a player's stick has been "checked"
  - Simulates when a player catches the ball

Auditory: Ping/Chime

- Positive Response
  - The user has correctly performed a task
    - Ex. Successfully cradled for 20 reps
- Bluetooth (Chime)
  - The stick has been paired with the app
  - The gloves have been paired with the app
- Drills
  - Indicates a drill as started/ended (Double)

Visual: Lights

- Indicates the stick and gloves have been successfully calibrated with the app

How Might We's

HMW: Make the e-stick accessible?

An adaptive lacrosse stick can be designed to fit the needs of each user

HMW: Encourage users to keep progressing their skills?

Enable group practice by allowing users to enter a "Group Code"

HMW: Make the workout experience feel less "robotic"?

Don't fully rely on the stick to guide users through a drill and incorporate visual trainers

HMW: Show progress from workout to workout?

Assign "points" to each completed workout and compare point totals from session to session

HMW: Create a customizable workout set for each user?

Ask users what their goals are when they sign up to use the app

HMW: Allow multiple users to workout together?

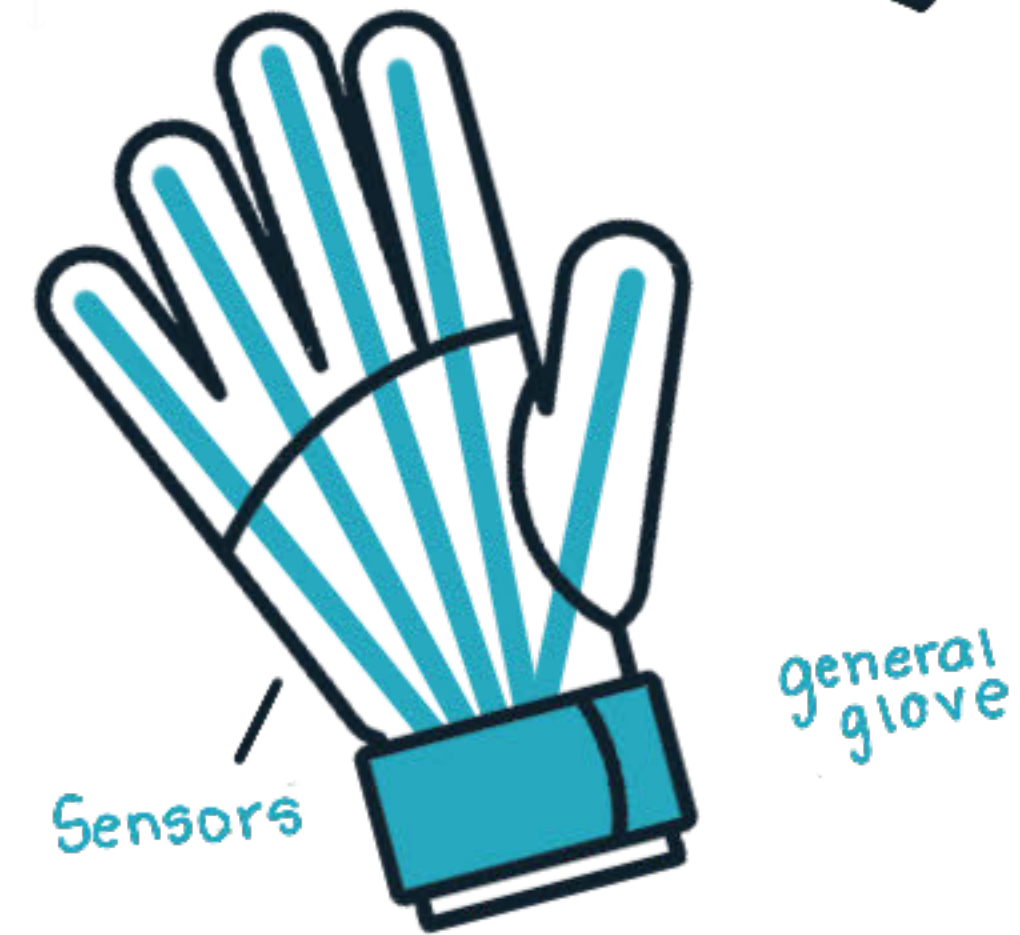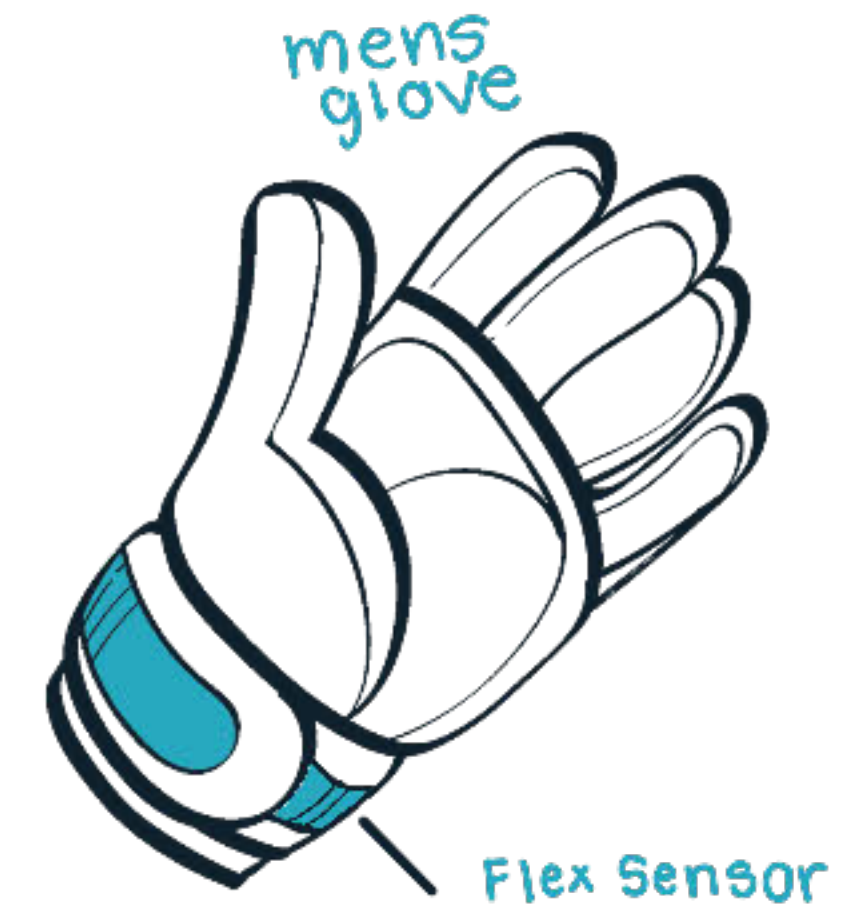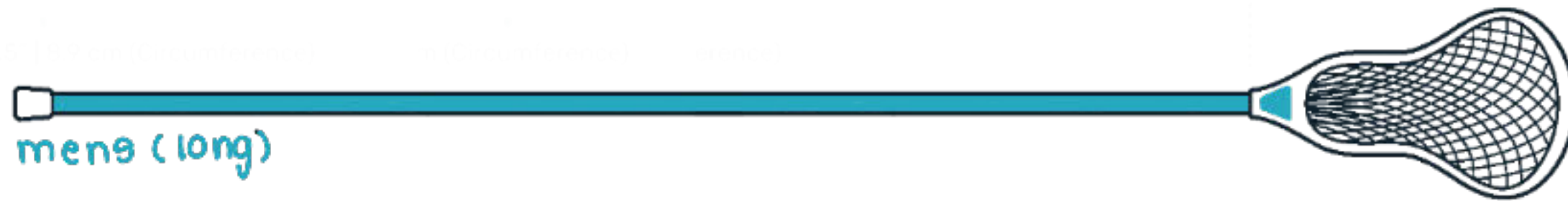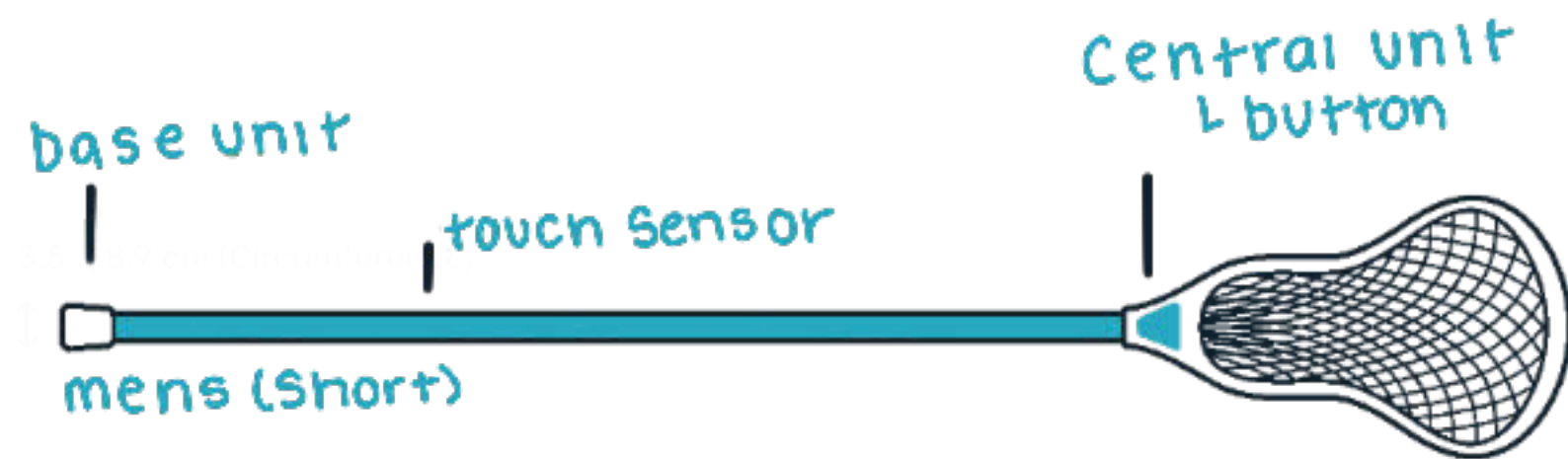Enable group practice by allowing users to enter a "Group Code"

HMW: Prevent "bad habits" from being further developed?

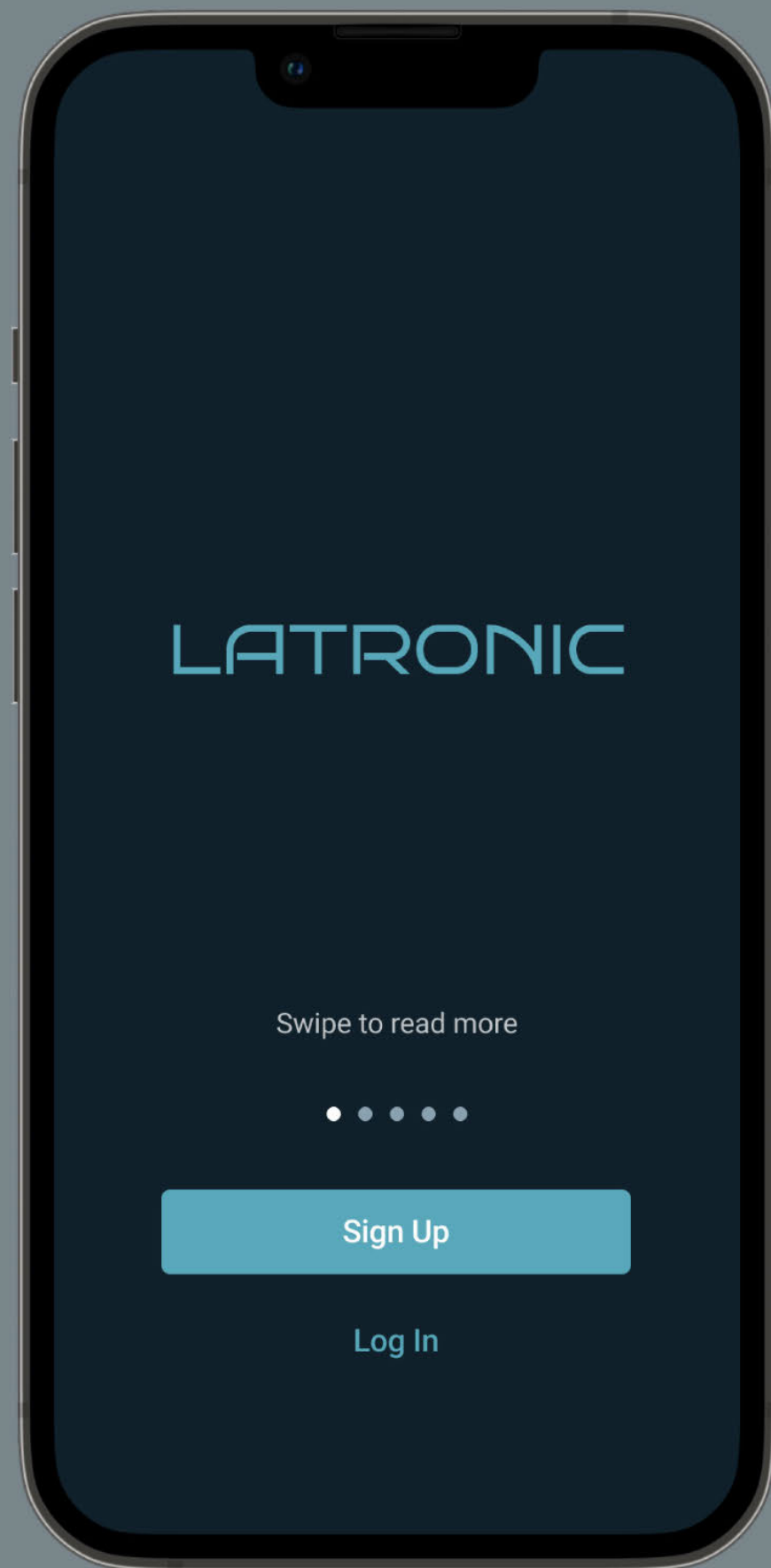Provide specific feedback on user inputs that may be overlooked (ex. hand placements)

HMW: Create workouts that can be used by players of all skill levels?

Create a base set of workouts designed to teach users who are new to the sport (beginner level)
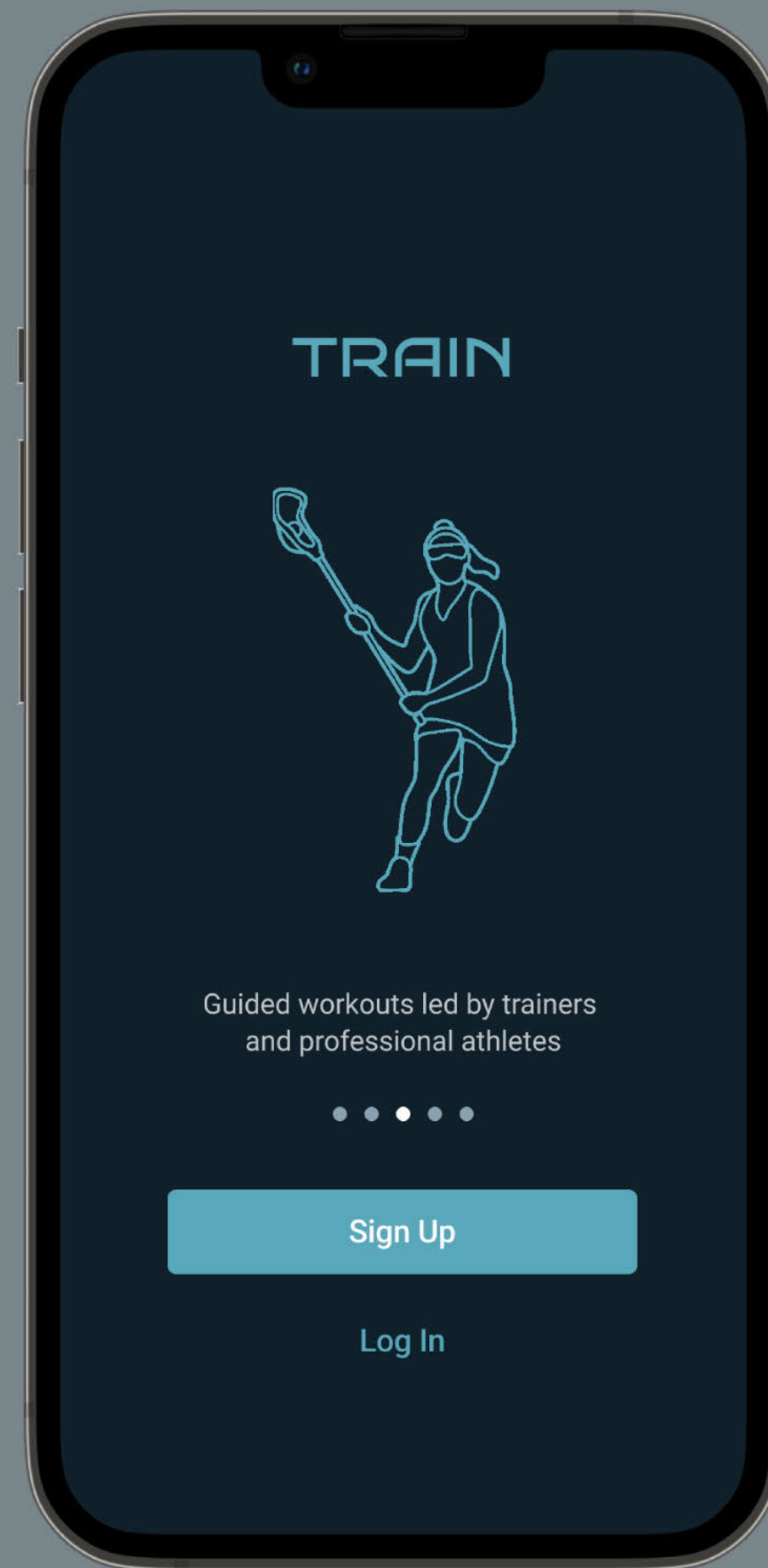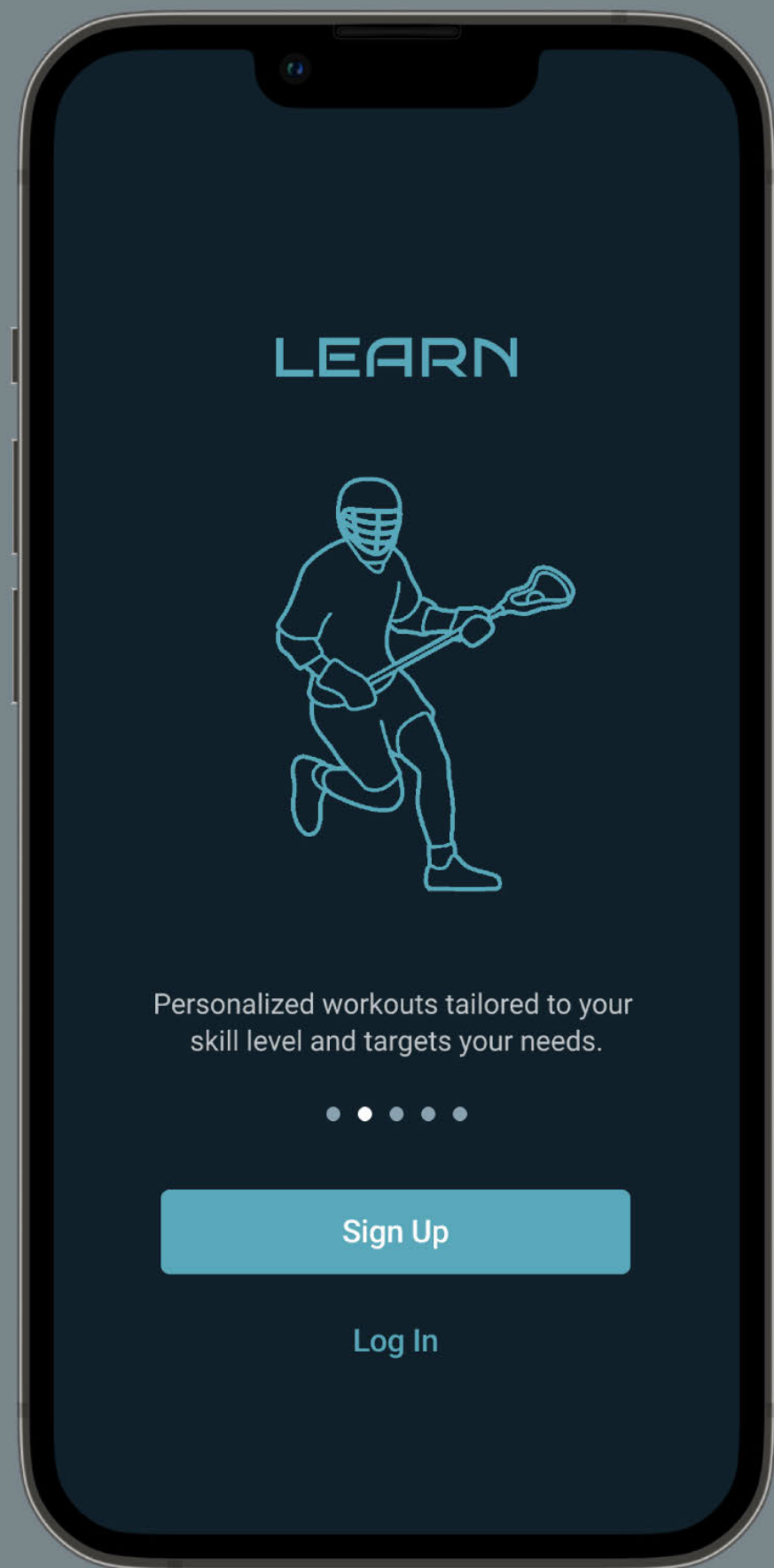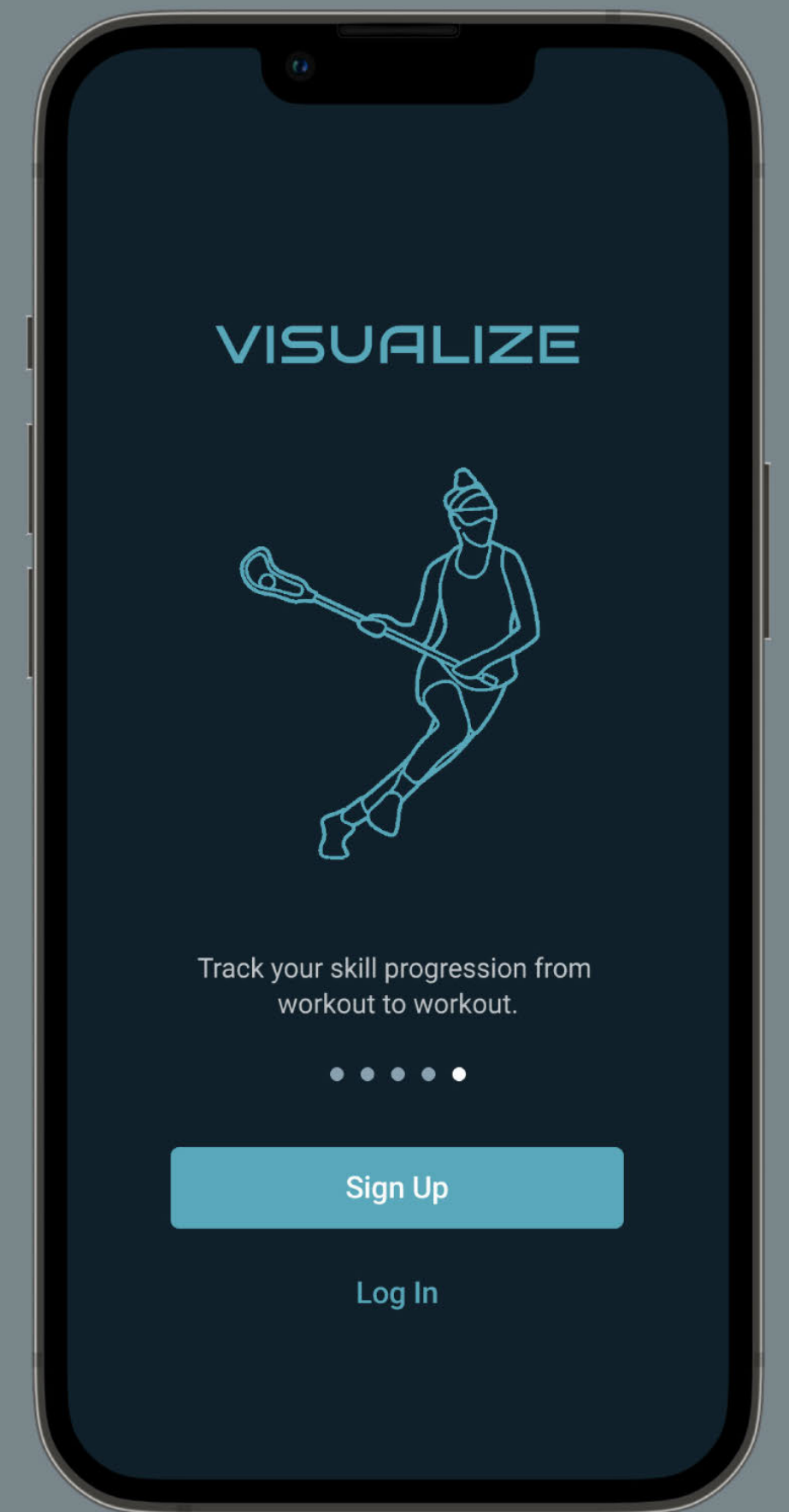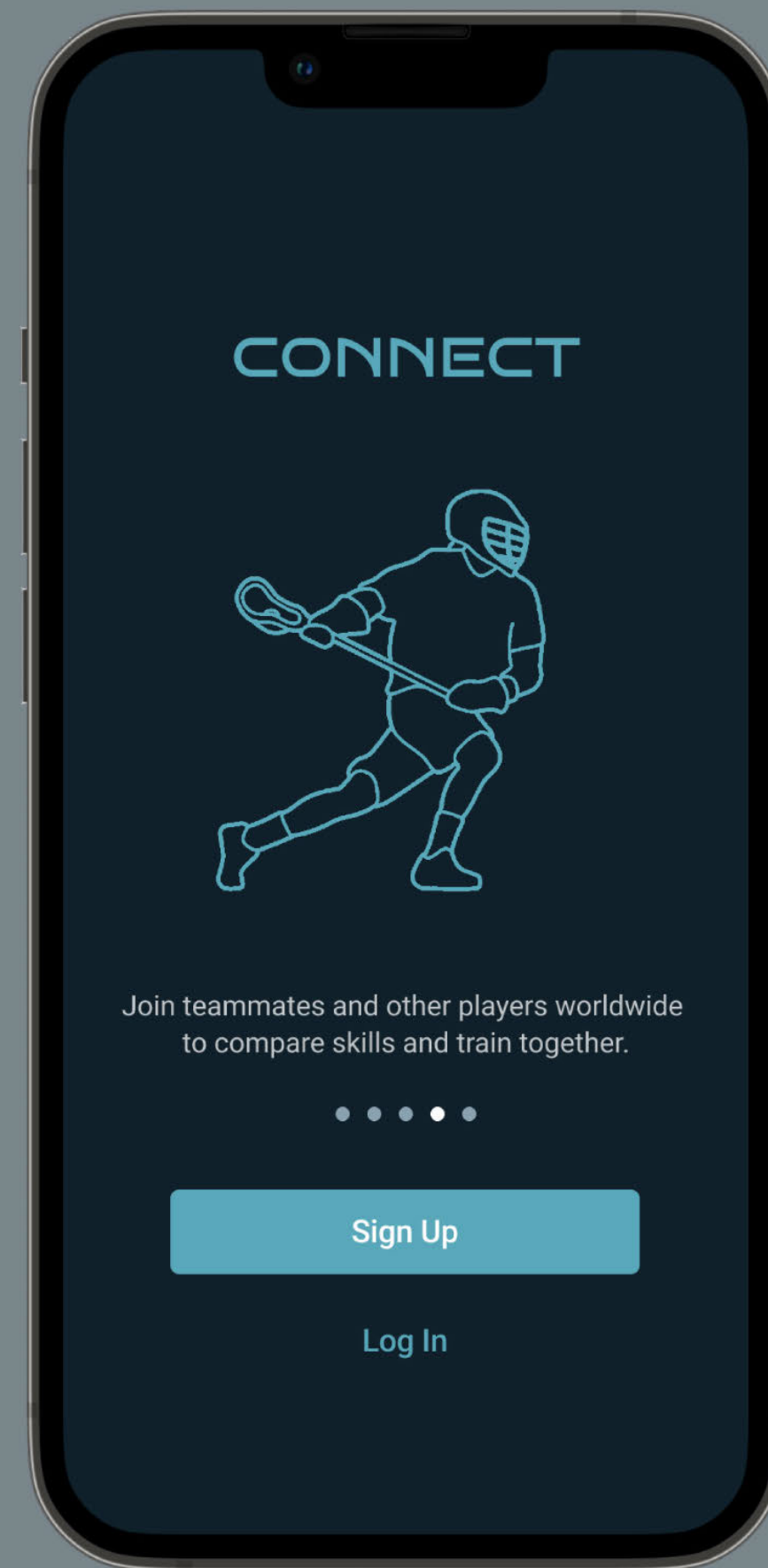
Sketches

base unit

touch sensor

Central unit
L button

mens (short)

mens (long)

womens

Goalie

mens glove

Flex Sensor

Sensors

general glove

Onboarding

LATRONIC

Swipe to read more

● ● ● ● ●

Sign Up

Log In

LEARN

Personalized workouts tailored to your
skill level and targets your needs.

● ● ● ● ●

Sign Up

Log In

TRAIN

Guided workouts led by trainers
and professional athletes

● ● ● ● ●

Sign Up

Log In

CONNECT

Join teammates and other players worldwide
to compare skills and train together.

● ● ● ● ●

Sign Up

Log In

VISUALIZE

Track your skill progression from
workout to workout.

● ● ● ● ●

Sign Up

Log In

Welcome Screen

Goals, Insights, & Features

Log In & Sign Up

SIGN UP

First Name
Jada

Last Name
Brooks

Email
jadabrooks@gmail.com ✓

Create a Password
•••••••••••••• ✓

☑ By signing up you accept our Terms & Conditions

Sign Up

Already have an account? Log In

LOG IN

Email
jadabrooks@gmail.com ✓

Password
•••••••••••••• ✓

☑ Remember Me   Forgot Password?

Log In

Don't have an account? Create an Account

Log In

Sign Up

Getting Started

BACKGROUND

Gender
Female ⌄

Age
19 ⌄

Height
5'11 ⌄

Dominant Hand
Left ⌄

Country
United States of America ⌄

State/Province
Maine ⌄

Cancel   Continue

GOALS

Choose all that apply:

Learn How to Cradle

Further Develop My Cradling Skills

Learn Drills to Teach Others

Make Better Use of My Self-Practice Time

Learn Stick Tricks

Back   Continue

PROFILE

Playing Level
College | Division III ⌄

Playing Position
Midfielder ⌄

How long have you been playing lacrosse?
6 - 10 years ⌄

How many hours a week do you practice on your own?
3 - 5 hours ⌄

Back   Continue

CONNECT

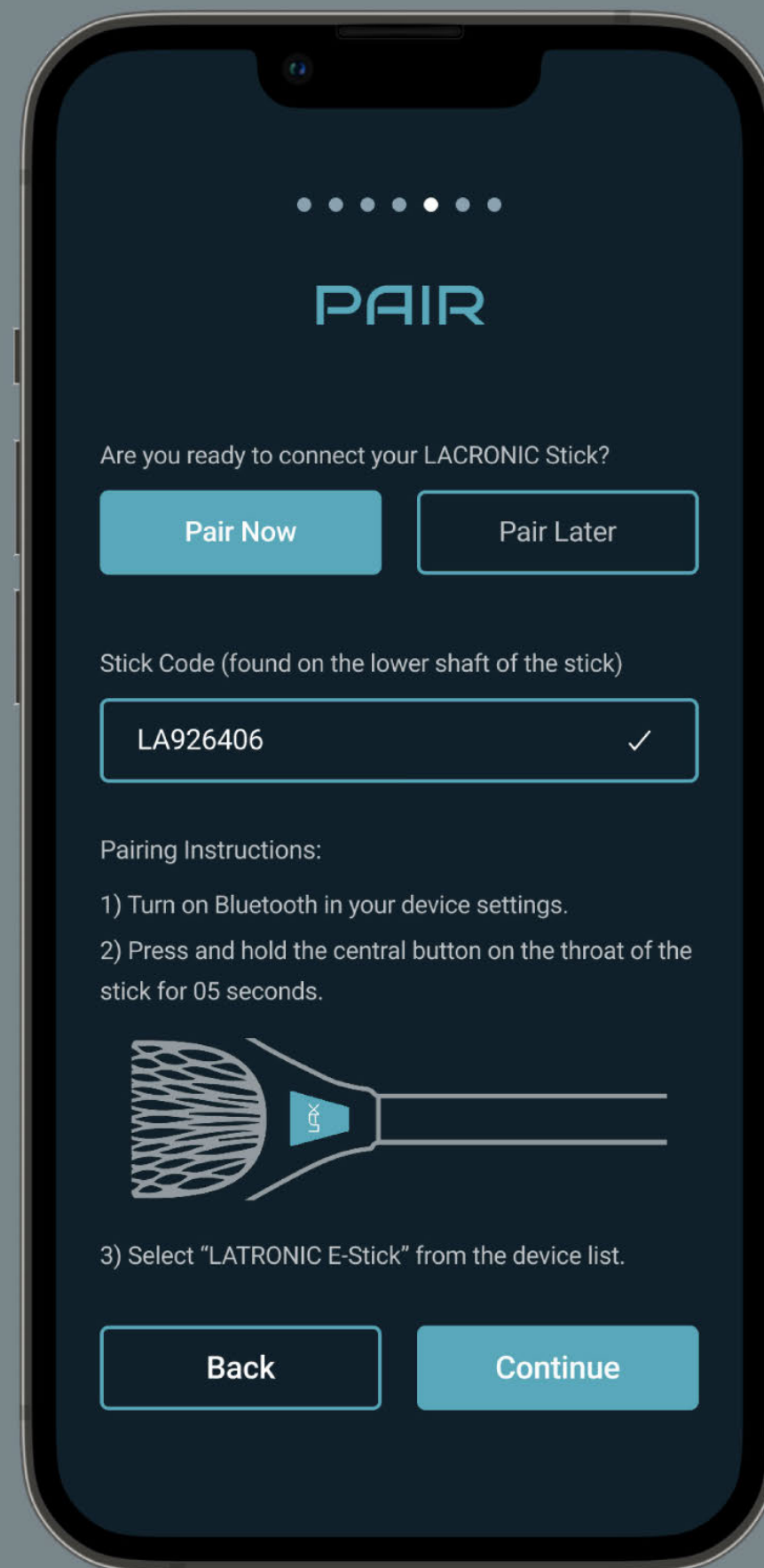Did your coach or trainer give you a Player Code?
BC027403 (Bates College) ✓

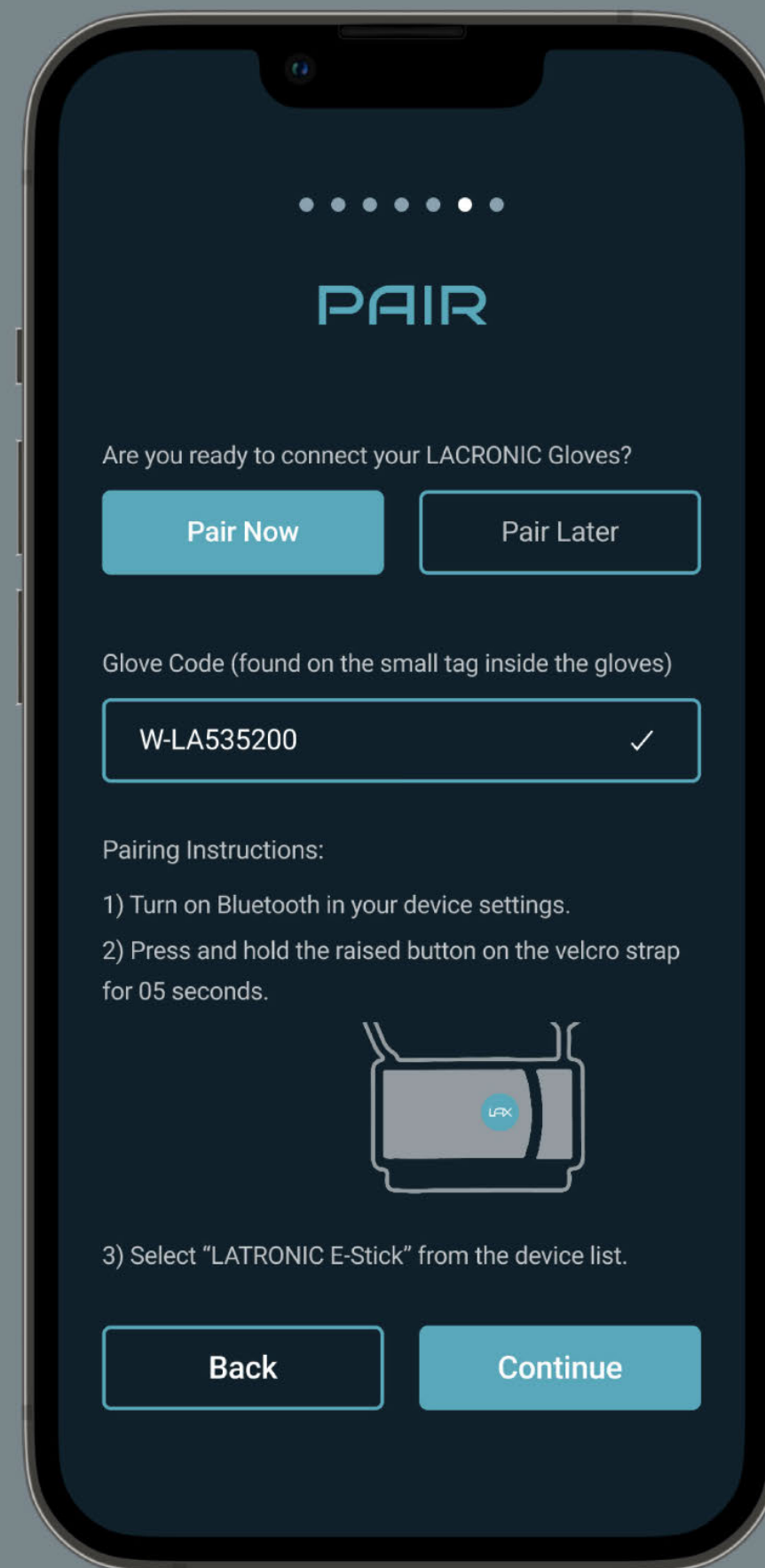Did your group leader give you a Group Code?
Optional

Back   Continue

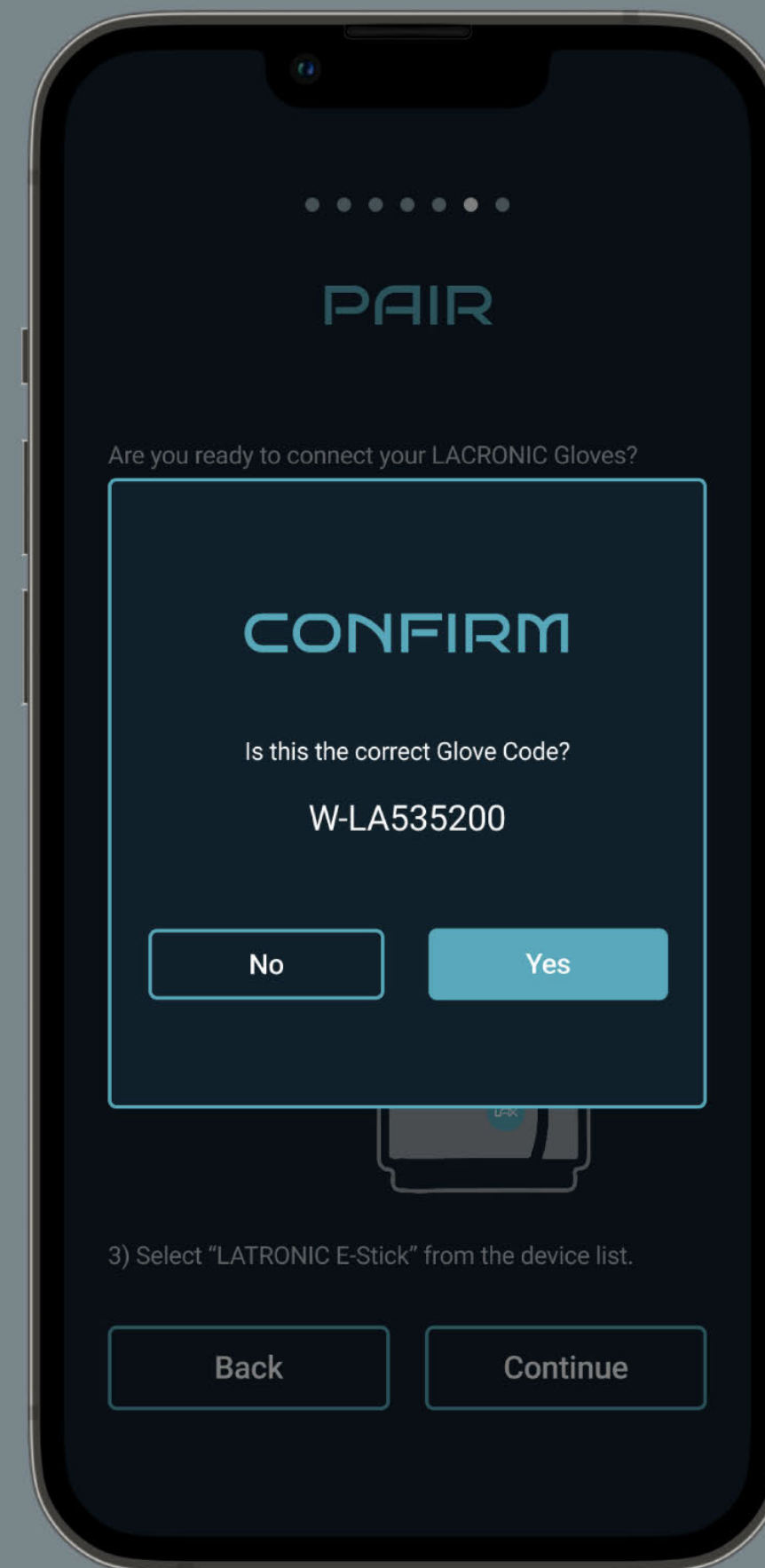Player Questionnaire   Connect Code Entry
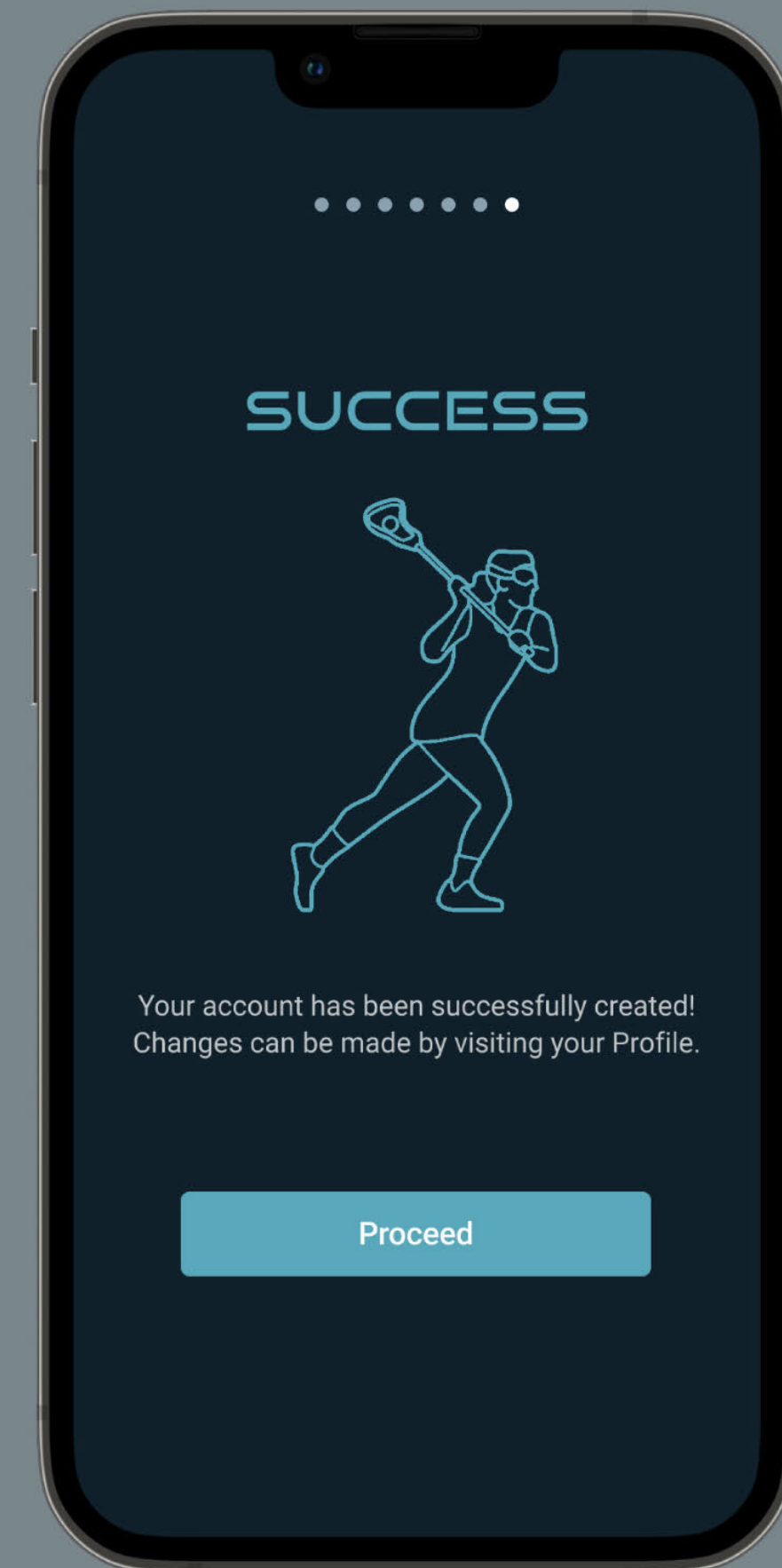
Prototype | 23

Equipment Pairing

PAIR

Are you ready to connect your LACRONIC Stick?

| Pair Now | Pair Later |

Stick Code (found on the lower shaft of the stick)

LA926406 ✓

Pairing Instructions:

1) Turn on Bluetooth in your device settings.
2) Press and hold the central button on the throat of the stick for 05 seconds.

3) Select "LATRONIC E-Stick" from the device list.

| Back | Continue |

Pairing the Stick

PAIR

Are you ready to connect your LACRONIC Gloves?

| Pair Now | Pair Later |

Glove Code (found on the small tag inside the gloves)

W-LA535200 ✓

Pairing Instructions:

1) Turn on Bluetooth in your device settings.
2) Press and hold the raised button on the velcro strap for 05 seconds.

3) Select "LATRONIC E-Stick" from the device list.

| Back | Continue |

Pairing the Gloves

PAIR

Are you ready to connect your LACRONIC Gloves?

CONFIRM

Is this the correct Glove Code?

W-LA535200

| No | Yes |

3) Select "LATRONIC E-Stick" from the device list.

| Back | Continue |

Paring Confirmation

SUCCESS

Your account has been successfully created!
Changes can be made by visiting your Profile.

| Proceed |

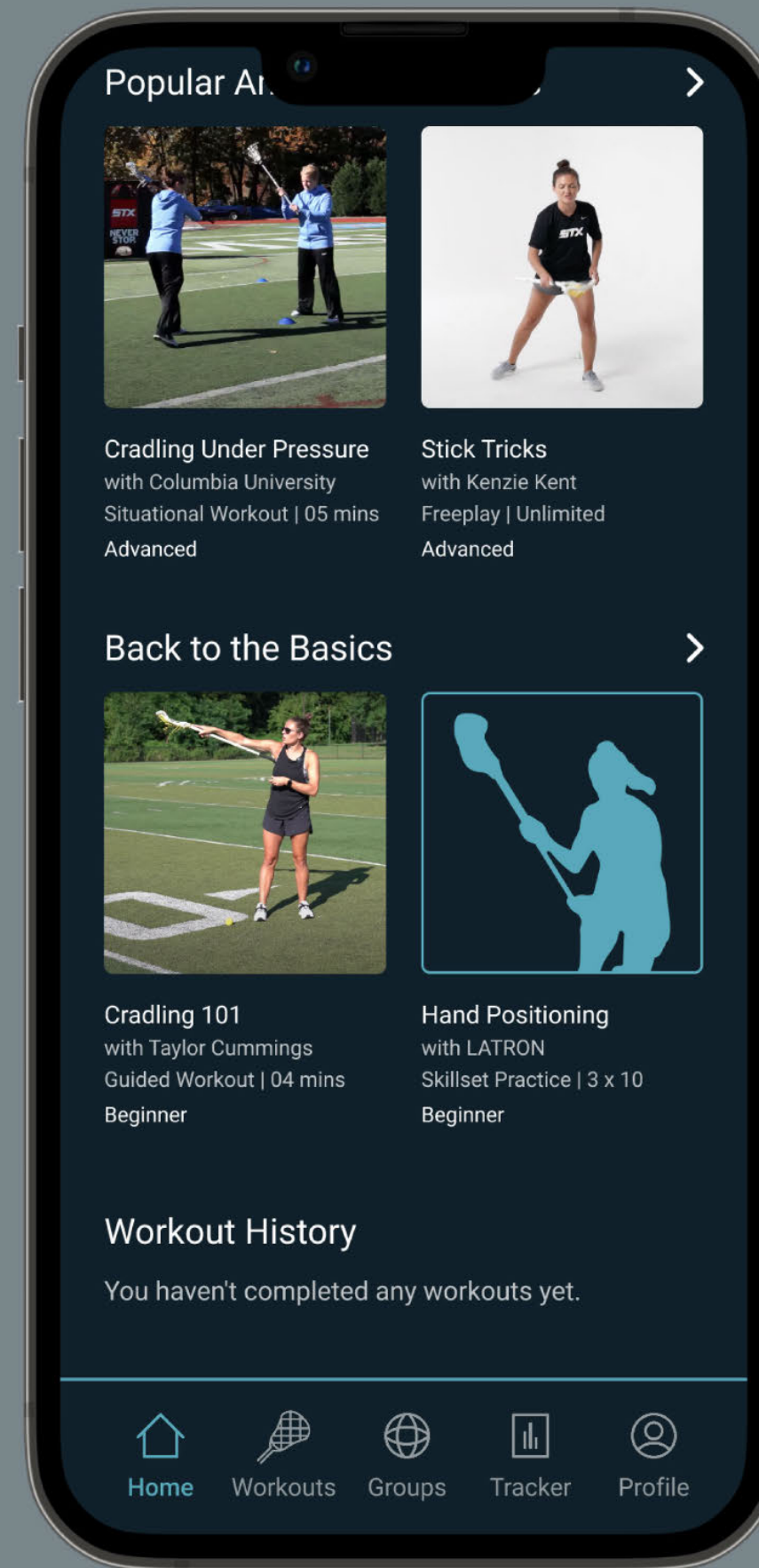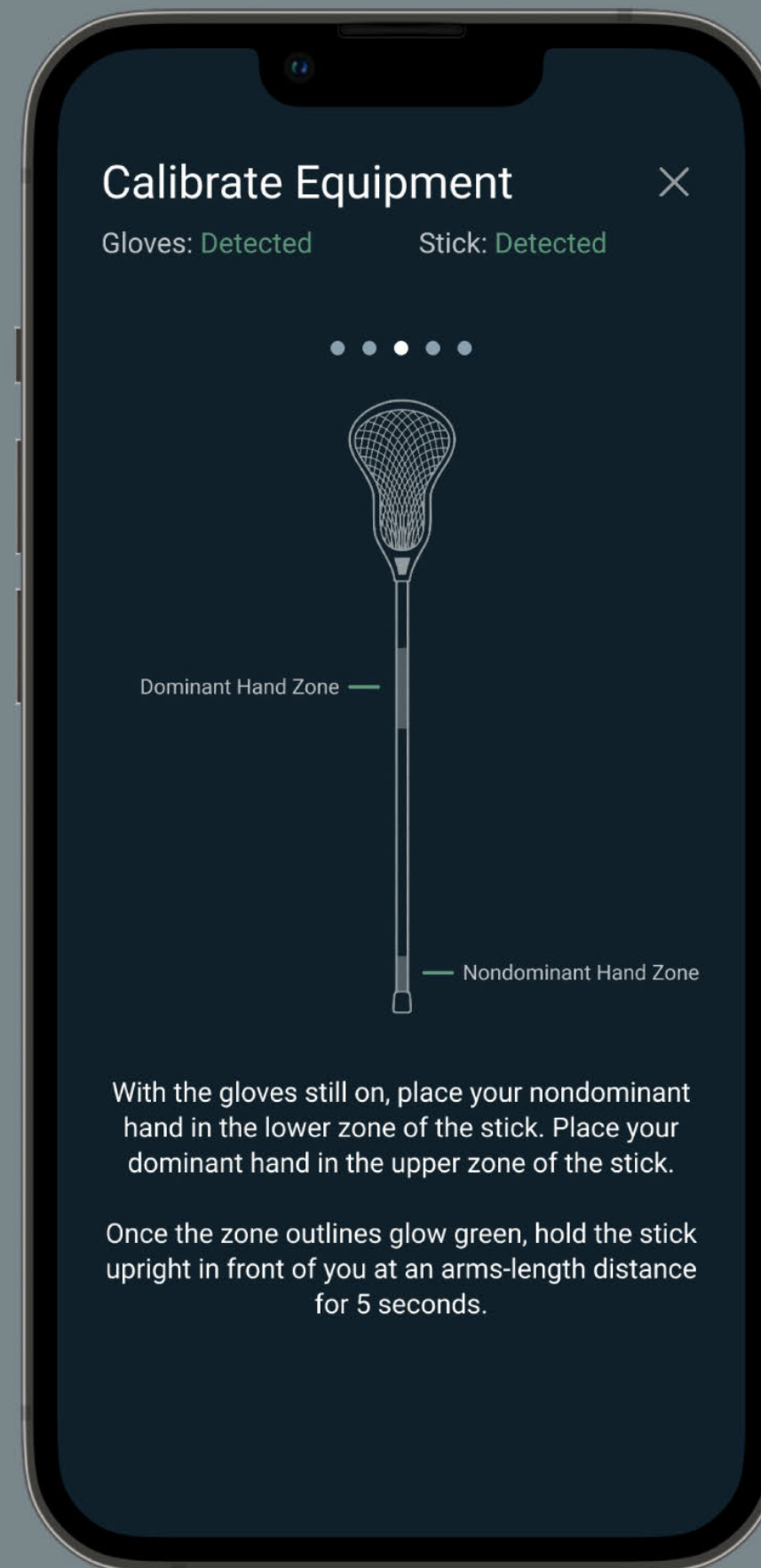**Account Creation Success**

Home + Workout

Home Screen

Workout Preview

Calibrating Equipment

Calibrate Equipment
Gloves: Detected   Stick: Detected

Put on your gloves and position your hands (palm-side outwards) like the guides provided.

Once the outline glows green, hold the position for 5 seconds.

Introduction

Calibrate Equipment
Gloves: Detected   Stick: Detected

Put on your gloves and position your hands (palm-side outwards) like the guides provided.

Once the outline glows green, hold the position for 5 seconds.

Hold

02 seconds remaining...

Completing the Task

Calibrate Equipment
Gloves: Detected   Stick: Detected

Dominant Hand Zone —

— Nondominant Hand Zone

With the gloves still on, place your nondominant hand in the lower zone of the stick. Place your dominant hand in the upper zone of the stick.

Once the zone outlines glow green, hold the stick upright in front of you at an arms-length distance for 5 seconds.

Placement Notes

Calibrate Equipment
Gloves: Detected   Stick: Detected

Mimic the pose above, with the stick on the **Left** side of your body and the front of the stick facing towards you. Keep your hands in their zones.

Once the outline glows green, hold the position for 5 seconds.

Move your stick closer to your head.

Help Hints

Calibrate Equipment
Gloves: Detected   Stick: Detected

Mimic the pose above, with the stick on the **Right** side of your body and the front of the stick facing towards you. Keep your hands in their zones.

Once the outline glows green, hold the position for 5 seconds.

Perfect

Calibration Complete

Completion

Workout

Cradling & Dodging
1:42 Remaining

Take one step this way and come across your face.

Top Hand   Bottom Hand

Cradle Sphere

Good

Remember to curl your wrists as you cradle.

No Vibration

Cradling & Dodging
1:12 Remaining

I'm cradling a Halfmoon out and I'm coming back.

Top Hand   Bottom Hand

Cradle Sphere

Needs Work

Avoid shifting your hand upwards.

Slight Vibration

Cradling & Dodging
0:42 Remaining

Step back, reposition, and then get back on your line.

Top Hand   Bottom Hand

Cradle Sphere

Watch Out

Keep the head of the stick inside your sphere.
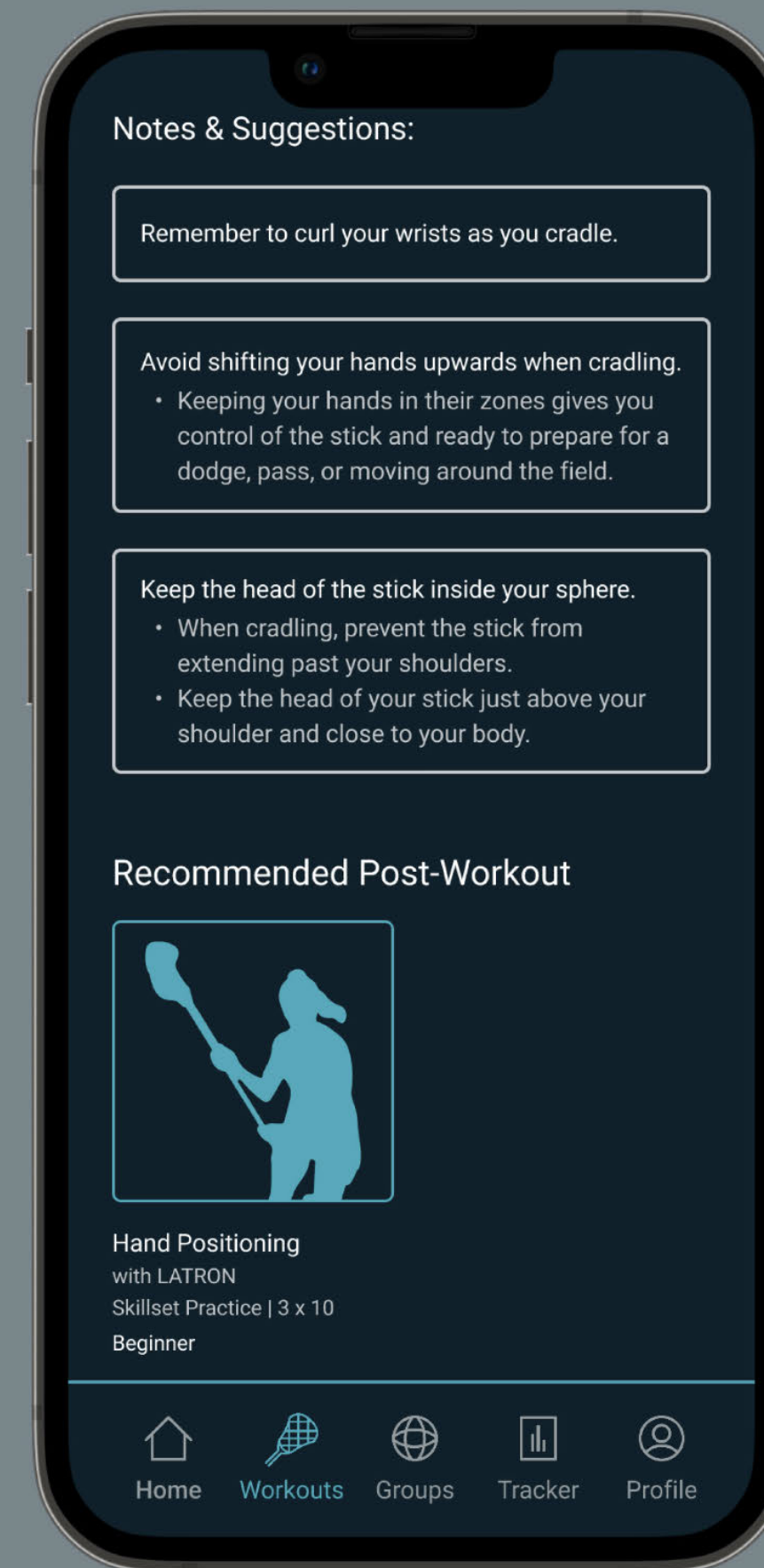
Strong Vibration
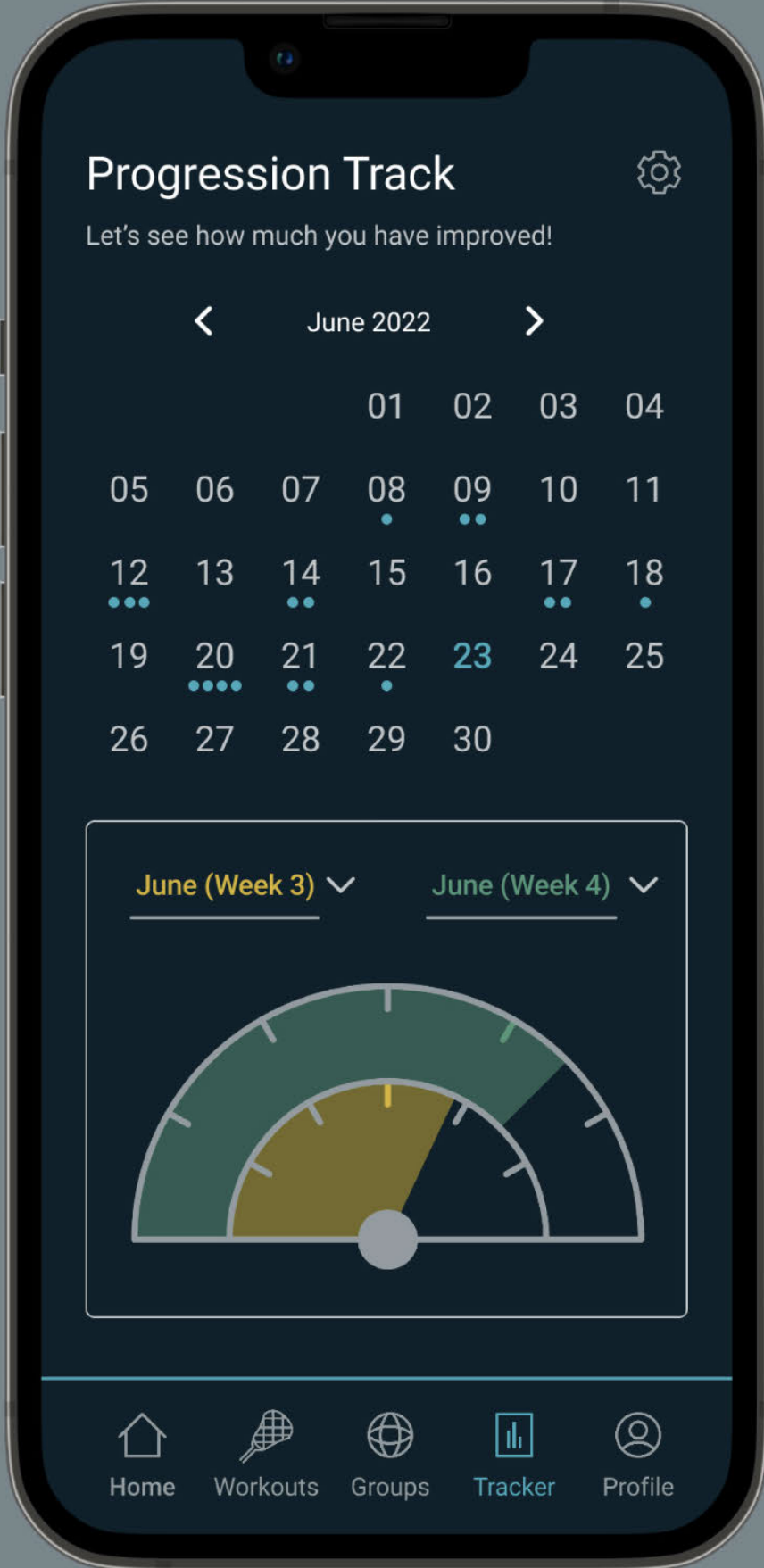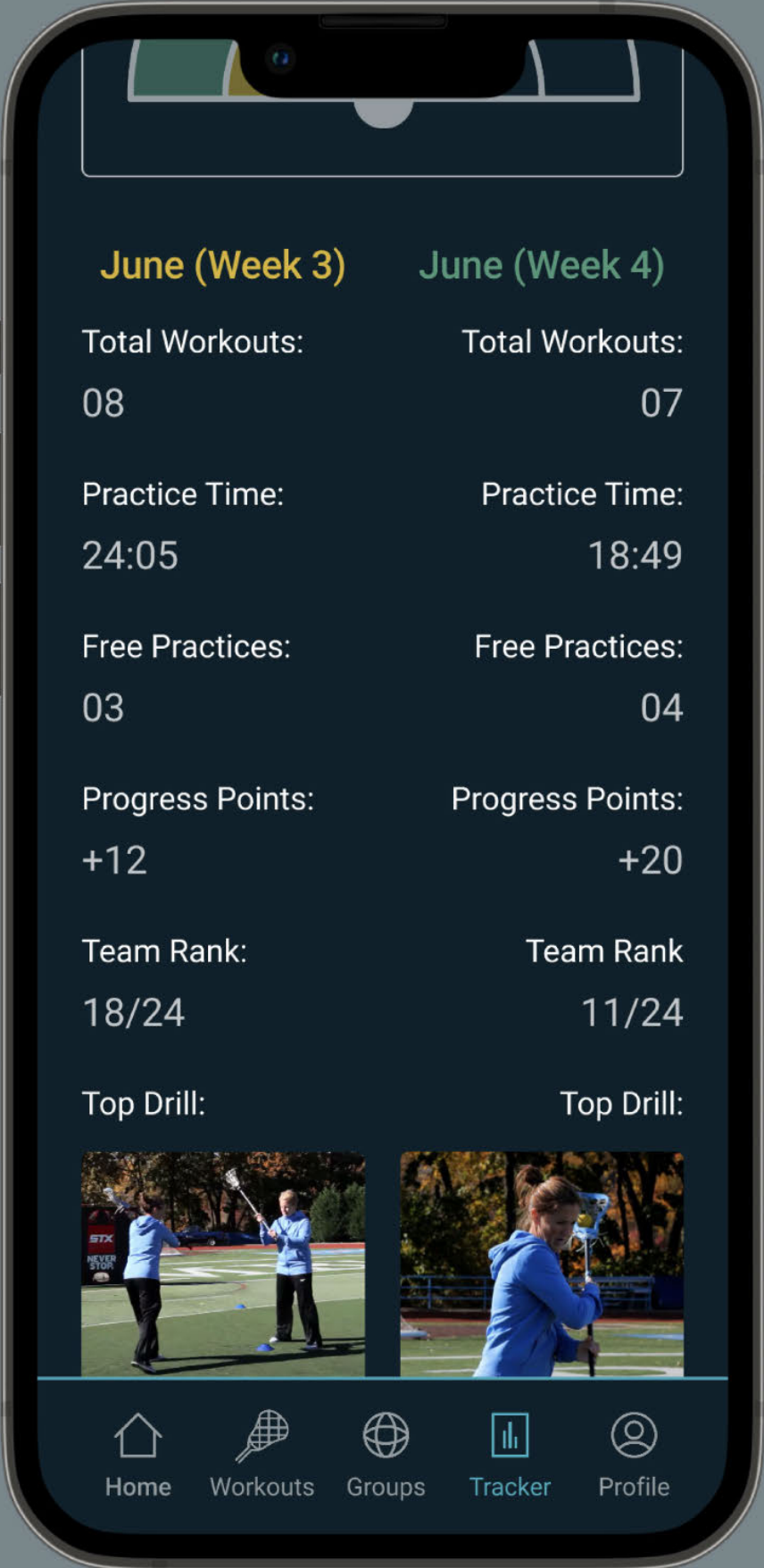
Post-Workout Summary

Report Meter

Feedback &
Recommendations

Progression Tracker

Weekly Progress Meter

Comparison Stats