

# Kinundrum Usability Test Report

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## 1. Purpose

*Kinundrum* is a web-hosted multimedia application that guides students through lower limb biomechanics case studies at increasing levels of difficulty. Case studies present animated injury scenarios, after which students solve interactive problems accompanied by anatomical 3D models, animations and illustrations.

This application primarily targets first-year kinesiology students in Dr. Laprade's anatomy course as a supplementary learning resource. The multimedia assets within the e-learning application can also serve as teaching tools for Dr. Laprade and her teaching assistants to use during lectures and tutorial sessions.

*Kinundrum* aims to promote active, deep learning, and enhance knowledge retention and understanding of leg anatomy. To achieve this goal, case study exercises are designed to allow students to review, apply and contextualize their anatomy knowledge while developing their reasoning and problem-solving skills.

The purpose of this usability testing was to assess the ease of use and ease of learnability of the *Kinundrum* interface. Using a paper prototype, three iterations of usability testing with rapid prototyping were completed. The results from test tasks and general feedback suggest that users can efficiently and intuitively navigate throughout the application and answer case study exercises. The usability testing also elucidated problems with *Kinundrum* that will be addressed in future iterations of the application prototype.

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## 2. Problem Statements

Can first-year kinesiology students:

1. Navigate through a case study intuitively?
2. Answer case study exercises using the interface features?
3. Search and access exercises within the Library?
4. Review and redo a case study?

### 3. User Profiles

#### **Primary User Persona: Tracy (who tries)**

*"Anatomy is hard! There is too much information to memorize."*

##### *Personality and Learning Profile*

- Surface learner with low visuospatial ability
- Detail-oriented, hardworking student
- Type A student who is anxious about grades

##### *User Goals*

- Learn and review key concepts in anatomy
- Practice how to approach and solve case study problems
- Gain strategies on how to effectively learn and study anatomy

##### *Summary*

Tracy is a hardworking student who is struggling in anatomy. Although she finds Dr. Laprade's lectures very interesting, she is overwhelmed by all the material she needs to know. After each class, she carefully re-writes her notes several times, and regularly reviews her flashcards. However, she finds the work she's putting into memorizing is not helping her understand the material. Tracy can list specific names of bones, muscles and nerves, but she always forgets what these structures look like and has a lot of difficulty linking the name of the structure to its function. When she consults Grant's Atlas, she gets overwhelmed by the complexity of the images and distracted by details such as the shapes of the muscles. During her peer group ICK tutorials, she has no idea where to begin and ends up relying heavily on her classmates to solve the case study problems. She is frustrated about her lack of contribution, but too embarrassed to reach out to the TAs or Dr. Laprade for extra help. As the upcoming exam draws closer, Tracy is feeling increasingly stressed. Recognizing that her current approach isn't working, she would love a resource that teaches her how to more effectively study anatomy. Specifically, she would like to be able to practice the steps to solving a case study problem on her own time, without the added stress of peers who are faster than her. Feeling discouraged by the available resources, she is looking for visuals that are simple and easy to understand. Finally, Tracy wishes she could monitor her level of knowledge so she can determine how much more studying she needs to do to get a good grade.

#### **Secondary User Persona: Polly (the parrot)**

*"Is this on the exam? OK, what's the most fun way to learn this?"*

##### *Personality and Learning Profile*

- Surface learner with low visuospatial ability
- Finds most learning resources overwhelming, dull or irrelevant
- Not particularly interested in anatomy; motivated to study only what will be on the exam

##### *User Goals*

- Understand structural relationships, function and dysfunction
- Study anatomy efficiently and effectively
- Have fun learning anatomy

### *Summary*

Polly knows that a solid understanding of anatomy is essential to becoming a PT, but she finds the lecture slides a little boring, the textbooks overwhelming, and online resources unengaging or irrelevant. YouTube videos can be fun, but don't always cover the content that Dr. Laprade tests on the exams. Kinundrum | Design Documentation 5 Polly likes the ICK tutorials because she gets to work with her friends. She's pretty good at identifying muscles and bony structures. But beyond that, her friends take over because they understand functional relationships better than she does. She can see these structures in her head, but can't visualize how they interact to produce movement. Innervation is even more complicated. Polly wishes there is a learning resource that is free, easy-to-use and engaging.

### **Secondary User Persona: Hans (the hotshot)**

*"High school biology was so easy. I'm sure anatomy will be a piece of cake."*

#### *Personality and Learning Profile*

- Surface learner with high visuospatial ability
- Feels overly confident about anatomy; doesn't study regularly because he feels he doesn't need to
- Unaware of how to study anatomy effectively

#### *User Goals*

- Learn how to study and review anatomy effectively
- Test his knowledge and understanding; find out which topics he struggles with and fill in his knowledge gaps

### *Summary*

Initially, Hans felt like he was going to ace anatomy with little effort. He got high marks in exercise science in high school without trying hard, so he felt like he was a step ahead of everyone else. His confidence was boosted when he realized he was already familiar with most of the anatomical vocabulary presented by Dr. Laprade. Writing the midterm, however, was a brutal wake-up call for Hans. Despite his familiarity with the material and general understanding of the concepts, Hans struggled to apply his knowledge to answer the test questions. Surprised and frustrated, Hans barely got a passing grade. Hans needs a learning tool that allows him to identify and resolve his knowledge gaps. Specifically, he would like to actively review and test his anatomy knowledge in different contexts.

## 4. Methodology

Three rounds of usability testing were conducted. Based on results and feedback from a previous testing session, changes to prototype were made before the next testing session (see **Section 6. Results**). Each round lasted about 30 minutes. All participants were between 18 and 30 years old and had no prior experience using *Kinundrum*.

**Table 1. Usability test participant summary**

Round	Participant and Sample Size	Testing Location
1	3 kinesiology undergraduate students	McCaul BMC office
2	3 first-year BMC students	BMC conference room
3	1 kinesiology TA and 1 kinesiology undergraduate student	McCaul BMC office

Prior to participant entry into the testing space, the following was done:

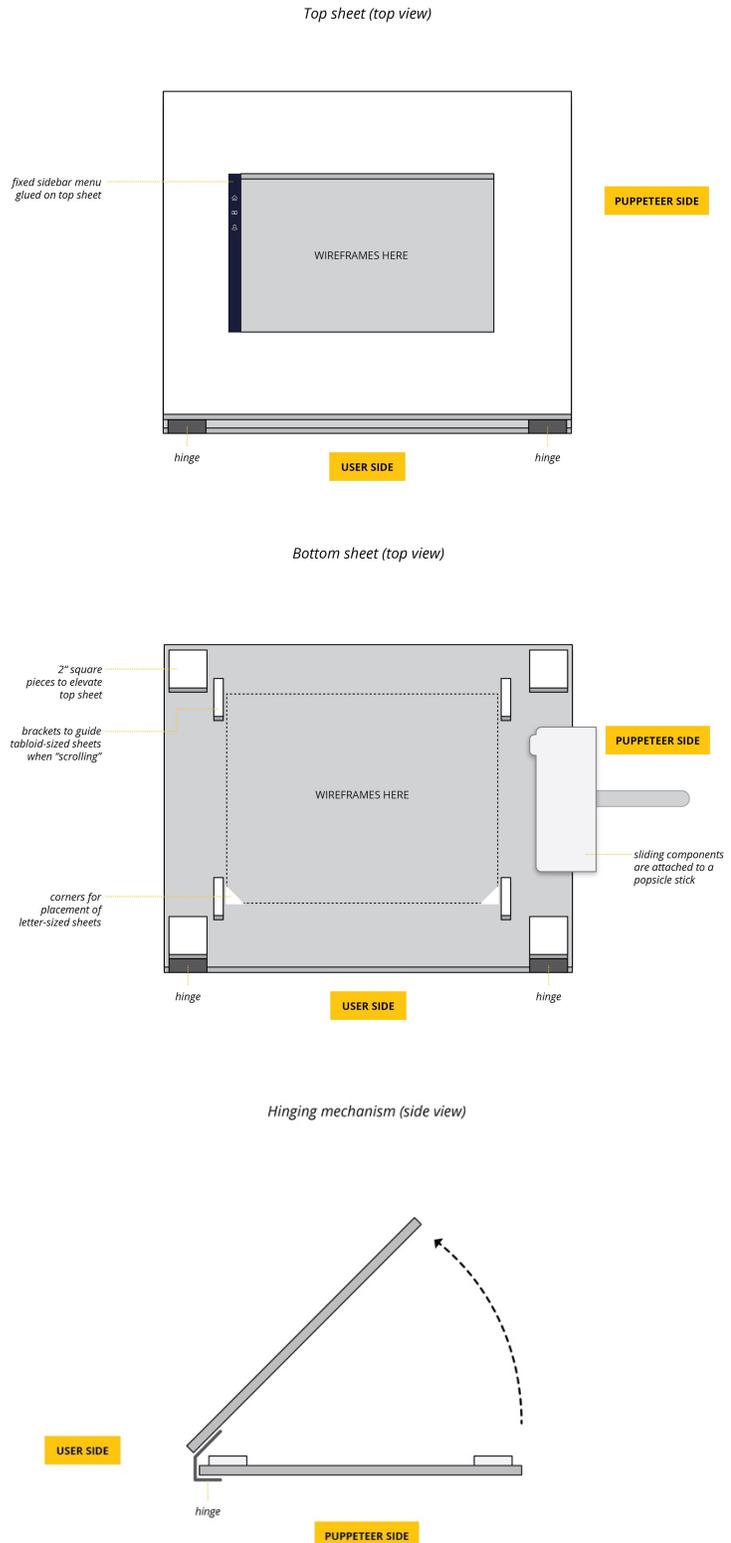
1. The paper prototype was prepared for use. A rectangular foam core frame, representing a computer desktop screen, was arranged on top of the *Kinundrum* Home screen. Printed wireframes and interactive components (buttons, overlays, etc.) were arranged and organized according to **Figure 2**.
2. The chairs were arranged according to **Figure 3** for rounds 1 and 3, and **Figure 4** for round 2.
3. When the user entered the testing space, they were instructed to be seated and told not to interact with the prototype until instructed to do so. Once seated, the moderator read the orientation script (see **Appendix A**) and obtained the user's consent.
4. The participant was asked to complete the tasks in a predetermined order (see **Section 5. Test Tasks**). The moderator ended a task if the participant verbally declared they completed the task or if the participant verbally declared they couldn't complete it.
5. Once the participant completed or attempted all tasks, the moderator held a debriefing session with the participant. They asked the participant a series of questions (see **Appendix B**) meant to probe the participants' general experience and satisfaction.

### Testing equipment

Testing was conducted using a paper prototype. The paper prototype consisted of colour-printed high-fidelity wireframes on letter and tabloid-sized sheets. The wireframes were presented using a constructed platform made of two hinged foam core sheets with a framed opening on the top sheet. Interface components were glued on foam core for multiple use and ease of manipulation. Sliding components such as the patient folder and incorrect feedback were attached to a wooden stick for easy manipulation. To mimic a lightbox/overlay effect, a sheet of mylar was placed over the wireframes.

**Figure 1. Prototype mechanism**

The frame platform was constructed out of black foam core. As shown in **Figure 1**, a top sheet of foam core was cut so that the opening has the dimensions 10 x 6.25 inches. This frame represented the 'desktop screen', and was attached via hinges to one side of the bottom sheet of black foam core. The two sheets of foam core opened to allow for placement of wireframes and other cut-out interface elements. The top and bottom sheets were separated by smaller pieces of foam core placed at the corners of the bottom sheet. This setup allowed the prototype puppeteer to easily slide wireframes to mimic scrolling through a page, or sliding interface elements from the side to mimic the patient folder and incorrect feedback.



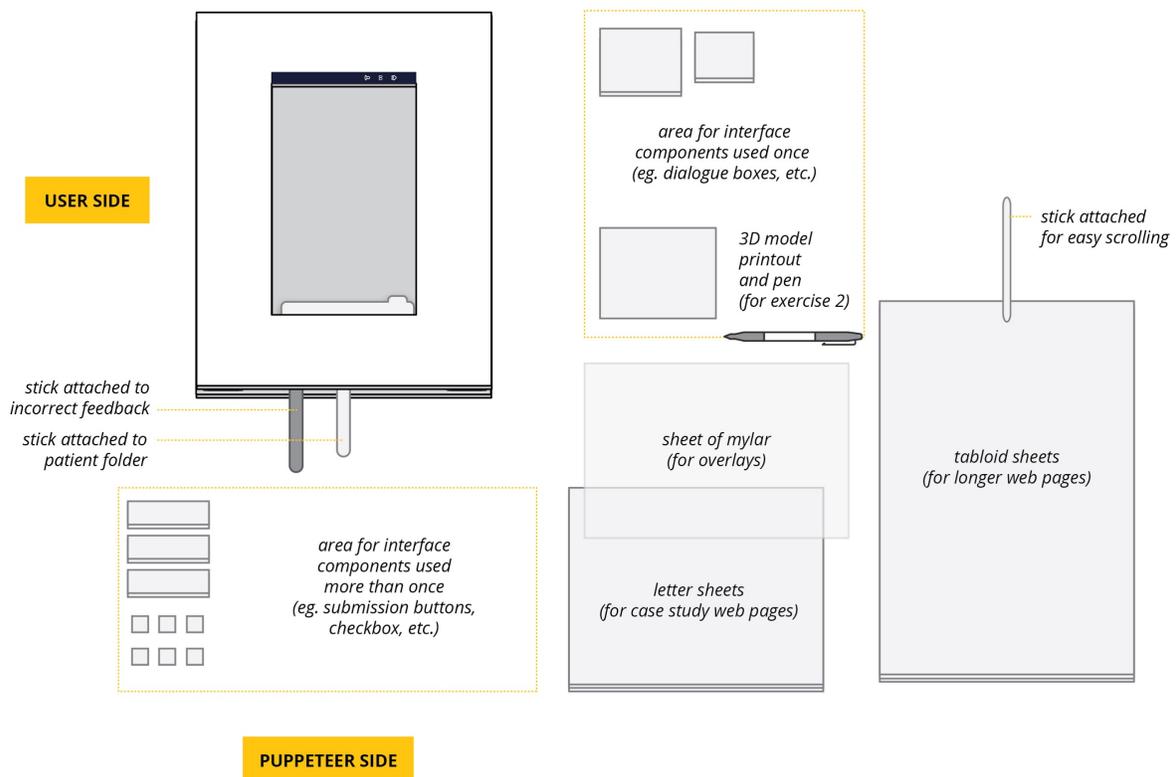
For *The Case of the Rebel Driver: Exercise 2*, the 3D model asset was represented by still images of the knee model. Unlike the actual 3D model viewport, the user was unable to explore the model freely, and could only use control buttons.

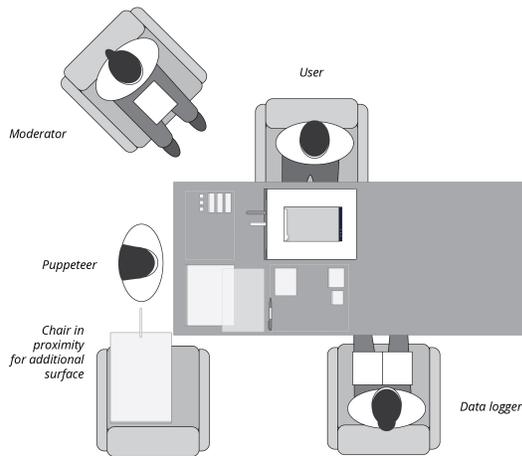
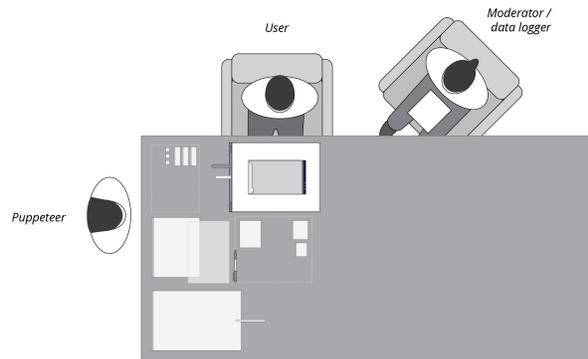
Description of how the 3D model exercise was represented (**test tasks 4-6**):

- viewport (user was limited to using the viewport buttons)
- drawing exercise (a paper cut-out with a specific view of the knee model was overlaid on top of the 3D model. To mimic the ligament appearing on the model, the prototype puppeteer used a coloured pen to mark the attachment points. A new paper cut-out was used for each participant.)

A laptop, word processor and notebook were used to record observational notes. The testing environment were set up as shown in **Figures 2, 3 and 4**.

**Figure 2. Prototype setup**



**Figure 3. Seating setup for rounds 1 and 3****Figure 4. Seating setup for round 2**

## Testing crew

**Moderator:** The “moderator” was responsible for reading the orientation script, task descriptions and debriefing questions (see **Appendix A and B**), and provided interpretation of the tasks when needed

**Data logger:** The “data logger” was responsible for recording whether the criteria for success for each test task are met, and other observational notes

**Prototype puppeteer:** The “prototype puppeteer” was responsible for manually adjusting the interface to reflect the user’s interaction with the paper prototype (switching and scrolling web pages, changing interface elements)

For round 2, and the second participant of round 3, the same person played both the moderator and data logger roles.

## Evaluation measures

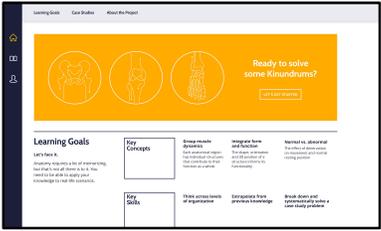
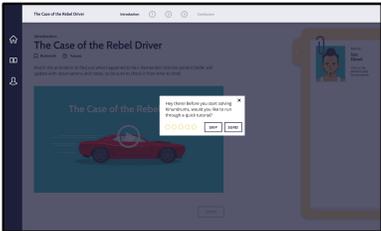
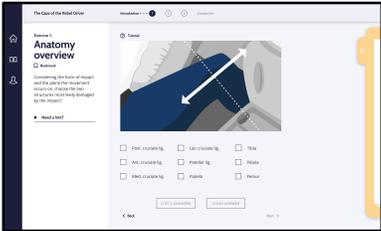
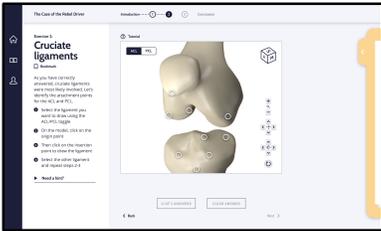
For each case study exercise, students were permitted a maximum of two attempts at submitting the correct answer as the user was not being tested on their anatomy knowledge. The moderator informed the user that they could stop by stating: *“Thank you. Please stop trying to complete the exercise. Let’s pretend that your third attempt to answer the question is correct.”*

The user was instructed to verbally declare each time they believed they completed a task. The user was also asked to verbally declare when they cannot complete the task.

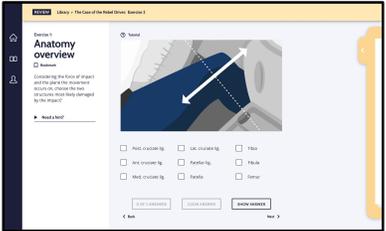
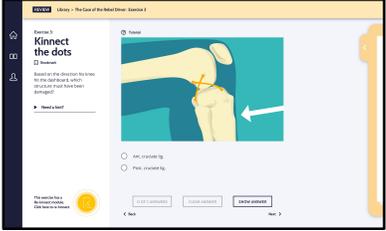
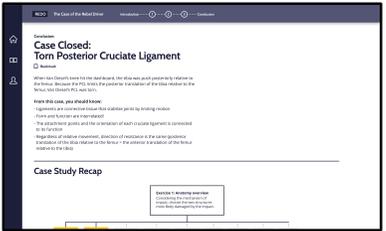
For each task, the data logger recorded notes on user actions and commentary. Based on the conditions of success (see **Section 5. Test Tasks**), each task was determined to be a success or failure. Because users were unable to interact with the 3D model asset, the data logger recorded their verbal description and miming of how they would interact with the 3D model (**test tasks 4-6**).

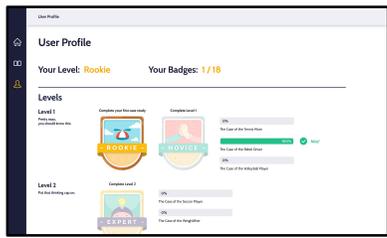
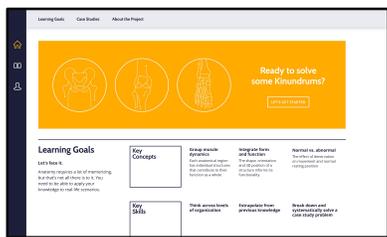
## 5. Test Tasks

Table 2. Test tasks and conditions for success

Test Task	Start State	Conditions for success	Moderator Script Round 1	Moderator Script Rounds 2 & 3
1		Clicks on Rebel Driver case study icon	You are taking Dr. Laprade's anatomy class and she has introduced a new learning resource called Kinundrum. For this week, Dr. Laprade has asked you to complete the case study of the Rebel Driver. You may start.	Same as round 1
2		<ul style="list-style-type: none"> <li>- Submit/clear answers</li> <li>- Navigate to next case study</li> <li>- Access hints and patient folder notes when needed</li> </ul>	Now that you are in the case study, please complete it. At certain points in the case study, we will ask you to complete particular tasks, but otherwise, just keeping moving forward.	Same as round 1
3		Clicks on the bookmark icon	(moderator waits for user to successfully complete exercise) Before you move on, you think that this question may show up on a test. Please save this exercise so that you can find it at a later time. You may begin.	If user answers Ex.1 incorrectly twice: Let's pretend that your third attempt to answer the question is correct. <b>Start:</b> Same as round 1 <b>End:</b> Thank you. You may continue onto the next exercise now.
4		Mentions interacting with the 3D model to follow the instructions given	Please note that since we are using a paper prototype, it will not respond accordingly. We are going to break this exercise down into two tasks. First, let us know verbally how you would answer this exercise. You may begin.	<b>Start:</b> same as round 1 <b>End:</b> Thank you. Let's move to the next task.



Test Task	Start State	Conditions for success	Moderator Script Round 1	Moderator Script Rounds 2 & 3
10		<ul style="list-style-type: none"> <li>- Clicks on the Library icon on the sidebar menu or by clicking <i>REVIEW</i> on the case study icon</li> <li>- Clicks anywhere on the row of Ex. 1</li> <li>- Clicks the <i>SHOW ANSWER</i> button, or answers the question and clicks on the <i>SUBMIT ANSWER</i> button.</li> </ul>	<p>If previously failed: Open and review the exercise you bookmarked earlier. You may begin.</p> <p>If previously failed: Suppose you have bookmarked exercise 1 of the Rebel Driver. You would like to open and review the exercise you bookmarked earlier. How would you do that? You may begin.</p>	<p><b>Start:</b> same as round 1</p> <p><b>End:</b> Thank you. Let's move to the next task.</p>
11		<ul style="list-style-type: none"> <li>Accesses Ex. 3 by clicking on the <i>Next</i> button twice, or by clicking Library icon and clicking Ex. 3</li> </ul>	<p>Please open exercise 3 from the Rebel Driver case study. You may begin.</p>	<p><b>Start:</b> Please review exercise 3 from the Rebel Driver case study. You may begin.</p> <p><b>End:</b> Thank you. Let's move to the next task.</p>
12		<ul style="list-style-type: none"> <li>- Clicks on the Home page</li> <li>- Hovers over the Rebel Driver case study icon &amp; clicks <i>REDO</i>. (<b>rounds 1 and 2</b>)</li> <li>- Clicks on <i>REDO</i> button under profile icon (<b>round 3</b>)</li> </ul>	<p>Now, you would like to redo the entire case study again and test your knowledge. You may begin.</p>	<p><b>Start:</b> same as round 1</p> <p><b>End:</b> Thank you. Let's move to the next task.</p>
13		<ul style="list-style-type: none"> <li>Clicks on User Profile icon</li> </ul>	<p>Let's skip ahead until you have answered every question in this case study again. Now you are on the conclusion page. Congratulations, you've earned the Keener badge! Find all of the badges you have collected so far. You may start.</p>	<p><b>Start:</b> same as round 1</p> <p><b>End:</b> Thank you. Let's move to the next task.</p>

Test Task	Start State	Conditions for success	Moderator Script Round 1	Moderator Script Rounds 2 & 3
14		<ul style="list-style-type: none"> <li>- Answers "Rookie level" and "1 badge"</li> <li>- Mentions Kininja and Bookworm badges</li> </ul>	Can you tell me what level you are at and how many badges you have won? Can you name the other badges you can win? You may begin.	<p><b>Start:</b> same as round 1</p> <p><b>End:</b> Thank you. Let's move to the next task.</p>
15		Clicks on The Case of the Tennis Mom: Exercise 4	Let's skip ahead again, and pretend that you have completed another case study: The Case of the Tennis Mom. Now, you want to review the Tennis Mom exercises, specifically exercise 4. Please find this exercise. You may begin.	<p><b>Start:</b> same as round 1</p> <p><b>End:</b> Thank you. Let's move to the next task.</p>

## 6. Results

The following table lists which test tasks met the conditions for success. Changes to the paper prototype were made after each round. Results have been separated by testing round. For additional observations, refer to **Appendix C**.

Changes to prototype are listed below:

### For Round 2:

- Added sidebar icons to the tutorial text box that introduces the Home, Library and User Profile
- When user submits answer incorrectly, the disabled 0 OF 2 ANSWERS button was changed to a disabled SUBMIT ANSWER button to avoid confusion from the lack of interaction.
- Made the Re-Kinnect icon bigger, and shortened text to "Click here to Re-Kinnect" for exercise 3 (**test task 8**)

### For Round 3:

- Modified the Library icon so it better resembles a book
- For exercise 2, changed the instructions so it explicitly states the visual asset is an interactive 3D model (**test task 4**)
- For exercise 2, made the control buttons larger, and changed the reset icon to a button that says RESET VIEW (**test task 4**)
- Changed the Review/Redo hover button to just Review, and added a Redo button below the case study icon (**test task 12**)

**Table 3. Usability test results**

Test tasks	Round 1: April 4 <sup>th</sup> , 2018			Round 2: April 5 <sup>th</sup> , 2018			Round 3: April 6 <sup>th</sup> , 2018	
	User 1	User 2	User 3	User 1	User 2	User 3	User 1	User 2
<b>Test task 1:</b> Can users access a case study from Home page?	Y	Y	Y	Y	Y	Y	Y	Y
<b>Test task 2:</b> Can users navigate through a case study and complete exercises?	Y	Y	Y	Y	Y	Y	Y	Y
<b>Test task 3:</b> Can users bookmark a case study exercise?	N	Y	Y	Y	Y	Y	Y	Y
<b>Test task 4:</b> Can users answer The Case of the Rebel Driver, Exercise 2?	Y	Y	N	Y	Y	N	Y	Y
<b>Test task 5:</b> <i>Conditional</i> - If users mention that they would interact with the 3D model to answer The Case of the Rebel Driver, Exercise 2, can users manipulate their view of the 3D model?	Y	Y	N	Y	Y	n/a	Y	Y
<b>Test task 6:</b> Can users complete The Case of the Rebel Driver, Exercise 2?	Y	N	Y	Y	Y	Y	Y	Y
<b>Test task 7:</b> Can users re-watch the introductory animation at any point during the case study?	N	Y	Y	N	Y	Y	Y	Y
<b>Test task 8:</b> <i>Conditional</i> - If users answer case study exercise 3 correctly, are they able to access Re-Kinnect?	N	N	N	n/a	Y	Y	Y	Y

Test tasks	Round 1: April 4 <sup>th</sup> , 2018			Round 2: April 5 <sup>th</sup> , 2018			Round 3: April 6 <sup>th</sup> , 2018	
	User 1	User 2	User 3	User 1	User 2	User 3	User 1	User 2
<b>Test task 9:</b> Can users access the home page after completing a case study?	Y	Y	Y	Y	Y	Y	Y	Y
<b>Test task 10:</b> Can users access a bookmarked case study to review it?	N then Y	Y	Y	Y	Y	Y	Y	Y
<b>Test task 11:</b> Can users navigate case study exercises within the Library?	Y	Y	Y	Y	Y	Y	Y	Y
<b>Test task 12:</b> Can users redo a case study exercise?	N	Y	N	N	N	Y	Y	N
<b>Test task 13:</b> Can users access their User Profile?	Y	Y	Y	Y	Y	Y	Y	Y
<b>Test task 14:</b> Can users interpret their Kinundrum progress?	Y	Y	Y	N	Y	Y	Y	Y
<b>Test task 15:</b> Can users find a specific case study exercise to review in the Library?	Y	Y	Y	Y	Y	Y	Y	Y

## 7. Discussion

### Successful test tasks

All users completed test tasks 1, 2, 9, 10, 13 and 15 successfully. These test tasks require interaction with the sidebar menu, including the Home, Library and User Profile icon. Test task 2 evaluated the users' ability to navigate within a case study and answer questions. Test task 10 and 15 prompted users to navigate and find a specific exercise within the Library. All users were able to identify the Library as the page to find bookmarked and review exercises. However, most users did not use the search bar, filter or tab sorting features. Instead, the majority scrolled to find the exercises for review. This is likely because there were so few completed exercises listed. The search bar, filters or

tab sorting functions would perhaps become useful as case studies are completed and more exercises are added to the Library. Based on these results, the sidebar menu, header progress bar and buttons, multiple choice/checkbox questions, Library and User Profile page design can be interpreted to be intuitive and easy-to-use.

### Mostly successful tasks

All but one user completed test task 3, 6, and 14 successfully.

- Test task 3: Round 1, User 1 failed to see bookmark icon. This may be attributed to the limitation of the prototype. The tutorial prompt is designed so that it highlights the bookmarked icon. Also the bookmark icon has the microinteraction on hover that would make it more visible.
- Test task 6: Round 1, User 2 did not use the toggle to switch from ACL to PCL. This may be because the user didn't recognize the toggle button or because he/she was so focused on interacting directly with the model, he/she didn't read the instructions in the question area. The break in flow of answering the question may also disconnect the user from the natural path he/she may have taken.
- Test task 14: Round 2, User 1 could not distinguish between badges and levels, and interpreted them to mean the same thing. Although not optimal, this does not necessarily affect the usability of the application.

### Failed tasks

A considerable number of users were unsuccessful with test tasks 4, 5, 7, 8, and 12. These tasks pertain to: 1) the 3D model (tasks 4-6); 2) re-watching the introductory animation (task 7); 3) accessing the "Re-Kinnect" exercise (task 8), and lastly, 4) distinguishing between "Review" vs "Redo" (task 12).

**1) 3D model:** The results were inconclusive on the effectiveness of navigation within the viewport.

- Some users did not immediately identify as an interactive 3D model that users can pan, zoom and rotate.
  - This can be addressed by changing question prompt to explicitly specify interaction with the 3D model. This may also be due the flat appearance of the 3D model when printed on paper.
- Most users correctly utilized the corresponding control buttons to rotate, pan, and zoom around the viewport model.
- Only three users used the "mouse" buttons to manipulate the view of the 3D model, while the other five users only used the control buttons.
  - This is likely due to the limitations of the paper prototype which restricted free exploration of the 3D model.

**2) Re-watch intro animation:** Many paths were taken to re-watch the animation

- Only four users clicked on the patient folder profile picture to re-watch the animation, which is the most efficient pathway

- The other four users used the progress bar to access the introduction page. These users clicked on the “1” button instead of “Introduction”. The users then realized that “1” refers to Exercise 1 and had to click on the “back” button to reach the introduction page. To avoid confusion, the introduction link in the progress bar should be re-designed to be more salient.
- Ultimately, almost every user was able to re-watch the animation. The only user who failed the task got stuck in the library. Since there was only one outright failure, there will be no corresponding changes to the design of the patient folder or introduction page.

### **3) Accessing the Re-Kinnect exercise:** All Round 1 users could not locate the Re-Kinnect icon

- All round 1 users failed to find the Re-kinnect exercise. All users returned to the Home page and tried to find the exercise there.
- After round 1, the Re-Kinnect icon was modified to be more salient. After this design change, there were no failures during rounds 2 or 3.

### **4) Distinguishing between “Review” vs “Redo”:** 4 out of 6 users failed to complete this task in round 1 and 2 and 1 out of 2 in round 3 following a re-design.

- All 5 users who failed to complete the task thought that to “Redo” a case study, one had to go to the Library and complete each exercise again. The users were clearly confused between the concept of “Review” mode and “Redo” mode which are conducive to earning different badges.
- To address this confusion, the “Review/Redo” hover button was changed to just “Review”, and a Redo button was added below the case study icon that appears once the user has completed the case study. This change was implemented during round 3 with a 50% success rate. It is important to note that round 3 only had 2 users. So, it is still unclear whether this design change ameliorates the confusion between “review” and “redo”.

## **General Feedback**

When solving the exercises, many students got stuck on Rebel Drive exercise 1. This is because there are multiple potentially correct answers to the question. Users often had to try multiple times before getting the “right” answer. This demonstrated the need for clarification of the question.

Many users mentioned having a “Back” button would be useful. Since this would be a feature integrated into the user’s web browser, we did not add it to our interface design. Because the paper prototype did not include a browser interface, we were unable to test how the browser “back” button would affect the usability of the application.

Users recommended the following interactions or graphical improvements. We will incorporate all the recommendations except for the last one because we don’t believe that redundancy affects usability:

- Re-Kinnect icon should flash or wiggle to incite the user to click it
- 3D viewport controller icons should be slightly bigger
- New notes in the patient folder should be highlighted
- Feedback should be more specific (ex: 1 of 2 answers correct)

- The “< Next” and *NEXT EXERCISE* button are redundant

Generally, users found the application fun, engaging, and easy to use. Most users appreciated the minimalistic interface design, graphic visual style, and enjoyed the cheeky wittiness integrated into the application experience. Users were attracted to the gaming approach to the user experience. Most users would use this application to learn material throughout the term and before exams to review their knowledge. The undergraduate kinesiology students mentioned that they prefer *Kinundrum* over their current learning resource (*Wiley Plus*) because it requires more critical thinking.

## Recommendations

Based on the usability test findings, the following changes will be implemented into the *Kinundrum* interface design.

### Changes made after usability test rounds 1 and 2

- Increased size of Re-Kinnect icon and reworded accompanying text to a call-to-action message
- Added sidebar icons to the tutorial text box that introduces the Home, Library and User Profile
- Modified the Library icon so that it better resembles a book
- For Exercise 2,
  - Changed question prompt to explicitly state that the 3D model is interactive
  - Increased size of control buttons
  - Changed the reset icon to a button that says RESET VIEW
- Changed the “Review/Redo” hover button to just “Review”, and added a “Redo” button below the case study icon that appears once the user has completed the case study

### Changes that will be made for future prototype iteration

- Enclose progress bar “Introduction” and “Conclusion” links in a box so that the buttons more visually resemble links
- Reword to clarify The Case of the Rebel Driver, Exercise 1
- Add browser window to future prototypes, so we can test how the “back” and “forward” buttons in the browser would affect the usability of the web application
- Highlight the new notes in the patient folder (either visually or via animation)
- Animate the Re-Kinnect icon to flash or wiggle to invite the user to click it
- Possibility of providing more specific incorrect feedback (this would require feedback from our content advisor, Dr. Laprade)

## Limitations

### Paper prototype

Because the usability testing was conducted using a paper prototype, there are several important limitations. The most significant limitation includes the restricted number of available features, the lack of microinteractions and unresponsive interactive 3D model.

Unlike the live web application, users must interact with the paper prototype in a specific order. For example, users couldn't access the Library without having first bookmarked exercise 1 and completing The Case of The Rebel Driver. The moderator must constantly prompt the user forward, thus breaking the flow a user might naturally take through a case study.

Because there are no microinteractions, users might have increased difficulty distinguishing between interactive elements (buttons, links) and unresponsive images. Additionally, because certain buttons are elevated by foam core (for easy handling by the prototype puppeteer), these interactive features may appear more salient than they would have on a computer screen.

### **Experimental Conditions**

Due to the laboratory conditions and formal environment of the usability testing, users may behave differently than they would if they were using the application in a more natural setting. For example, all users completed the tutorial. But it is uncertain whether all users would complete tutorials on their own.

Lastly, because the sample size was small for each testing round, the results are not statistically significant. However, the users provided insightful, qualitative feedback on interface and user experience that will inform future iterations of *Kinundrum*.

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## **Appendix A: Orientation Script**

Hello! My name is "moderator's name", and I will be your moderator for the usability testing on *Kinundrum* today. First, let me introduce you to my colleagues. This is "data logger's name", and this is "prototype puppeteer's name". We are graduate students in the UofT Biomedical Communications program, and for our Masters research project, we are developing *Kinundrum*: a problem-based multimedia learning application. First, we would like to thank you for agreeing to participate. Your feedback will be used to make our application more useful and easier to use.

So, what is *Kinundrum*?

*Kinundrum* is a desktop web application that we are designing as a supplementary resource for Dr. Laprade's anatomy class for undergraduate kinesiology students. After watching lower limb injury scenarios, students work through the case study by solving problems.

At this stage, we have developed a paper prototype of our app. This rectangle represents the computer screen and anything you see within represents the application interface.

To mimic interactions with a computer, we ask you to pretend your hand is the mouse. To click, you can simply tap the screen with your index finger. To click and drag, you can tap and drag your finger across the screen. Feel free to touch the prototype directly with your finger. "Prototype puppeteer's name" will tell you when you can touch the prototype.

To complete the usability testing, I'm going to ask you to perform a number of sample tasks. It's important that you understand that it is not you being tested, but rather the application that is being

tested. For each task prompt, I will tell you when you can begin, and you will tell me when you feel you have finished the task. Please tell us what you are thinking as you work through the task. Some tasks require you to find information. Please say the information out loud when you have found it.

On some occasions, I may ask you to stop attempting to complete a task. If this happens, it's not a reflection of your abilities, nor is it a comment on your effort. Please stop performing the task and prepare for the next one.

If any question I ask is confusing or you have trouble remembering, feel free to ask me to repeat the question. Please bear in mind that I cannot give you instructions on how to complete a task after the testing has begun. However, if you ever get stuck, feel free to let us know and we can stop and move on to the next task.

This testing should last about 30 minutes. If you feel uncomfortable at any point during the testing, you are free to leave.

Do you have any questions at this point?

Lastly, do you consent to take part in this usability testing? If so, please read over and sign this form.

Thank you! Let's get started.

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## Appendix B: Concluding Script and Debriefing Questions

### **Rounds 1 and 3:**

Thank you for completing our usability test. We're going to wrap things up by asking you some general questions.

- How useful would you find this application as a supplementary resource?
- When would you most likely use Kinundrum? (e.g. to review before a test, as you are learning the material during lectures)
- Do you have any general feedback on the application design and user experience so far?

### **Round 2:**

Thank you for completing our usability test. We're going to wrap things up by asking you for general feedback.

- Do you have any feedback on the application design and user experience so far?
- Did you find any interface features confusing or difficult to understand?
- If you were a student in the kinesiology course, when would you most likely use Kinundrum? (e.g. to review before a test, as you are learning the material during lectures)

## Appendix C: Usability Test Data Log

### Usability Test: Round 1 – April 4<sup>th</sup>, 2018

#### Notes on user 1 session:

- Dialogue box for REVIEW/REDO, and tutorial boxes for Library were not shown
- Tutorial text box for bookmark icon looked like it was pointing towards the library (confused – called it the bookmark page)
- User seemed relaxed throughout the session

Test Tasks	Successful (Y/N)	Observations
<b>User 1 (3:30-4:30)</b>		
Test task 1: Can users access a case study from Home page?	Y	<ul style="list-style-type: none"> <li>• Clicked case studies on header &gt; Easy to find case study</li> <li>• Tutorial yes – actually reading all tutorials!</li> <li>• He knew the answer already after watching the animation</li> </ul>
Test task 2: Can users navigate through a case study and complete exercises?	Y	<ul style="list-style-type: none"> <li>• Said he didn't need a hint but clicked it for fun &gt; selected PCL and patellar lig. &gt; incorrect</li> <li>• Thought the disabled 0 of 2 answers button meant that he got 0 correct</li> <li>• Tried ACL &gt; next exercise</li> </ul>
Test task 3: Can users bookmark a case study exercise?	N	<ul style="list-style-type: none"> <li>• Pressed on the Library to bookmark</li> <li>• Then back to Home &gt; Case Studies &gt; Rebel Driver (saved progress)</li> </ul>
Test task 4: Can users answer The Case of the Rebel Driver, Exercise 2?	Y?	<ul style="list-style-type: none"> <li>• Read question &gt; he would select ACL first, and "rotate the knee"</li> <li>• He said he would zoom out a little – easier to orient from a distance</li> </ul>
Test task 5: Conditional - If users mention that they would interact with the 3D model to answer The Case of the Rebel Driver, Exercise 2, can users manipulate their view of the 3D model?	Y	<ul style="list-style-type: none"> <li>• Rotate icon to rotate, pan icon to change the area he's looking at</li> <li>• He thinks reset view button is undo button</li> <li>• Attachment points not sure – only mentioned using control buttons</li> </ul>
Test task 6: Can users complete The Case of the Rebel Driver, Exercise 2?	Y	<ul style="list-style-type: none"> <li>• ACL selected &gt; then drew PCL (he said the steps seem logical)</li> <li>• knew that second selection was the insertion point</li> </ul>
Test task 7: Can users re-watch the introductory animation at any point during the case study	N	<ul style="list-style-type: none"> <li>• Clicked on 1 on progress bar - thought that was introduction &gt; then watched the animation from intro page</li> <li>• Pressed Start in intro &gt; from exercise 1, clicked on 2 on progress bar &gt; he said he would click next or 3 on the progress bar &gt; selected PCL &gt; correct</li> </ul>
Test task 8: If users answer case study exercise 3 correctly, are they able to access Re-Kinnect?	N	<ul style="list-style-type: none"> <li>• For Re-Kinnect exercise – went to Home</li> <li>• He admitted he didn't know where the Re-Kinnect exercise is</li> </ul>

Test Tasks	Successful (Y/N)	Observations
<b>User 1 (3:30-4:30)</b>		
Test task 9: Can users access the home page after completing a case study?	Y	<ul style="list-style-type: none"> <li>Clicks on BACK TO HOME after scrolling down</li> <li>Asked if Case Study Recap is interactive</li> </ul>
Test task 10: Can users access a bookmarked case study to review it?	N then Y	<ul style="list-style-type: none"> <li>Library &gt; clicked on intro</li> <li>Called the Library the bookmark page</li> <li>Went to intro, realized mistake then went back to Library, asked to repeat task &gt; clicked on ex 2 &gt; hit SHOW ANSWER</li> </ul>
Test task 11: Can users navigate case study exercises within the Library?	Y	<ul style="list-style-type: none"> <li>Used Next links to navigate to ex3</li> </ul>
Test task 12: Can users redo a case study exercise?	N	<ul style="list-style-type: none"> <li>Clicked on Re-Kinnect icon on ex3, played with slider &gt; went back to the Library to intro to REDO task</li> </ul>
Test task 13: Can users access their User Profile?	Y	<ul style="list-style-type: none"> <li>Clicked on Keener badge dialogue box, then went to User Profile</li> </ul>
Test task 14: Can users interpret their Kinundrum progress?	Y	<ul style="list-style-type: none"> <li>He mentions Rookie level and Keener badge</li> <li>Found all badges</li> </ul>
Test task 15: Can users find a specific case study exercise to review in the Library?	Y	<ul style="list-style-type: none"> <li>Clicked on the Tennis Mom case study icon &gt; hover &gt; REVIEW &gt; in Library, he scrolls down to exercise 4</li> </ul>

**User comments:**

- Found it very useful, uses Wiley Plus and he doesn't like it
- Found answering questions difficult on Wiley Plus, lots of fill in the blank, singular/plural semantics – not a good system
- Likes the graphics, and the global sidebar
- He would use the app after lectures, supplement instead of memorizing, would rather use this instead of atlas before an exam
- Back button would have been helpful
- Thought recap was interactive, really likes the recap diagram, they don't have it on Wiley Plus

**Notes on user 2 session:**

- Tutorial boxes for the Library were not shown
- User seemed very eager to answer exercise 1 and forgot task

Test Tasks	Successful (Y/N)	Observations
<b>User 2 (4:30-5:30)</b>		
Test task 1: Can users access a case study from Home page?	Y	<ul style="list-style-type: none"> <li>Scrolls down to get to Rebel Driver</li> </ul>

Test Tasks	Successful (Y/N)	Observations
<b>User 2 (4:30-5:30)</b>		
Test task 2: Can users navigate through a case study and complete exercises?	Y	<ul style="list-style-type: none"> <li>• Yes to tutorial, reads it, thinks Library icon is history;</li> <li>• This time, puppeteer pointed at bookmark and tutorial icons</li> <li>• Bookmark – did not follow task, just proceeded to answering the question; exercise 1 is difficult for both user 1 and 2;</li> <li>• Clicks on checkmark instead of CLEAR ANSWER to deselect;</li> <li>• Thought about the femur moving forward, had to reread question to understand it</li> </ul>
Test task 3: Can users bookmark a case study exercise?	Y	<ul style="list-style-type: none"> <li>• User clicked bookmark icon after moderator repeated the task</li> </ul>
Test task 4: Can users answer The Case of the Rebel Driver, Exercise 2?	Y	<ul style="list-style-type: none"> <li>• Talked about where the attachment points would be</li> <li>• He said he would mouse drag to explore and rotate in the 3D model area</li> </ul>
Test task 5: Conditional - If users mention that they would interact with the 3D model to answer The Case of the Rebel Driver, Exercise 2, can users manipulate their view of the 3D model?	Y	<ul style="list-style-type: none"> <li>• Talked about using the interface area and mouse dragging</li> </ul>
Test task 6: Can users complete The Case of the Rebel Driver, Exercise 2?	N	<ul style="list-style-type: none"> <li>• Did not click PCL toggle, but selected two attachment points</li> </ul>
Test task 7: Can users re-watch the introductory animation at any point during the case study	Y	<ul style="list-style-type: none"> <li>• Clicks on patient folder, and profile photo,</li> <li>• Selects PCL for the exercise</li> </ul>
Test task 8: If users answer case study exercise 3 correctly, are they able to access Re-Kinnect?	N	<ul style="list-style-type: none"> <li>• Goes back to Home for the Re-Kinnect exercise, scrolls around, can't find it, clicks case studies on header,</li> <li>• Moderator ends the task and he returns to exercise 3, but then he finds the Re-Kinnect exercise and plays with slider</li> </ul>
Test task 9: Can users access the home page after completing a case study?	Y	<ul style="list-style-type: none"> <li>• Clicks on home on sidebar, did not scroll</li> </ul>
Test task 10: Can users access a bookmarked case study to review it?	Y	<ul style="list-style-type: none"> <li>• Clicks on Library on sidebar</li> <li>• Scrolls down and clicks ex 2 &gt; resubmits an answer</li> </ul>
Test task 11: Can users navigate case study exercises within the Library?	Y	<ul style="list-style-type: none"> <li>• Clicks on Next link &gt; Next link &gt; finds exercise 3</li> </ul>
Test task 12: Can users redo a case study exercise?	Y	<ul style="list-style-type: none"> <li>• Clicks on Home on sidebar, hovers over Rebel Driver case study icon, clicks REDO</li> </ul>
Test task 13: Can users access their User Profile?	Y	<ul style="list-style-type: none"> <li>• Clicks User Profile on sidebar</li> </ul>

Test Tasks	Successful (Y/N)	Observations
<b>User 2 (4:30-5:30)</b>		
Test task 14: Can users interpret their Kinundrum progress?	Y	<ul style="list-style-type: none"> <li>Only mentions Level</li> <li>Names all badges</li> </ul>
Test task 15: Can users find a specific case study exercise to review in the Library?	Y	<ul style="list-style-type: none"> <li>Clicks on Tennis Mom case study icon &gt; hover &gt; REVIEW (asked to repeat task)</li> <li>In Library, scrolls down list and selects exercise 4</li> </ul>

**User comments:**

- Likes using technology to study, wants to enjoy studying, have something that helps keep him motivated,
- He thinks Kinundrum is a good study tool because it's fun, likes the game feel
- He would use the app at the beginning of studying before the exam to identify big knowledge gaps, and also to start building confidence
- In video, emphasis on tibia moving posteriorly so he didn't think ACL would be an answer on ex1; the picture made sense, might be the question (which plane pairing... transverse movement, ant-post Don't make the image related to the accident, just show the plane)
- Interface is more fun than Wiley Plus (questions are recycled) – questions are not helping him study for musculoskeletal anatomy
- Finds Wiley a hassle/chore
- Says he can do Kinundrum while watching a leafs game (???)
- Feels there's more critical thinking involved
- For 3D model: would have drawn the ligament itself; first instinct to drag, thinks zooming function is important

**Notes on user 3 session:**

- Needed to repeat tasks for user
- User often clicked on elements that are not interactive, trigger-happy

Test Tasks	Successful (Y/N)	Observations
<b>User 3 (5:00-5:30)</b>		
Test task 1: Can users access a case study from Home page?	Y	<ul style="list-style-type: none"> <li>Clicks on LET'S GET STARTED &gt; Case studies section, selects Rebel Driver</li> </ul>
Test task 2: Can users navigate through a case study and complete exercises?	Y	<ul style="list-style-type: none"> <li>Reads tutorial;</li> <li>Selects PCL and patella &gt; incorrect &gt; selects on checkbox then realizes she should click on CLEAR ANSWER &gt; PCL and patellar lig. &gt; clear &gt; incorrect for a few attempts so moderator jumps to correct answer</li> </ul>
Test task 3: Can users bookmark a case study exercise?	Y	<ul style="list-style-type: none"> <li>Clicks bookmark icon</li> </ul>

Test Tasks	Successful (Y/N)	Observations
<b>User 3 (5:00-5:30)</b>		
Test task 4: Can users answer The Case of the Rebel Driver, Exercise 2?	N	<ul style="list-style-type: none"> <li>Vaguely mentions the 3D interactivity ...</li> </ul>
Test task 5: Conditional - If users mention that they would interact with the 3D model to answer The Case of the Rebel Driver, Exercise 2, can users manipulate their view of the 3D model?	N	
Test task 6: Can users complete The Case of the Rebel Driver, Exercise 2?	Y	<ul style="list-style-type: none"> <li>Doesn't click PCL toggle but selects the attachment points</li> </ul>
Test task 7: Can users re-watch the introductory animation at any point during the case study	Y	<ul style="list-style-type: none"> <li>Clicks on patient folder and profile photo</li> </ul>
Test task 8: If users answer case study exercise 3 correctly, are they able to access Re-Kinnect?	N	<ul style="list-style-type: none"> <li>Just clicks Next, which takes her to the Conclusion</li> <li>Then she clicks on Home icon on sidebar</li> <li>Admits she cannot find the Re-Kinnect exercise</li> </ul>
Test task 9: Can users access the home page after completing a case study?	Y	<ul style="list-style-type: none"> <li>Clicks Home on sidebar</li> </ul>
Test task 10: Can users access a bookmarked case study to review it?	Y	<ul style="list-style-type: none"> <li>Clicks on REVIEW graphic on the description paragraph which is not interactive,</li> <li>Then clicks on Library on sidebar &gt; selects ex1 &gt; resubmits answer</li> </ul>
Test task 11: Can users navigate case study exercises within the Library?	Y	<ul style="list-style-type: none"> <li>Goes back to Home &gt; clicks on Rebel Driver &gt; Hover &gt; Redo &gt; reads dialogue box and exits REDO mode by closing the dialogue box &gt; hover &gt; clicks REVIEW &gt; Library &gt; ex 3</li> </ul>
Test task 12: Can users redo a case study exercise?	N	<ul style="list-style-type: none"> <li>Goes to Library &gt; selects Rebel Driver intro</li> <li>She thinks that redoing is reviewing every exercise from the Library and completing them again</li> </ul>
Test task 13: Can users access their User Profile?	Y	<ul style="list-style-type: none"> <li>Selects User profile on sidebar</li> </ul>
Test task 14: Can users interpret their Kinundrum progress?	Y	<ul style="list-style-type: none"> <li>Mentions Rookie level and winning one badge</li> <li>Read all badges and levels</li> </ul>
Test task 15: Can users find a specific case study exercise to review in the Library?	Y	<ul style="list-style-type: none"> <li>Selects Library on sidebar, and scrolls down to find ex 4</li> </ul>

**User comments:**

- most students struggle on application questions; Wiley Plus has no application questions; good to apply
- will use the app all throughout; use at the beginning, and then again closer to the test

- stuck a lot of times, more instruction, back button to go back to where you just were (would use the browser back button)
- originally felt that the model was an image – use a tutorial for the 3D model, or something in the instruction indicating
- loved the animations – Dr. Laprade showed students previously (last term)

#### Our notes:

- Ask supervisors about exercise 1 question wording
- Ex 2, add "...on the 3D model" to exercise description
- Ex 2 – (reset view) button (should just say words instead of symbol)
- Check with Dr. Laprade, how important is the origin and insertion order? (possible solution: colour code for origin and insertion)
- Icons for global nav should be in the tutorial box
- Library icon needs to change (too close to bookmark icon)
- Re-Kinnect icon should be more salient (GIANT Just: click here to REKINNECT, bigger icon)
- After incorrect, the disabled submit answer should say SUBMIT ANSWER (instead of default 0 of 2)

## Usability Test: Round 2 – April 5<sup>th</sup>, 2018

### Notes on user 1 session:

- User carefully read all the text (tutorial, questions, all the pop-ups), but still misunderstood difference between review and redo
- User had trouble with 3D model initially, but worked out how to correctly orient view and answer question

Test Tasks	Successful (Y/N)	Observations
<b>User 1 (11:30-12:00)</b>		
Test task 1: Can users access a case study from Home page?	Y	<ul style="list-style-type: none"> <li>• Clicks on LET'S GET STARTED &gt; Case studies section, selects Rebel Driver</li> </ul>
Test task 2: Can users navigate through a case study and complete exercises?	Y	<ul style="list-style-type: none"> <li>• Reads tutorial</li> <li>• Intro - Clicks on START before watching animation</li> <li>• Exercises - easily selects, submits &amp; clear answers</li> <li>• Mentions confusion between NEXT ANSWER and NEXT (although uses buttons correctly)</li> </ul>
Test task 3: Can users bookmark a case study exercise?	Y	<ul style="list-style-type: none"> <li>• Clicks bookmark icon</li> </ul>

Test Tasks	Successful (Y/N)	Observations
<b>User 1 (11:30-12:00)</b>		
Test task 4: Can users answer The Case of the Rebel Driver, Exercise 2?	Y	<ul style="list-style-type: none"> <li>Initially, doesn't realize that they can change the view of the 3D model (maybe limitation of paper prototype)</li> <li>When trying to select 2nd attachment point, realizes they have to change the 3D model view</li> <li>Clicks on correct viewport buttons to rotate the 3D model to ideal view</li> <li>User understands how to answer question by selecting attachment points</li> </ul>
Test task 5: Conditional - If users mention that they would interact with the 3D model to answer The Case of the Rebel Driver, Exercise 2, can users manipulate their view of the 3D model?	Y	<ul style="list-style-type: none"> <li>Clicks on correct viewport buttons to pan, zoom &amp; rotate</li> <li>Clicks on correct viewport button to reset view</li> <li>Doesn't think that 3D model view can also be manipulated by mouse movements directly in viewport window</li> </ul>
Test task 6: Can users complete The Case of the Rebel Driver, Exercise 2?	Y	<ul style="list-style-type: none"> <li>Clicks on PCL toggle</li> <li>Clicks on 2 sequential attachments points</li> </ul>
Test task 7: Can users re-watch the introductory animation at any point during the case study	N	<ul style="list-style-type: none"> <li>Doesn't know how to re-watch video</li> <li>Clicks on progress bar to access exercise 1 ( doesn't recognize that introduction is a link)</li> <li>Clicks on Home icon in global navigation menu</li> <li>Clicks on Library icon in global navigation menu</li> <li>Skips library tutorial</li> <li>Clicks on the review introduction exercise - watches animation</li> </ul>
Test task 8: If users answer case study exercise 3 correctly, are they able to access Re-Kinnect?	Y	<ul style="list-style-type: none"> <li>Clicks on rekinnect Icon</li> <li>Drags on slider handle</li> </ul>
Test task 9: Can users access the home page after completing a case study?	Y	
Test task 10: Can users access a bookmarked case study to review it?	Y	<ul style="list-style-type: none"> <li>Clicks on user profile icon, realizes it's the wrong page</li> <li>Clicks on library icon</li> <li>Within library, clicks to access correct case study</li> </ul>
Test task 11: Can users navigate case study exercises within the Library?	Y	<ul style="list-style-type: none"> <li>Clicks next twice</li> </ul>
Test task 12: Can users redo a case study exercise?	N	<ul style="list-style-type: none"> <li>Clicks to access introduction exercise in library</li> <li>Confuses review mode for redo mode</li> </ul>
Test task 13: Can users access their User Profile?	Y	
Test task 14: Can users interpret their Kinundrum progress?	N	<ul style="list-style-type: none"> <li>Confuses levels and badges for the same thing</li> <li>Understands that she's on level 1, but calls it the Rookie "badge"</li> </ul>
Test task 15: Can users find a specific case study exercise to review in the Library?	Y	<ul style="list-style-type: none"> <li>Clicks on library icon</li> <li>Scrolls down and selects correct case study</li> </ul>

**User comments:**

- when exercises require multiple answers, user wishes that there was feedback for individual answers (e.g. she got ½ answers correct)
- user didn't SHOW/HIDE ANSWER buttons in library review mode
- user would use *Kinundrum* primarily as a learning tool in the beginning of the course; user would also refer to app as review tool
- user found app fun and engaging!

**Notes on user 2 session:**

- User carefully read all the text (tutorial, questions, all the pop-ups), but still misunderstood difference between review and redo

Test Tasks	Successful (Y/N)	Observations
<b>User 2 (12:00-12:30)</b>		
Test task 1: Can users access a case study from Home page?	Y	<ul style="list-style-type: none"> <li>• Scrolls down home page to case studies</li> <li>• Clicks on Rebel Driver</li> </ul>
Test task 2: Can users navigate through a case study and complete exercises?	Y	<ul style="list-style-type: none"> <li>• Reads tutorial</li> <li>• Clicks on tutorial dots thinking they might be links, then realizes their correct purpose as progress bar</li> <li>• Exercises - easily selects, submits &amp; clear answers</li> <li>• Clicks on hint carrot to access hint</li> <li>• Mentions confusion between NEXT ANSWER and NEXT (although uses buttons correctly)</li> </ul>
Test task 3: Can users bookmark a case study exercise?	Y	<ul style="list-style-type: none"> <li>• Clicks bookmark icon</li> </ul>
Test task 4: Can users answer The Case of the Rebel Driver, Exercise 2?	Y	<ul style="list-style-type: none"> <li>• Correctly describes how to use ACL/PCL toggle</li> <li>• Correctly describes how to use viewport control buttons to rotate model</li> <li>• Correctly describes how to draw ligament on model</li> </ul>
Test task 5: Conditional - If users mention that they would interact with the 3D model to answer The Case of the Rebel Driver, Exercise 2, can users manipulate their view of the 3D model?	Y	<ul style="list-style-type: none"> <li>• Clicks on correct viewport buttons to pan, zoom &amp; rotate</li> <li>• Clicks on correct viewport button to reset view</li> <li>• Doesn't think that 3D model view can also be manipulated by mouse movements directly in viewport window</li> <li>• Correctly assumes top right box is orientation box</li> </ul>
Test task 6: Can users complete The Case of the Rebel Driver, Exercise 2?	Y	<ul style="list-style-type: none"> <li>• (forgets?) to click on PCL toggle</li> <li>• Clicks on 2 sequential attachments points</li> </ul>
Test task 7: Can users re-watch the introductory animation at any point during the case study	Y	<ul style="list-style-type: none"> <li>• Clicks on profile picture in patient folder</li> </ul>
Test task 8: If users answer case study exercise 3 correctly, are they able to access Re-Kinnect?	n/a	<ul style="list-style-type: none"> <li>• User was re-directed to rekinnect module</li> </ul>

Test Tasks	Successful (Y/N)	Observations
<b>User 2 (12:00-12:30)</b>		
Test task 9: Can users access the home page after completing a case study?	Y	<ul style="list-style-type: none"> <li>Clicks on home icon</li> </ul>
Test task 10: Can users access a bookmarked case study to review it?	Y	<ul style="list-style-type: none"> <li>Clicks on review icon image on the interface, realizes its not a button</li> <li>Clicks on library icon, completes tutorial</li> <li>Scrolls and clicks on correct review exercise 1</li> </ul>
Test task 11: Can users navigate case study exercises within the Library?	Y	<ul style="list-style-type: none"> <li>Clicks on "library" breadcrumb to go back to library</li> <li>Scrolls and clicks on correct review exercise 3</li> </ul>
Test task 12: Can users redo a case study exercise?	N	<ul style="list-style-type: none"> <li>Clicks to access introduction exercise in library</li> <li>Confuses review mode for redo mode</li> </ul>
Test task 13: Can users access their User Profile?	Y	<ul style="list-style-type: none"> <li></li> </ul>
Test task 14: Can users interpret their Kinundrum progress?	Y	<ul style="list-style-type: none"> <li>Mentions Rookie level and winning 1/18 badges</li> <li>Correctly states all badges</li> </ul>
Test task 15: Can users find a specific case study exercise to review in the Library?	Y	<ul style="list-style-type: none"> <li>Clicks on library icon</li> <li>Clicks case study heading to sort exercises</li> <li>Scrolls and selects correct review exercise 4</li> </ul>

**User comments:**

- mentions that the NEXT and NEXT EXERCISE buttons to be unnecessarily redundant
- finds it difficult to know what is a button and what isn't a button (could be limitation of paper prototype)
- suggests that *new* notes to the patient folder should be highlighted (visually salient) to distinguish from old notes
- user would use the app primarily at the beginning while learning the lecture material, and then use before exams as a supplementary review tool
- user found app fun and engaging (she loves arts and crafts!)

**Notes on user 3 session:**

- only user to understand how to redo a case study!
- however, also only user to not realize 3D model view can be changed

Test Tasks	Successful (Y/N)	Observations
<b>User 3 (12:30-1:00)</b>		
Test task 1: Can users access a case study from Home page?	Y	<ul style="list-style-type: none"> <li>Clicks on "Case Studies" on top of home page</li> <li>Clicks on rebel driver profile icon</li> </ul>
Test task 2: Can users navigate through a case study and complete exercises?	Y	<ul style="list-style-type: none"> <li>Reads tutorial</li> <li>Exercises - easily selects, submits &amp; clear answers</li> <li>Clicks on hint carrot to access hint</li> </ul>

Test Tasks	Successful (Y/N)	Observations
<b>User 3 (12:30-1:00)</b>		
Test task 3: Can users bookmark a case study exercise?	Y	<ul style="list-style-type: none"> <li>Clicks bookmark icon</li> </ul>
Test task 4: Can users answer The Case of the Rebel Driver, Exercise 2?	N	<ul style="list-style-type: none"> <li>Correctly describes how to use ACL/PCL toggle</li> <li>Describes clicking and dragging from origin to insertion point</li> <li>User doesn't mention changing the 3D model view -later attributes to limitations of paper prototype</li> </ul>
Test task 5: Conditional - If users mention that they would interact with the 3D model to answer The Case of the Rebel Driver, Exercise 2, can users manipulate their view of the 3D model?	n/a	
Test task 6: Can users complete The Case of the Rebel Driver, Exercise 2?	Y	<ul style="list-style-type: none"> <li>(forgets?) to click on PCL toggle</li> <li>Clicks on 2 sequential attachments points</li> </ul>
Test task 7: Can users re-watch the introductory animation at any point during the case study	Y	<ul style="list-style-type: none"> <li>Clicks on profile picture in patient folder</li> </ul>
Test task 8: If users answer case study exercise 3 correctly, are they able to access Re-Kinnect?	Y	<ul style="list-style-type: none"> <li>Clicks on rekinnect icon</li> <li>Drags on slider handle</li> </ul>
Test task 9: Can users access the home page after completing a case study?	Y	<ul style="list-style-type: none"> <li>Clicks on home icon</li> </ul>
Test task 10: Can users access a bookmarked case study to review it?	Y	<ul style="list-style-type: none"> <li>Clicks on library icon, completes tutorial</li> <li>Clicks to filter case studies by "bookmark"</li> <li>Correctly clicks on review exercise 1</li> </ul>
Test task 11: Can users navigate case study exercises within the Library?	Y	<ul style="list-style-type: none"> <li>Clicks NEXT twice to access review exercise 3</li> </ul>
Test task 12: Can users redo a case study exercise?	Y	<ul style="list-style-type: none"> <li>Clicks on home icon</li> <li>Clicks on rebel driver - REDO</li> </ul>
Test task 13: Can users access their User Profile?	Y	<ul style="list-style-type: none"> <li>Clicks on user profile icon</li> </ul>
Test task 14: Can users interpret their Kinundrum progress?	Y	<ul style="list-style-type: none"> <li>Mentions Rookie level and winning 1/18 badges</li> <li>Correctly states all badges</li> </ul>
Test task 15: Can users find a specific case study exercise to review in the Library?	Y	<ul style="list-style-type: none"> <li>Clicks on library icon</li> <li>Scrolls and selects correct review exercise 4</li> </ul>

**User comments:**

- finds global navigation menu to be more appropriate for touch screen, but not bothered by it

- didn't make connection between ACL/PCL acronyms and the actual terms
- finds library icon visually confusing
- suggests 3D viewport control icons be slightly bigger, so it's more salient
- didn't know whether 3D model could be freely rotated with mouse click/drag or only via viewport controls
- user would use the app primarily at the beginning while learning the lecture material and not as a review because they like to review using their own notes
- user found app fun and engaging!

## Usability Test: Round 3 – April 6<sup>th</sup>, 2018

### Notes on user 1 session:

- User went through task really quickly and easily
- Successfully completed all tasks
- Occasionally clicked on interface elements that are not elements

Test Tasks	Successful (Y/N)	Observations
<b>User 1 (1:00-1:30)</b>		
Test task 1: Can users access a case study from Home page?	Y	<ul style="list-style-type: none"> <li>• Scrolls down to case studies section</li> <li>• Clicks on Rebel Driver profile icon</li> </ul>
Test task 2: Can users navigate through a case study and complete exercises?	Y	<ul style="list-style-type: none"> <li>• Reads tutorial</li> <li>• Intro - Clicks on START multiple times before realizing he needs to click on video player to watch animation</li> <li>• Exercises - easily selects &amp; submits answers</li> </ul>
Test task 3: Can users bookmark a case study exercise?	Y	<ul style="list-style-type: none"> <li>• Clicks bookmark icon</li> </ul>
Test task 4: Can users answer The Case of the Rebel Driver, Exercise 2?	Y	<ul style="list-style-type: none"> <li>• User understands to click toggle to select ligament</li> <li>• User describes rotating model by clicking and dragging with the mouse</li> <li>• User understands how to answer question by selecting attachment points</li> </ul>
Test task 5: Conditional - If users mention that they would interact with the 3D model to answer The Case of the Rebel Driver, Exercise 2, can users manipulate their view of the 3D model?	Y	<ul style="list-style-type: none"> <li>• Clicks and drags in viewport to rotate model</li> <li>• User describes using viewport buttons to change view</li> </ul>
Test task 6: Can users complete The Case of the Rebel Driver, Exercise 2?	Y	<ul style="list-style-type: none"> <li>• Clicks on PCL toggle</li> <li>• Clicks on 2 sequential attachments points</li> </ul>
Test task 7: Can users re-watch the introductory animation at any point during the case study	Y	<ul style="list-style-type: none"> <li>• Clicks on exercise 1 link in progress bar, realizes error</li> <li>• Clicks on introduction link n progress bar</li> <li>• Clicks on video player</li> </ul>

Test Tasks	Successful (Y/N)	Observations
<b>User 1 (1:00-1:30)</b>		
Test task 8: If users answer case study exercise 3 correctly, are they able to access Re-Kinnect?	Y	<ul style="list-style-type: none"> <li>Clicks on rekinnect Icon</li> <li>Users mentions he was distracted by LET'S WRAP IT UP button, wouldn't have necessarily clicks on rekinnect without the prompt</li> </ul>
Test task 9: Can users access the home page after completing a case study?	Y	
Test task 10: Can users access a bookmarked case study to review it?	Y	<ul style="list-style-type: none"> <li>Clicks on all the little icons in the introduction area, including review icon image</li> <li>Clicks on library icon in global navigation menu</li> <li>Reads tutorial</li> <li>Clicks on "bookmark" to filter for exercise 1</li> <li>Clicks to access exercise 1</li> </ul>
Test task 11: Can users navigate case study exercises within the Library?	Y	<ul style="list-style-type: none"> <li>Clicks to go back to the library</li> <li>Selects "The Case of the Rebel Driver" filter</li> <li>Scrolls to Exercise 3</li> </ul>
Test task 12: Can users redo a case study exercise?	Y	<ul style="list-style-type: none"> <li>Clicks on home icon</li> <li>Clicks on REDO button under The Case of the Rebel Driver profile</li> </ul>
Test task 13: Can users access their User Profile?	Y	<ul style="list-style-type: none"> <li>Clicks on user profile icon</li> </ul>
Test task 14: Can users interpret their Kinundrum progress?	Y	<ul style="list-style-type: none"> <li>Correctly states Rookie level and number of badges</li> <li>Correctly states other badges</li> </ul>
Test task 15: Can users find a specific case study exercise to review in the Library?	Y	<ul style="list-style-type: none"> <li>Clicks on library icon</li> <li>Clicks on The Case of the Tennis mom filter to the exercises</li> <li>Scrolls and selects Exercise 4</li> </ul>

**User comments:**

- User found app intuitive to use
- User suggests that rekinnect icon should shake or wiggle to be more visually salient and draw users' attention
- User thinks that students would use this to learn and review material

**Notes on user 2 session:**

- User went through task really quickly and easily
- Successfully completed all tasks
- Occasionally clicked on interface elements that are not elements

Test Tasks	Successful (Y/N)	Observations
<b>User 2 (4:00-4:30)</b>		
Test task 1: Can users access a case study from Home page?	Y	<ul style="list-style-type: none"> <li>Scrolls down to case studies section</li> <li>Clicks on Rebel Driver profile icon</li> </ul>

Test Tasks	Successful (Y/N)	Observations
<b>User 2 (4:00-4:30)</b>		
Test task 2: Can users navigate through a case study and complete exercises?	Y	<ul style="list-style-type: none"> <li>• Reads tutorial</li> <li>• Intro - Clicks on START multiple times before realizing she needs to click on video player to watch animation</li> <li>• Exercises - easily selects &amp; submits answers</li> </ul>
Test task 3: Can users bookmark a case study exercise?	Y	<ul style="list-style-type: none"> <li>• Clicks bookmark icon</li> </ul>
Test task 4: Can users answer The Case of the Rebel Driver, Exercise 2?	Y	<ul style="list-style-type: none"> <li>• User understands to click toggle to select ligament</li> <li>• User describes rotating model by clicking and dragging with the mouse</li> <li>• User understands how to answer question by selecting attachment points</li> </ul>
Test task 5: Conditional - If users mention that they would interact with the 3D model to answer The Case of the Rebel Driver, Exercise 2, can users manipulate their view of the 3D model?	Y	<ul style="list-style-type: none"> <li>• Clicks and drags in viewport to rotate model</li> <li>• User describes using viewport buttons to pan/rotate/zoom</li> </ul>
Test task 6: Can users complete The Case of the Rebel Driver, Exercise 2?	Y	<ul style="list-style-type: none"> <li>• Clicks on PCL toggle</li> <li>• Clicks on 2 sequential attachments points</li> </ul>
Test task 7: Can users re-watch the introductory animation at any point during the case study	Y	<ul style="list-style-type: none"> <li>• Clicks on exercise 1 link in progress bar, realizes error</li> <li>• Clicks on introduction link in progress bar</li> <li>• Clicks on video player</li> </ul>
Test task 8: If users answer case study exercise 3 correctly, are they able to access Re-Kinnect?	Y	<ul style="list-style-type: none"> <li>• Clicks on rekinnect Icon</li> </ul>
Test task 9: Can users access the home page after completing a case study?	Y	<ul style="list-style-type: none"> <li>• User clicks on homepage from sidebar but the natural progress of the case study was broken</li> </ul>
Test task 10: Can users access a bookmarked case study to review it?	Y	<ul style="list-style-type: none"> <li>• Clicks on library icon in global navigation menu</li> <li>• Reads tutorial</li> <li>• Clicks to access introduction then went to exercise 1</li> </ul>
Test task 11: Can users navigate case study exercises within the Library?	Y	<ul style="list-style-type: none"> <li>• Selects "3" in progress bar.</li> </ul>
Test task 12: Can users redo a case study exercise?	N	<ul style="list-style-type: none"> <li>• Clicks "&lt; Back" until reached start of case study.</li> </ul>
Test task 13: Can users access their User Profile?	Y	<ul style="list-style-type: none"> <li>• Clicks on user profile icon</li> </ul>
Test task 14: Can users interpret their Kinundrum progress?	Y	<ul style="list-style-type: none"> <li>• Correctly states Rookie level and number of badges</li> <li>• Correctly states other badges</li> </ul>

Test Tasks	Successful (Y/N)	Observations
<b>User 2 (4:00-4:30)</b>		
Test task 15: Can users find a specific case study exercise to review in the Library?	Y	<ul style="list-style-type: none"><li>• Clicks on “redo”, gets pop-up then exits.</li><li>• Tries to click on side badge buttons of Bernie</li><li>• Clicks on Profile picture then Review, then library (scrolls to exercise 4)</li></ul>

**User comments:**

- User found app very fun
- would use throughout term and even after course