Developing and Implementing an iBook of the Student and Instructor *Clinical Perfusion Education Guidelines Manual*

by

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Abstract

The Milwaukee School of Engineering's (MSOE) Master of Science in Perfusion (MSP) Program currently distributes paper *Clinical Perfusion Education Guideline Manuals (CPEG Manual)* to both students and instructors. The *CPEG Student Manual* provides the student with the information necessary to fulfill the clinical component of the MSP Program. The *CPEG Instructor Manual* provides the instructor with guidelines for clinical instruction and student assessment to best assist the students in fulfilling the clinical component of the MSP Program. This method of providing the *CPEG Manuals* has been generally successful for students and instructors, but there are certain challenges associated, including a lack of portability, accessibility, and convenience. A student survey revealed that 46% of current students rarely or never bring their *CPEG* Manual with them to cases. This thesis project describes the development of an electronic version of both the *CPEG Student Manual* and *CPEG Instructor Manual* that is easily accessible on a variety of mobile device platforms.

Various methods were analyzed for developing the *CPEG Manuals* into an electronic format. Initially, the goal of the project was to create a mobile application containing the *CPEG Manual* content. This method was abandoned for reasons including cost, required skillset, lack of versatility, and timeframe. It was decided to develop the *CPEG Manuals* in the format of interactive electronic books, known as iBooks, to maximize the benefits that iBooks provided.

The iBook format was selected for its ease in accessibility across a variety of different mobile platforms. The iBook format allows for interactive components and provides the ability to edit and modify content as needed by the MSP Program. This will help increase student and instructor engagement and use of the *CPEG Manuals,* thereby helping students fulfill the clinical component of the MSP Program.

Acknowledgments

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1. Introduction

Advancements in mobile technology have significantly influenced education and how students gather information. Technology has also considerably influenced how students allocate their time and attention. As of 2017, students average over 185 minutes per day accessing content on their smart phones [1]. Accessing content via mobile devices and tablets continues to gain popularity among students and educators for performing academic tasks in a more flexible, comfortable, and portable fashion.

Numerous universities worldwide have implemented mobile learning for an "anytime, anywhere" education approach. A 2012 survey by the Educause Center for Applied Research found that 67% of surveyed students considered mobile technology to be very essential to their academic activities and achievements. The survey also found that students are currently leading the implementation of mobile technological devices into their classrooms [2].

The Milwaukee School of Engineering (MSOE) Master of Science in Perfusion (MSP) Program currently uses printed-paper manuals for the *Clinical Perfusion Education Guidelines Manual* that each student receives. The *Clinical Perfusion Education Guidelines Manual* provides the student with the information necessary to fulfill the clinical component of the MSP Program. These manuals consist of a total of 72 pages when printed, making it a challenge to manually work with them. The clinical instructors have a similar manual, the *Clinical Perfusion Education Guidelines Instructor Manual,* containing 80 pages of material including guidelines for clinical instruction and assessment.

The goal of this project was to replace the paper manuals with a digital book, specifically an iBook, which can be easily accessible by mobile phone or tablet by both students and instructors. The iBook will ideally be accessible across different platforms and devices for a universal application. Additionally, the iBook will allow for students to more easily and interactively track their progress in each clinical level to ensure that they are successfully meeting all clinical objectives. It will also provide instructors with more accessible material to guide conversation and instruction throughout cases with students.

2. Background

2.1 Technological Advancements in Higher Education

Over the past several years, dramatic advancements have been made in mobile and wireless communication technology. Smart phones and tablets with 3G, 4G, and Wi-Fi services are more affordable and accessible than ever before. These fast-growing technologies have created new opportunities in countless fields, including higher education. Educational institutions are embracing mobile and wireless communication technologies to remain competitive, enhance learning, and enrich the academic experience [3].

Advancements in mobile technology have been changing how students gather information and allocate their time and attention. Mobile applications are largely responsible for this, with millennial students averaging over 185 minutes per day accessing content on their smart phones [1]. A 2014 survey targeting 1,181 University of Central Florida students looked at the benefits of implementing mobile applications and devices for academic purposes. The survey found that 72% of students agree or strongly agree that using mobile devices makes it easier to access coursework and 77% of students reported using their smart phone for learning [2].

2.2 Electronic Texts and iBooks

A digital book is a general category that includes electronic books, interactive electronic books (iBook), and other forms of digital texts [4]. An electronic book can be defined as a digital version of printed text. Electronic books are not typically interactive and do not go beyond being replicas of their printed counterpart [5]. These are

commonly delivered in PDF format and have the longest history. In 1971, Michael Stern Hart introduced the Project Gutenberg to encourage the establishment of electronic books [6]. During this time, the first electronic document, *The Declaration of Independence,* was created [7]. This milestone marks the beginning of digital books.

An interactive electronic book (iBook) has the potential to go beyond the original content of its printed text. iBooks can include a variety of widgets providing an interactive user experience [5]. Examples of iBook widgets include image galleries, media, review quizzes, Keynotes, interactive images, scrolling sidebars, popovers, and HTML. One of the first interactive electronic books, *Our Choice,* was introduced by Mike Matas in his 2011 TED talk [8]. *Our Choice* utilized numerous innovative, interactive, and creative features and was promoted as a "next-generation digital book" [9].

Bozkurt and Bozkaya's definition of an iBook explained that "interactive e-books are essentially digital book formats in which the user, the digital book, and the environment can interact reciprocally at a high level; digital book elements can communicate and interact among themselves and environment as well as users, and many communication channels are put in use at one and the same time." [9] Because of iBook's features, the distinction between mobile applications and iBooks can be unclear. Table 1 lists the four types of interactions involved with an iBook experience [9].

Table 1. The Four Types of iBook Interactions [9].

1. Interaction between environments 2. Interaction user and iBook 3. Interaction among iBook elements 4. Interaction with other users/online

2.3 Benefits and Challenges of the iBook

There are both benefits and challenges associated with using an iBook over a printed book. While some students prefer reading content from printed text because of the strain on the eyes that digital screens can provide, the benefits of an iBook can overcome this challenge.

For the iBook reader, benefits are plentiful. The portability of iBooks allows the reader to carry an entire library on one device for anytime, anywhere access. Another major benefit is that iBooks are searchable and allow for the reader to quickly and easily find what they need. In addition, customizing and annotating readings via highlighting, underlining, note taking, and so on, are supported without harming the original work [9]. The most important benefit of an iBook specifically is the incorporation of interactive elements. A 2015 survey questioning 135 post-graduate students at a state university in Turkey looked at post-graduate student preferences for digital books [4]. Table 2 lists the features that influence the students' preferences for digital books.

Table 2. Features that Influence Post-Graduate Students' Preferences for Digital Books [4].

1. Anytime, anywhere access
2. Portability/Mobility
3. Full-text searching ability
4. Easy to store
5. Affordable or free
6. Ability to create virtual library
7. Environmental benefits
8. Ability to use multiple documents at once
9. Durability
10. Ability to highlight and underline
11. Ability to copy and paste
12. Easy to share
13. Ability to print and convert
14. Ability to zoom and scale
15. Ability to store large amounts of material
16. Multimedia support (Video, sound, high quality image, etc.)
17. Easy to browse
18. Customizability (font, background color, etc.)
19. Ability to annotate
20. Easy to use
21. Easy to cite
22. Accessibility (text to sound etc.)
23. Easy to read
24. Ability to bookmark
25. Content/information is up-to-date
26. Easy to organize
27. Ease of navigation

There are also significant benefits specifically for authors, publishers, libraries, and academic institutions. For publishers and authors, iBooks are easy to publish, permit self-publishing, and can be delivered to readers almost immediately. Creating an iBook takes up very little space and costs much less than a paper book [9]. In terms of libraries and academic institutions, iBooks save space and require less maintenance than paper books. They also allow for unlimited circulation and countless users can access the same book at the same time. Lastly, iBooks are much more environmentally friendly than

paper books [9].

While there are many benefits to iBooks, the associated challenges must be discussed. Some readers simply prefer the tactile experience of a paper book. In addition to this, digital screens can fatigue the eyes and be difficult to read for long periods of time. Other potential challenges include piracy, hacking, and potential compatibility issues amongst different devices [4, 9].

2.4 The Clinical Perfusion Education Guidelines Manual

The *Clinical Perfusion Education Guidelines Manual (CPEG)* is currently a printed manual that provides the student with the necessary information to fulfill the clinical component of the MSP program at MSOE. The *CPEG Manual* is 72 pages and bound with an additional 22 pages of the Student Handbook. The contents of the manual are listed in Table 3. The clinical instructors have a similar manual containing the standards and guidelines for clinical instruction and assessment. The *CPEG Instructor Manual* is 80 pages. The contents of the instructor manual are listed in Table 4.

Table 3. The *CPEG Student Manual* Table of Contents.

Table 4. The *CPEG Instructor Manual* Table of Contents.

Students progress through their clinical rotations and clinical levels after mastering all objectives and passing the level's clinical competency exam. The students keep track of their progress through the level objectives by recording their clinical objectives/focus topics for each clinical case on a Clinical Case Log Form. The *CPEG Manual* serves as guidance for determining the clinical objectives/focus topics that the student should focus on in their current level. During a case, the clinical instructor may ask to review the student's clinical objectives/focus topics to guide conversation, instruction, and assess the student's understanding.

In addition to providing the necessary clinical objectives needed to graduate the program, the *CPEG Manual* supplies useful information that should be accessible at any time. This includes contact information, information regarding scheduling and procedures, and locker numbers/combinations for clinical rotation sites.

3. Project Statement

While the distributed paper *Clinical Education Guidelines Student Manual* and *Clinical Education Guidelines Instructor Manual* are generally effective at delivering the necessary material, they are bulky, lack portability and mobility, and are easily forgotten. The paper manuals also suffer from a lack of durability to withstand damages and contamination, which is extremely important in a hospital and operating room setting. Because of these weaknesses, the goal of this project was to replace the paper manuals with a digital book, an iBook, which can be easily accessible by mobile phone or tablet by both students and instructors. The iBook will ideally be accessible across different platforms and devices for a universal application. Additionally, the iBook will allow for students to more easily and interactively track their progress in each clinical level to ensure that they are successfully meeting all clinical objectives. It will also provide instructors with more accessible material to guide conversation, instruction, and assess progress throughout cases with students.

4. Methods

As previously stated, the goal of this project was to replace the paper manuals with a digital book, which can be easily accessible by mobile phone or tablet by both students and instructors. The intent was to provide a more easily accessible, portable, durable, and interactive format of both the student and instructor manuals.

Table 5 lists the phases of the project development. In Phase 1, the *CPEG Manual* content was reviewed with the clinical program director to ensure that content was accurate and up-to-date prior to project development. Any new ideas, additions, and changes were discussed with the clinical program director.

Table 5. Project Development Process.

Phase 1: Review/Update Student and Instructor *CPEG Manuals* with Clinical Program Director
Phase 2: Identify Viable Platforms
Phase 3: Survey Current Students
Phase 4: Platform Development
Phase 5: Beta Testing
Phase 6: Final Platform Implementation

Because a non-professional developer undertook the project development, viable developmental platforms had to be determined in Phase 2. First, possible options were researched and explored. This included deciding between creating a mobile application and a digital book. In order to determine the best method to accomplish this, three different processes were evaluated. These processes included developing a mobile

application with Apple's Xcode, a mobile application with the Ionic Framework, and an iBook using Apple's iBooks Author. All three processes required different tools and knowledge bases.

First, the Ionic Framework was evaluated. The Ionic Framework requires prerequisites in programing languages that include Javascipt, CSS, and HTML. Because of timeframe, tools available, and experience, the Ionic Framework was not a viable option.

Because the developer was working with an Apple Macbook Pro, Xcode was determined to be the next best alternative for mobile application development. Xcode is an integrated development environment for macOS encompassing a collection of software development tools. Xcode requires knowledge of the programming language Swift [10]. While this was a viable option for creating a mobile application, there were distinct disadvantages. The developer did not have the timeframe, budget, or tools to create this into a successful cross-platform mobile application. Because of this, the mobile application would have only been available for iOS users (e.g., iPhone, iPad).

Developing an iBook proved to be superior to the two other platforms. Creating an iBook using the ePub template in iBooks Author allows for the iBook to be accessed across mobile platforms including iOS, Android, and any other ePub readers [11]. There are several additional advantages of developing the *CPEG Manual* in the form of an iBook versus a mobile application. iBooks are designed to handle the large amount of text the *CPEG Manual* requires, while mobile applications are not. The iBook was determined to allow for easier access by program directors for modifications and updates.

The iBook was also found to be more interactive, visually appealing, user-friendly, and capable of allowing annotation by the user.

Current first-year and second-year students were surveyed in Phase 3 to determine how well the *CPEG Manual* iBook would be received. Institutional Review Board (IRB) approval was not required for the survey because it is an example of program improvement. The survey was created using Google Forms and was sent out via email to the 13 students. Table 6 includes the survey questions and responses, and the full survey and responses can be found in Appendix A.

Table 6. Survey Questions and Responses.

Question	Responses				
I bring my manual to every case.	Always	Sometimes	Rarely	Never	
	6	1	5	1	
How often do you look at your manual?	Before/during every case	As needed	Rarely	Never	
	1	9	3	0	
Do you use your manual to fill out your objectives on your case log form?	Yes	No	Sometimes		
	4	4	5		
I would look at my manual more if it was accessible on my mobile device.	Strongly agree	Agree	Maybe	Disagree	Strongly disagree
	5	4	4	0	0
I would find it easier to keep track of my clinical objectives if my manual were on my mobile device.	Strongly agree	Agree	Maybe	Disagree	Strongly disagree
	7	3	3	0	0
Which statement do you agree with regarding format of the manual?	I would prefer my manual as an iBook				2
	I would prefer both a paper copy and an iBook				11
	I would prefer a paper copy only				0
What kind of mobile phone do you have?	iPhone	Samsung	Android	Google	
	8	2	2	1	
I believe that an iBook would be useful for my learning and progress in the program.	Strongly agree	Agree	Maybe	Disagree	Strongly disagree
	3	7	3	0	0
I would routinely access clinical manual content using an iBook on my mobile device.	Strongly agree	Agree	Maybe	Disagree	Strongly disagree
	5	3	4	1	0

After receiving and analyzing the survey results and student suggestions from all 13 students, it was determined that an iBook would be helpful and desirable for students. Students provided additional comments and suggestions; these are listed in Table 7. The suggestions were considered, discussed with the program director, and implemented as seen appropriate.

Table 7. Survey Comments and Suggestions.

Suggestions/Comments	Number of Responses
In addition to the clinical manual, I would like surgeon protocol added to the iBook.	13/13
In addition to the clinical manual, I would like del Nido protocol added to the iBook.	11/13
In addition to the clinical manual, I would like instructor contact information added to the iBook.	9/13
In addition to the clinical manual, I would like specific surgeon preferences added to the iBook.	1/13
In addition to the clinical manual, I would like the priming sheet added to the iBook.	1/13
In addition to the clinical manual, I would like femoral cannula options added to the iBook.	1/13
It would be helpful if an iBook version allowed me to jump to the section I needed rather than searching through the manual.	1/13
Having information readily available on a mobile device would be a convenient way to access a lot of useful information quickly.	1/13
I've also taken pictures of the del Nido and surgeon protocol and stored them on my phone.	1/13

During Phase 4, the iBook was decided on and developed using Apple's iBooks Author application. While different templates and formats are available, the ePub template was chosen to build the iBook. The ePub template is the only template on iBooks Author that allows for access on non-Apple devices. It was chosen for this reason, with the disadvantage being that the ePub template does not have as many features

available. An iBook was created for both the *CPEG Student Manual* and the *CPEG Instructor Manual.* Helpful and interactive widgets were added to the iBook, in addition to requested supplementary content based on student survey results. These additions were discussed and approved of by the clinical program director.

Beta testing was done in Phase 5. Testing included providing the developed iBook to a limited group of students for the *CPEG Student Manual* and instructors for the *CPEG Instructor Manual.* The users were sent the iBooks via email and downloaded the iBooks onto their mobile devices for testing. The users assessed the iBooks for functionality, design, and usefulness and then provided feedback. After feedback was received, features and design were adjusted and improved.

After final adjustments were made, the project entered Phase 6, Final Platform Implementation. Current students and instructors were offered the finalized iBook and onsite support and assistance was made available by the developer. The clinical program director was trained in how to access, update, and make changes to the iBook content as needed. Written instructions were also made available. This will allow for longevity of both iBooks and adaption to future changes in the program.

5. Results

The completed project consisted of a *CPEG Student Manual* iBook and a *CPEG Instructor Manual* iBook. Both iBooks were published in an ePub format to allow for access on any mobile device with either the iBooks application or another ePub reader. The iBooks were uploaded to the MSOE Perfusion Google Drive account for distribution to students and instructors by direct download or via email. It was decided not to publish the iBooks on the Apple iBooks store to preserve the privacy of the MSP Program.

The *CPEG Student Manual* iBook consists of 12 electronic chapters, shown in Table 8. The interactive checklists, surgeon preferences, del Nido protocol, and instructor contact information were new additions to the manual. These additions were determined to be beneficial by survey feedback and discussions with the clinical program director.

Table 8. The *CPEG Student Manual* iBook Table of Contents.

The interactive checklists allow students to track their progress in each level. The user can open the interactive checklist for their intended level under Chapter 9: Interactive Checklists. The interactive checklist shows completed and uncompleted objectives and the date on which they were completed as shown in Figure 1. The checklists save the user's progress for each individual level.

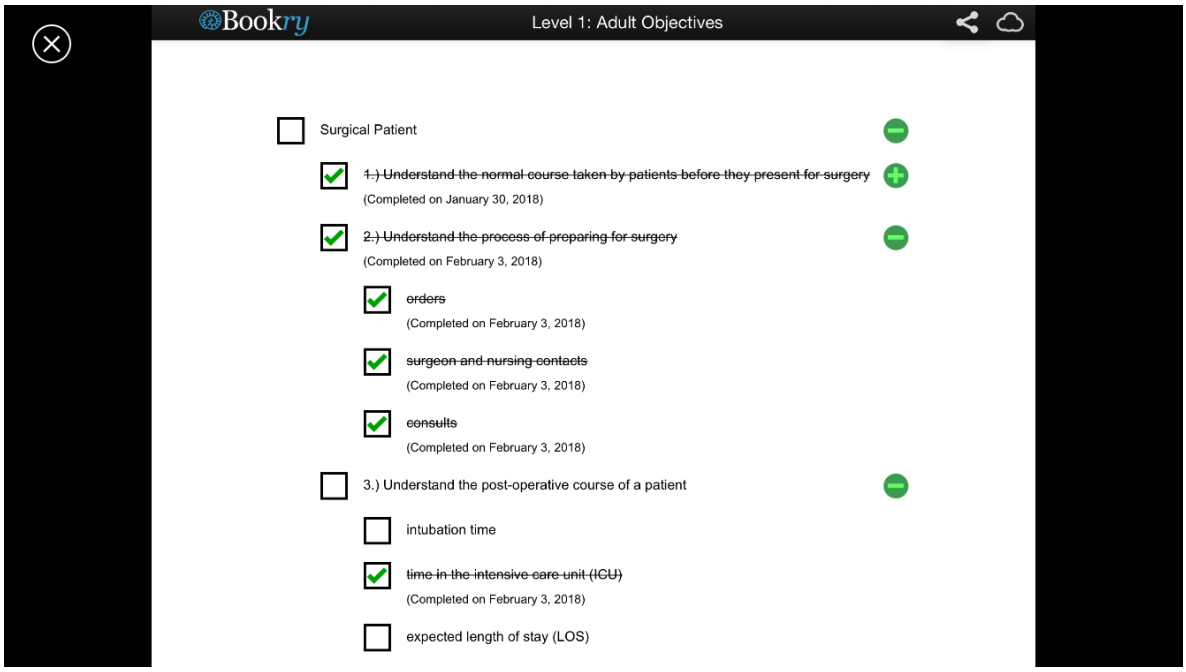

Figure 1. Interactive Checklist Widget. The interactive checklist lets users check off completed objectives while viewing the date that the objective was completed.

The *CPEG Instructor Manual* consists of 11 electronic chapters, shown in Table 9. The only additions to the *CPEG Instructor Manual* were the surgeon preferences, del Nido protocol, and link to the online student evaluation form. The other additions, including the interactive checklist, were determined to be unnecessary.

Table 9. The *CPEG Instructor Manual* iBook Table of Contents.

1. Introduction
2. Standards for Clinical Instruction
3. Guidelines for Clinical Assessment
4. Clinical Grading System
5. Quarterly Clinical Surveys
6. MSP Program Officials
7. Clinical Levels
   - 7.1 Level 1: Adult
   - 7.2 Level 2: Adult
   - 7.3 Level 3: Adult
   - 7.4 Level 4: Adult
   - 7.5 Level 1: Pediatric
   - 7.6 Level 2: Pediatric
8. Clinical Case Log Form
9. Clinical Competency Exams
10. Surgeon Preferences
    - General Information
    - Dr. Barragry
    - Dr. Crouch
    - Dr. Downey
    - Dr. Kress
    - Dr. O'Hair
    - Dr. Weiss
11. Del Nido Protocol
12. Student Evaluation Form

The instructional documents, found in Appendix B and Appendix C, have been created to aid and support the use of the *CPEG Student Manual* and *CPEG Instructor Manual* iBooks in the evolving MSP Program. The purpose of the documents was to provide easy-to-follow instructions pertaining to accessing the iBooks, downloading the iBooks, utilizing the iBooks, and editing the content. These instructions will assist the program director in modifying content as changes occur in the MSP Program.

6. Discussion

In order to address the lack of mobility, durability, and overall lack of convenience of the paper *CPEG Student Manual* and *CPEG Instructor Manual,* the goal of this project was to replace the paper manuals with an iBook that can be easily accessible by mobile phone or tablet by both students and instructors.

A major benefit of an iBook includes anytime, anywhere accessibility across a variety of different mobile platforms. In the student survey, seven of the thirteen students reported "sometimes", "rarely", or "never" bringing their *CPEG Manual* to clinical cases. When those seven students were asked to give a reason for their answer, the reasons included that the manual was too much to carry around and that the students did not like having to carry it with them. Another student reported taking pictures of the manual to keep on his or her mobile device. The iBook manual is an economical and easily accessible solution to this problem.

Additional benefits of the iBook include the ability for students to interactively track their progress in each clinical level to ensure that they are successfully meeting all clinical objectives. The interactive checklist component of the iBook encourages student engagement and involvement. In the student survey, ten of the thirteen students strongly agreed or agreed that they would find it easier to keep track of their clinical objectives if the *CPEG Manual* was accessible on their mobile device.

Currently, students receive the *CPEG Manual,* surgeon preferences, del Nido protocol, and instructor contact information all as separate documents. This can be difficult to keep track of and to bring along to each clinical case. The *CPEG Manual*

iBook combines all of these important documents into one. The student survey results confirmed that these additions to the iBook would be extremely helpful.

There are several other benefits of the iBook that should be mentioned. The iBook is searchable and contains a table of contents that allows the reader to quickly and easily navigate to the information that they are looking for. The iBook also offers annotation features including the ability to highlight, bookmark, and take notes. While these features are specific to accessing the *CPEG Manual* on the Apple iBooks application, it should be noted that different ePub readers might contain different annotative features.

The *CPEG Instructor Manual* was designed to provide instructors with more accessible material to guide conversation and instruction throughout cases with students. It also gives instructors easy access to the clinical objectives to allow for assessment of student progress. The interactive checklists were not included in the *CPEG Instructor Manual;* it was determined that these would not bring much value to the instructors.

6.1 Recommendations

Though the developed iBooks will work for a variety of mobile phone and tablet platforms, the iBooks were developed on an Apple electronic book authoring application and, therefore, are specifically designed to work best on Apple mobile devices, tablets, and computers. It is desired that a continuation of this project be performed in order to enhance the iBook's features on non-Apple devices. In addition to this, a separate project could be performed to create electronic books specifically for popular mobile platforms other than Apple. Informally, instructors also discussed a desire for the electronic student evaluation forms to be more easily accessible on their mobile devices. While this project

included a chapter with a link to the student evaluation forms, a continuation of this project could better incorporate the electronic student evaluation forms into the *CPEG Instructor Manual.* Lastly, the student survey indicated that most students would prefer both a paper and iBook format of the *CPEG Manual*. Because of this, it is recommended that students receive both formats and that the iBook does not completely replace the paper copy.

6.2 Limitations

A possible limitation to this project is that the iBooks were developed on an Apple computer using an Apple application. Currently, only users with an Apple computer and the downloaded iBook Author application can edit and modify content of the iBooks.

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Appendix A: Student Survey for the Analysis of the *CPEG Manual*

This appendix features the student survey regarding usage of the *CPEG Manual* and the student responses. The survey was created using Google Forms.

Survey Questions

MSOE Perfusion - Clinical Perfusion Education Guidelines Manual Survey

Perfusion students, please fill out the survey regarding the Clinical Perfusion Education Guidelines Manual. Any feedback is appreciated. Thank you for your participation!
(For questions referring to an "iBook": An iBook is an interactive electronic book. iBooks are accessible on all mobile devices/tablets with the iBooks app or any other ePub reader app, they are not limited to Apple devices.)

* Required

1. **I bring my manual to every case?** *
   Mark only one oval.
   - ◯ Always
   - ◯ Sometimes
   - ◯ Rarely
   - ◯ Never

2. **If you answered "sometimes", "rarely", or "never" on the previous question, why?**

3. **How often do you look at your manual?** *
   Mark only one oval.
   - ◯ Before/during every case
   - ◯ As needed
   - ◯ Rarely
   - ◯ Never

4. **Do you use your manual to fill out your objectives on your case log form?** *
   Mark only one oval.
   - ◯ Yes
   - ◯ No
   - ◯ Sometimes

5. **I would look at my manual more if it was accessible on my mobile device.** *
Mark only one oval.

- ◯ Strongly Agree
- ◯ Agree
- ◯ Maybe
- ◯ Disagree
- ◯ Strongly Disagree

6. **I would find it easier to keep track of my clinical objectives if my manual was on my mobile device.** *
Mark only one oval.

- ◯ Strongly Agree
- ◯ Agree
- ◯ Maybe
- ◯ Disagree
- ◯ Strongly Disagree

7. **Which statement do you agree with regarding format of the manual?** *
Mark only one oval.

- ◯ I would prefer my manual as an iBook
- ◯ I would prefer both a paper copy and an iBook
- ◯ I would prefer a paper copy only

8. **What kind of phone do you have?** *

_____

9. **I believe that an iBook would be useful for my learning and progress in the program.** *
Mark only one oval.

- ◯ Strongly Agree
- ◯ Agree
- ◯ Maybe
- ◯ Disagree
- ◯ Strongly Disagree

10. **I would routinely access clinical manual content using an iBook on my mobile device.** *
Mark only one oval.

- ◯ Strongly Agree
- ◯ Agree
- ◯ Maybe
- ◯ Disagree
- ◯ Strongly Disagree

11. **In addition to the clinical manual, I would like _____ added to the iBook.** *
Check all that apply.

- ☐ Surgeon Protocol
- ☐ Del Nido Protocol
- ☐ Instructor Contact Information
- ☐ Other: _____

12. **Any additional comments?**

_____

Survey Responses

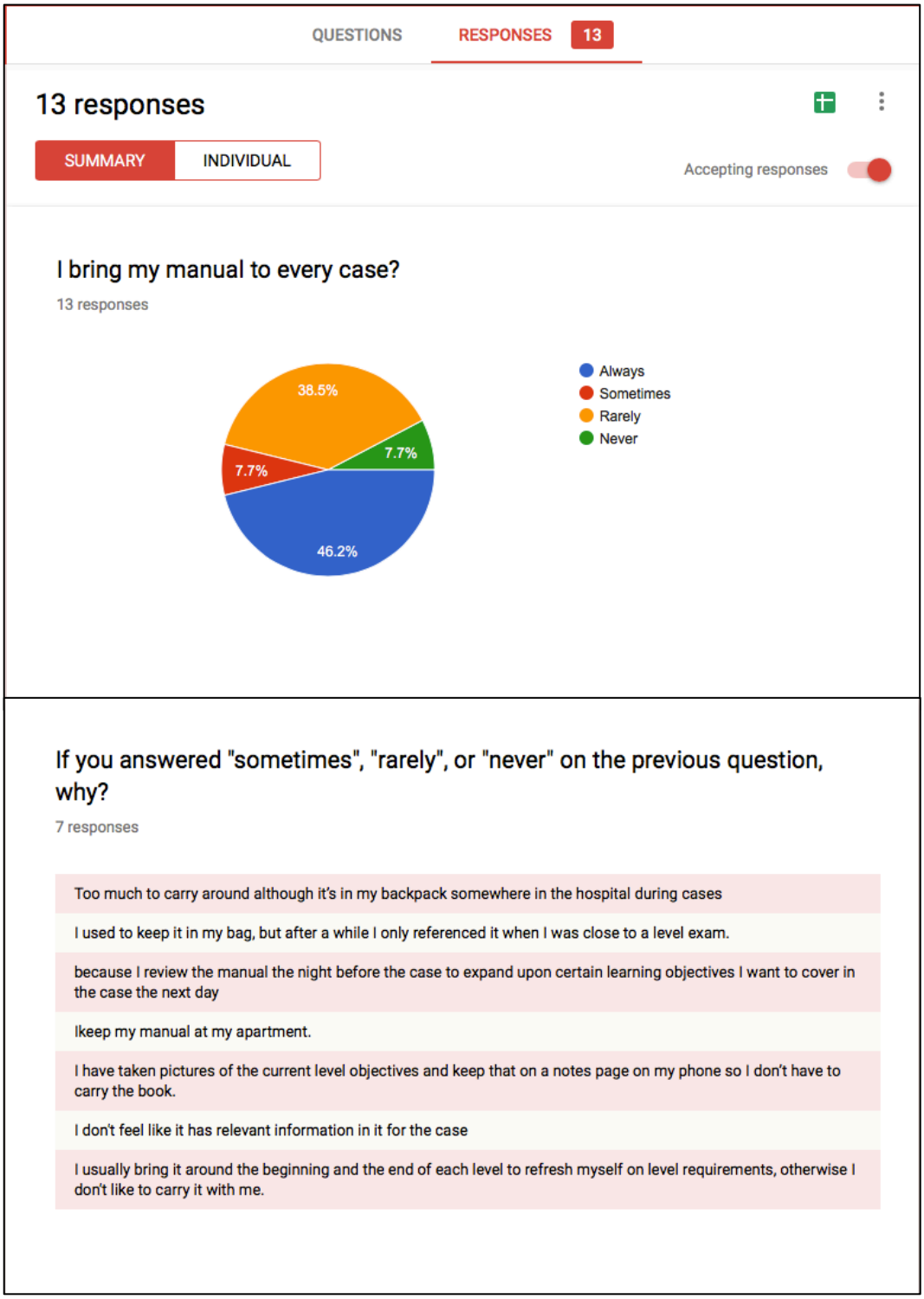


Figure A-1. Survey Question 1 and Question 2.

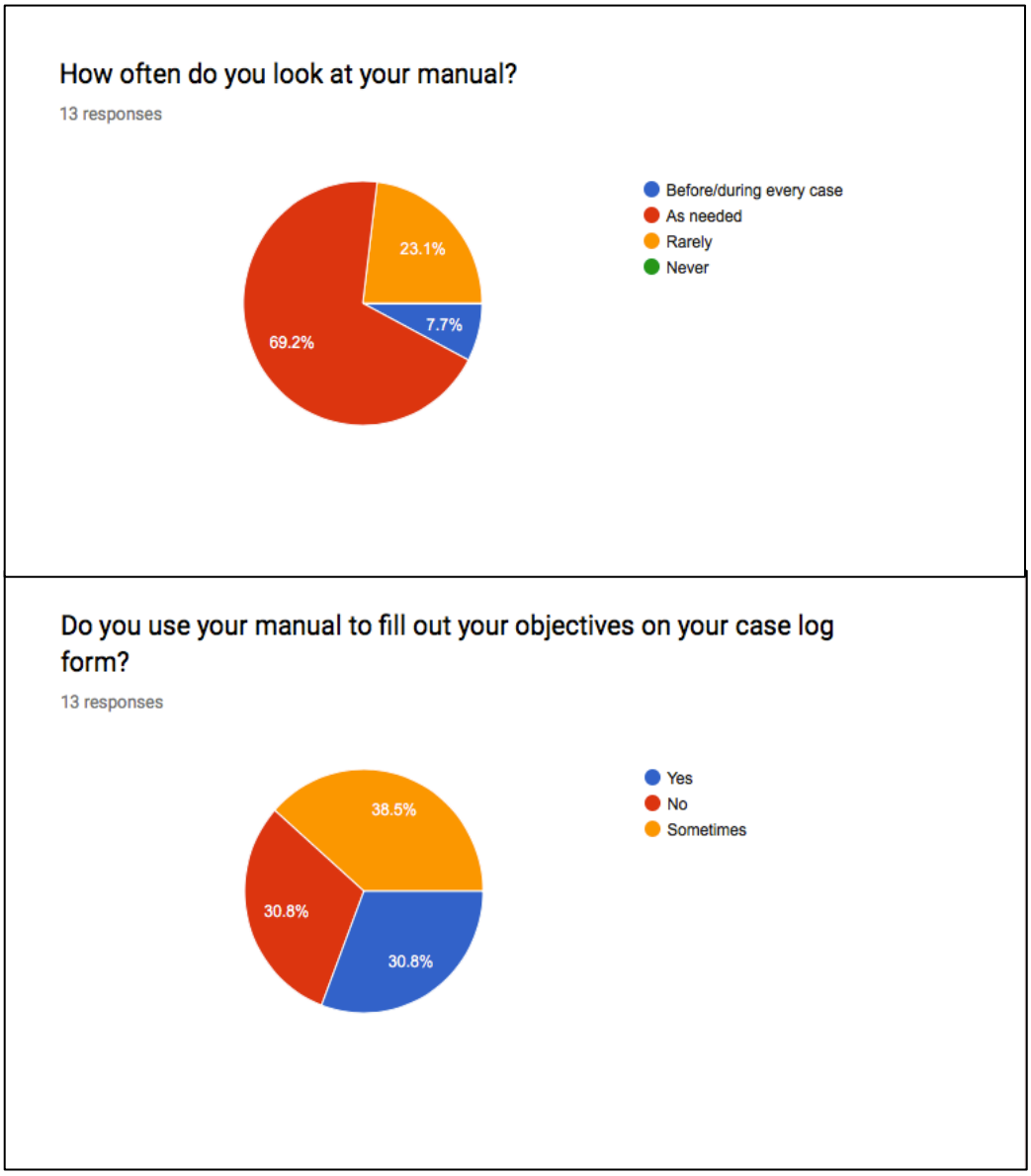


Figure A-2. Survey Question 3 and Question 4.

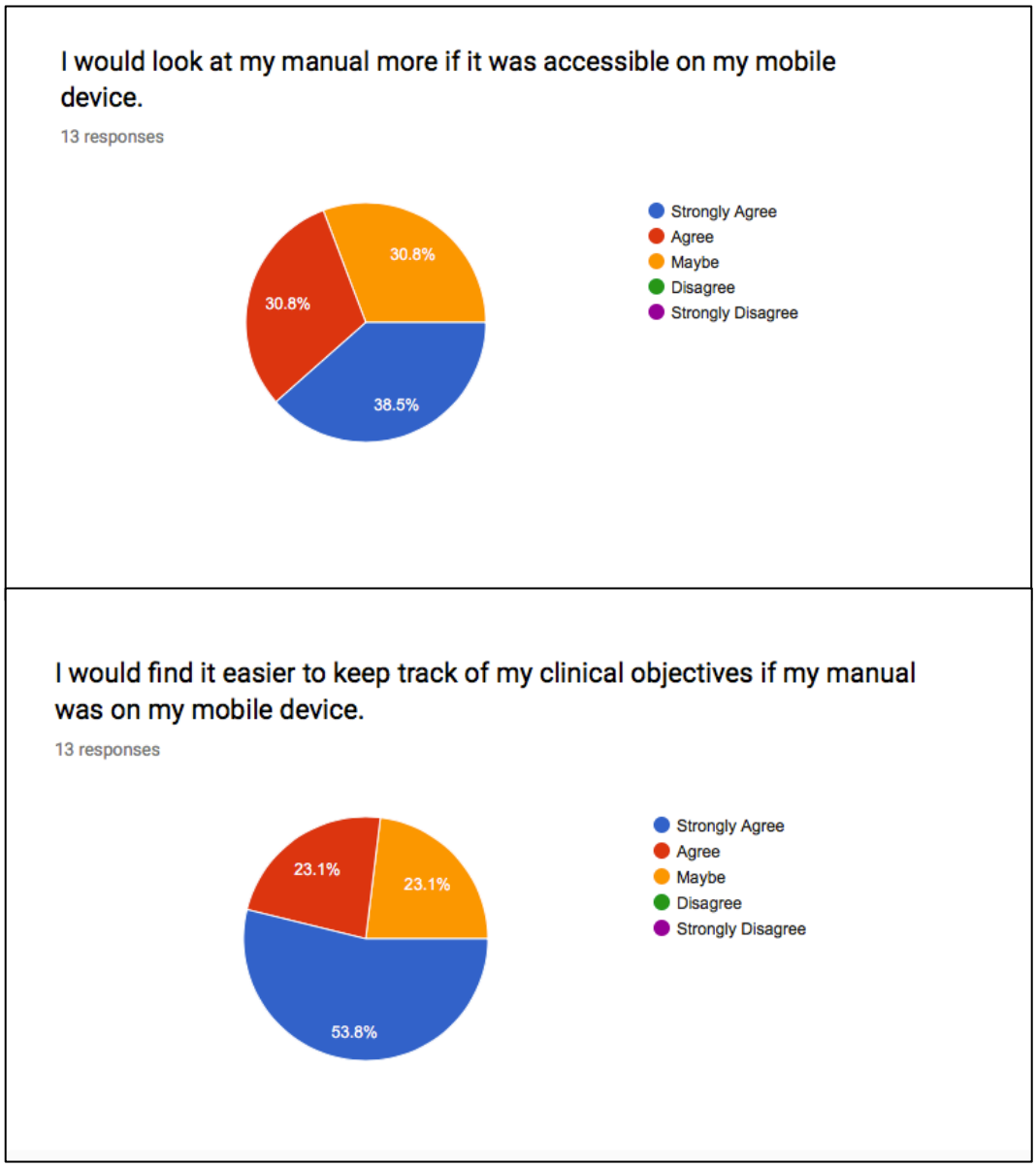


Figure A-3. Survey Question 5 and Question 6.

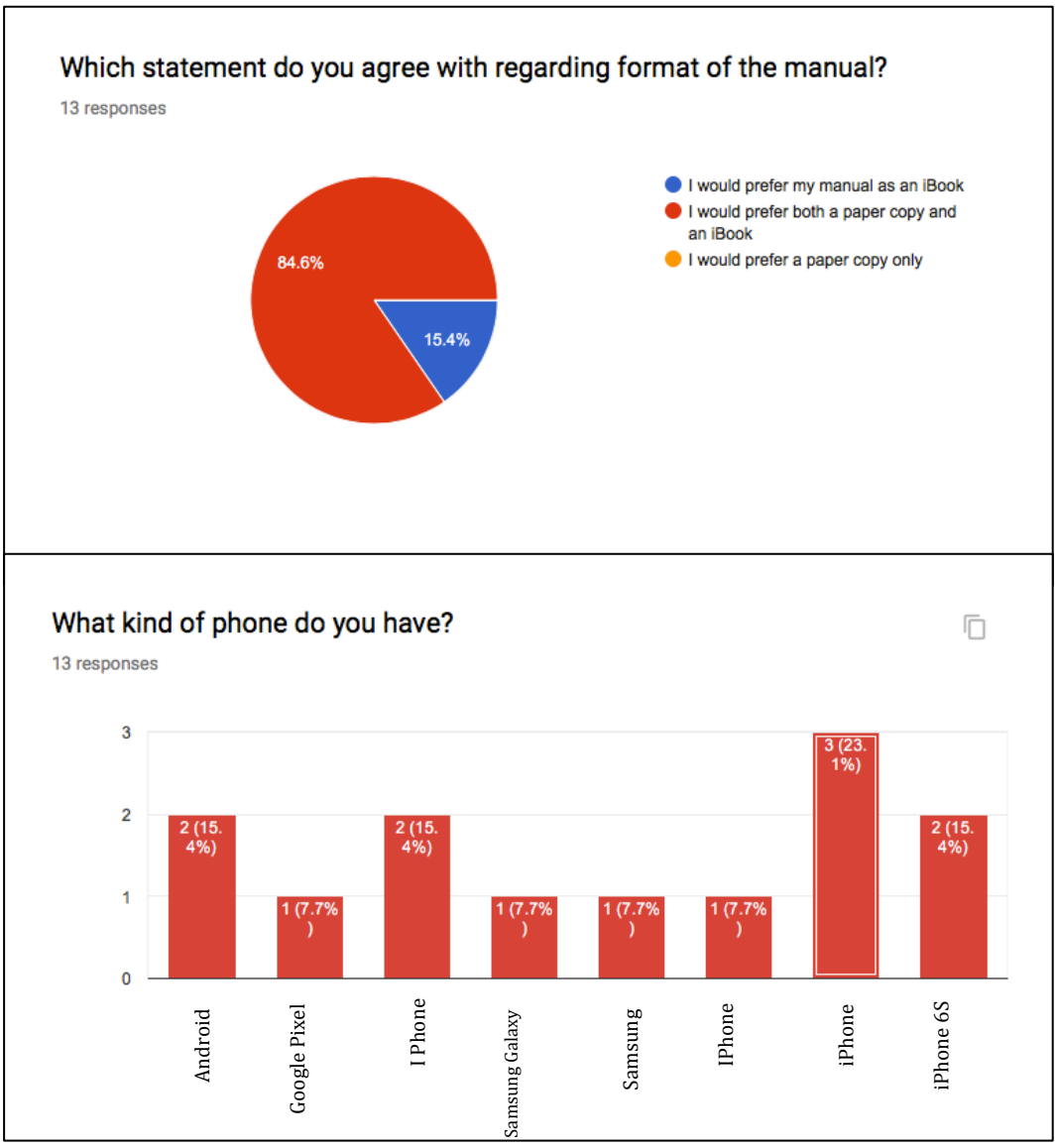


Figure A-4. Survey Question 7 and Question 8.

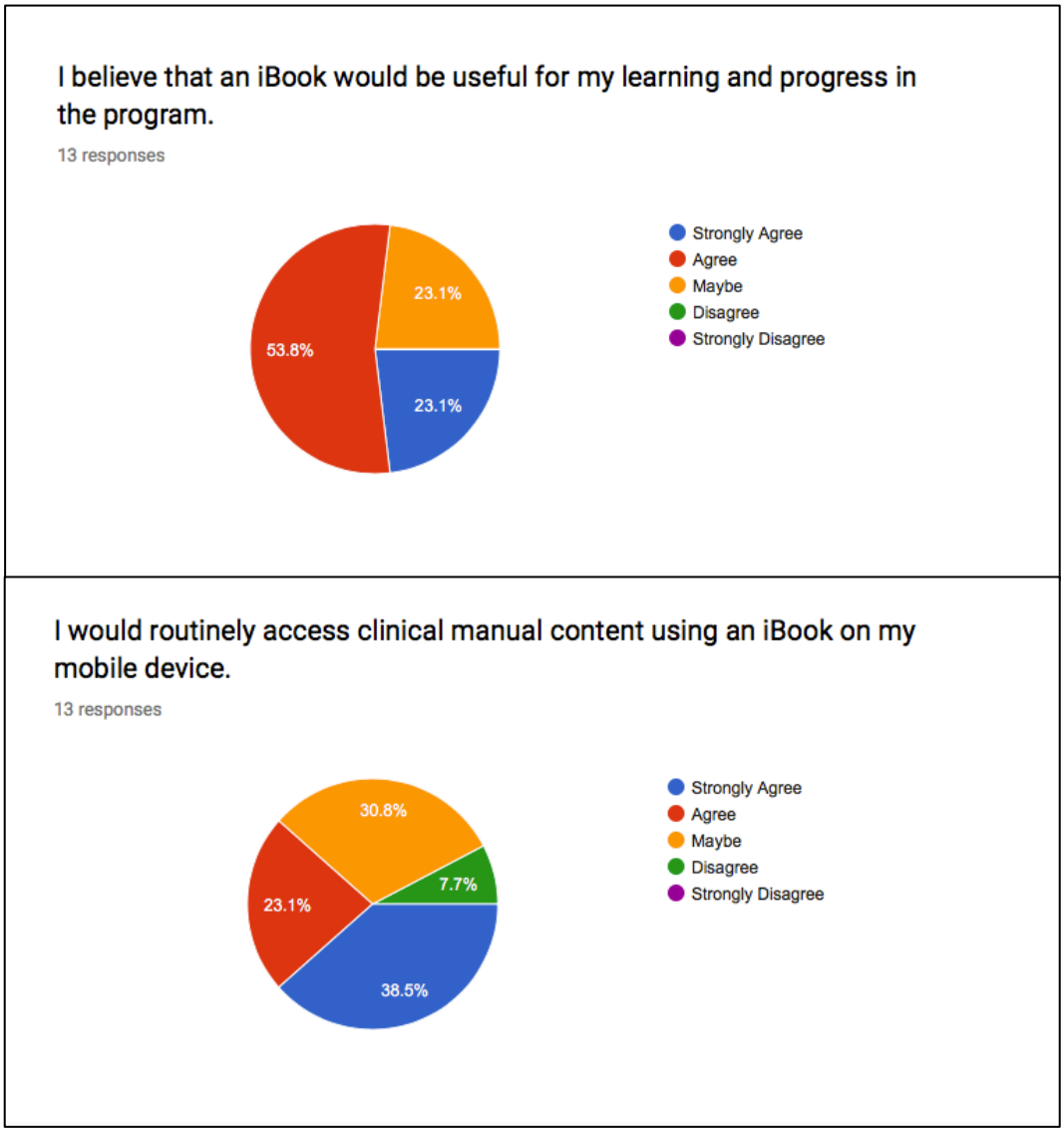


Figure A-5. Survey Question 9 and Question 10.

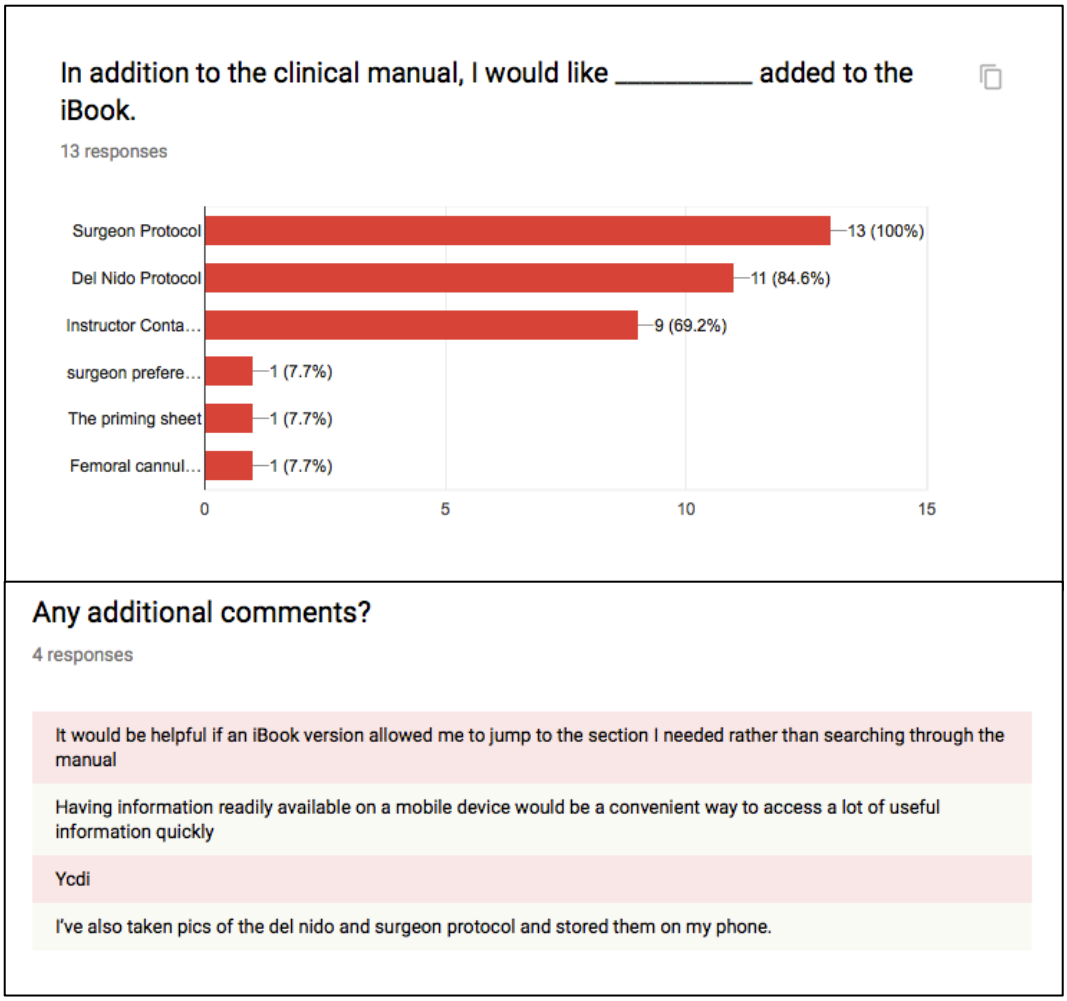


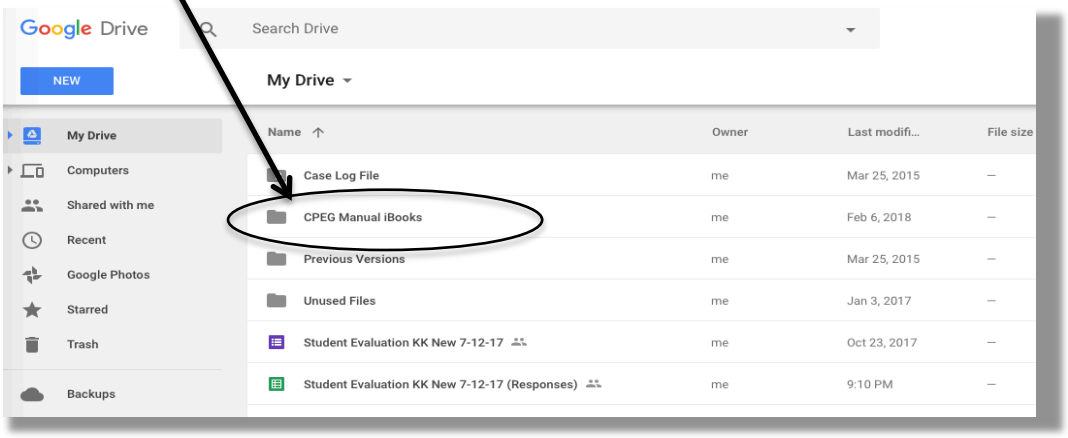
Figure A-6. Survey Question 11 and Question 12.

Appendix B: Instructions For *CPEG Manual* Download and Use

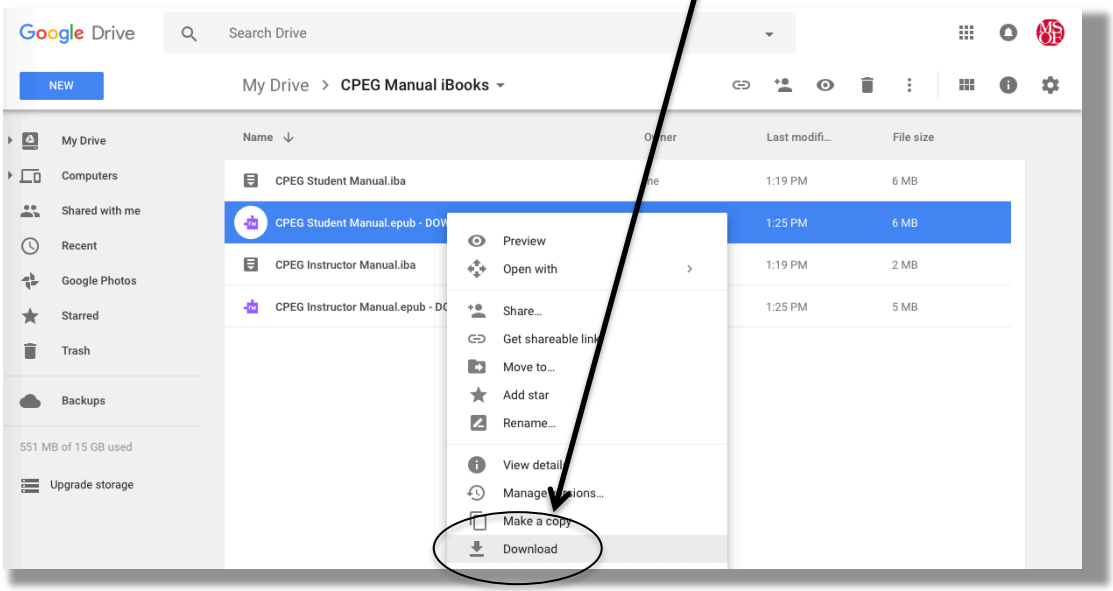
This appendix features instructions for student and instructor download and use of the *CPEG Manuals.*

Download From Google Drive

Step 1: Sign into the msoeperfusion@gmail.com Google Drive account and double-click CPEG Manual iBooks to open the folder



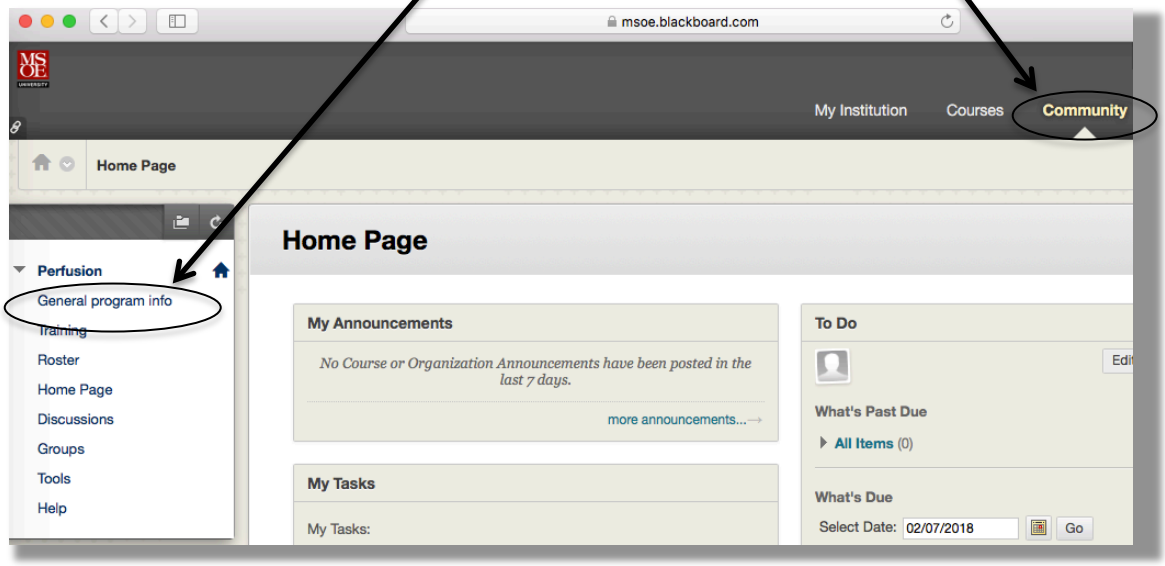
Step 2: Right click on either the CPEG Student Manual.epub or the CPEG Instructor Manual.epub to bring the menu bar up. Then click download.
(ePub files can also be directly emailed to students and instructors from this screen)



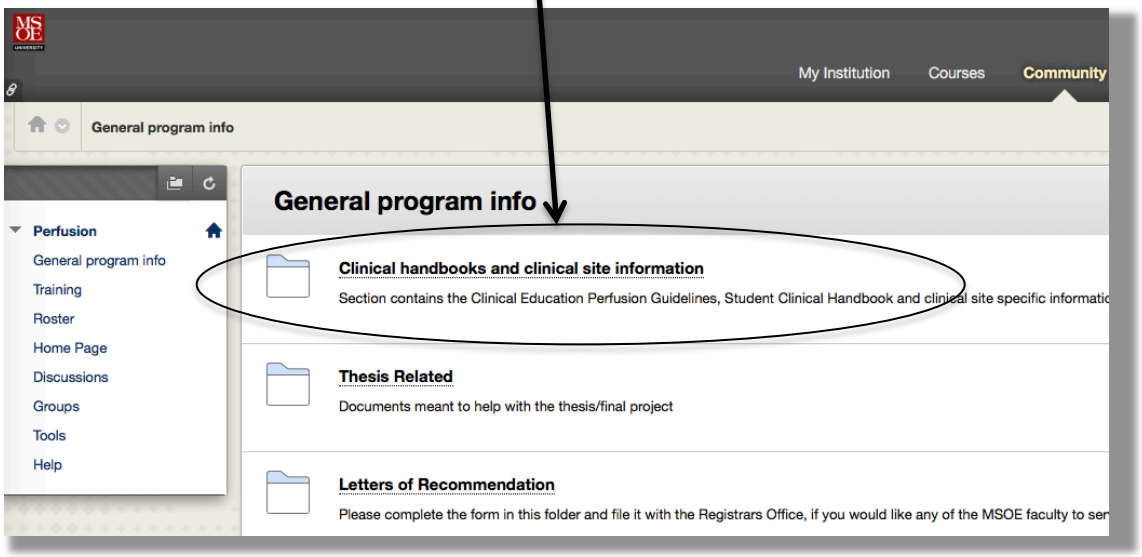
Step 3: Open the downloaded file on any ePub reader.

Download from Blackboard

Step 1: Sign into your account on msoe.blackboard.com. In the Perfusion Community, click on the General Program Info tab.



Step 2: Open the Clinical handbooks and clinical site information folder. Choose the CPEG Manual from this folder.

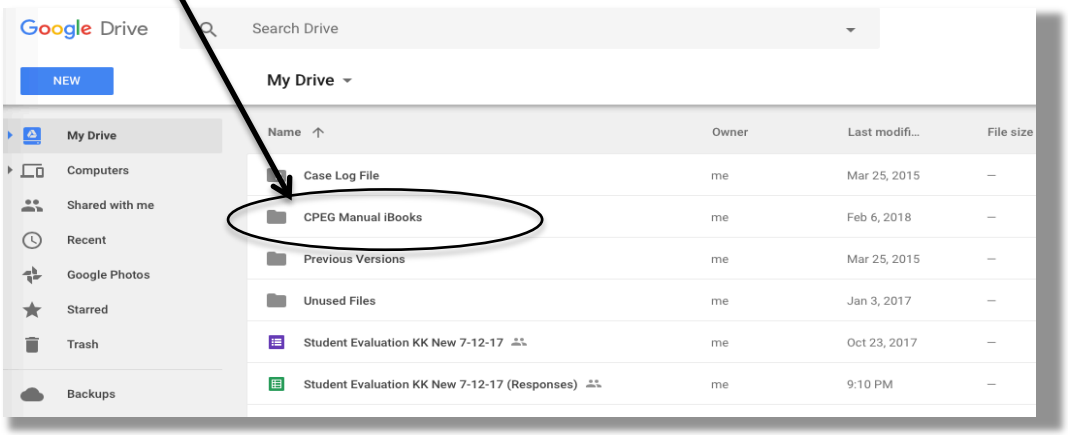


Appendix C: Instructions for Changing and Updating iBook Content

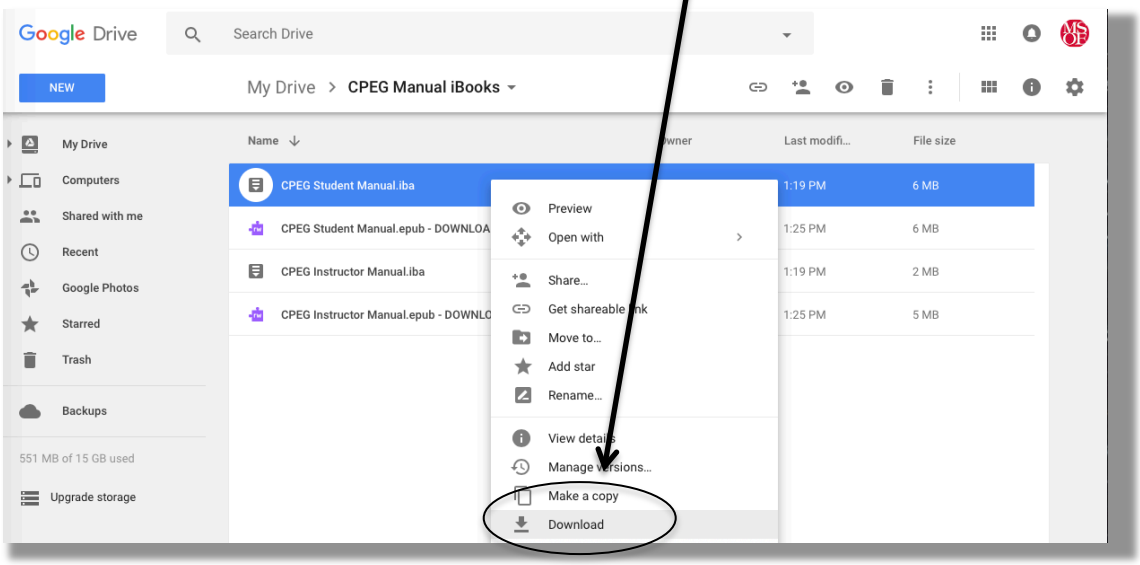
This appendix features instructions for downloading and accessing the iBooks for any necessary changes.

Updating *CPEG Instructor/Student Manual* iBook Content

Step 1: Sign into the msoeperfusion@gmail.com Google Drive account and double-click CPEG Manual iBooks to open the folder

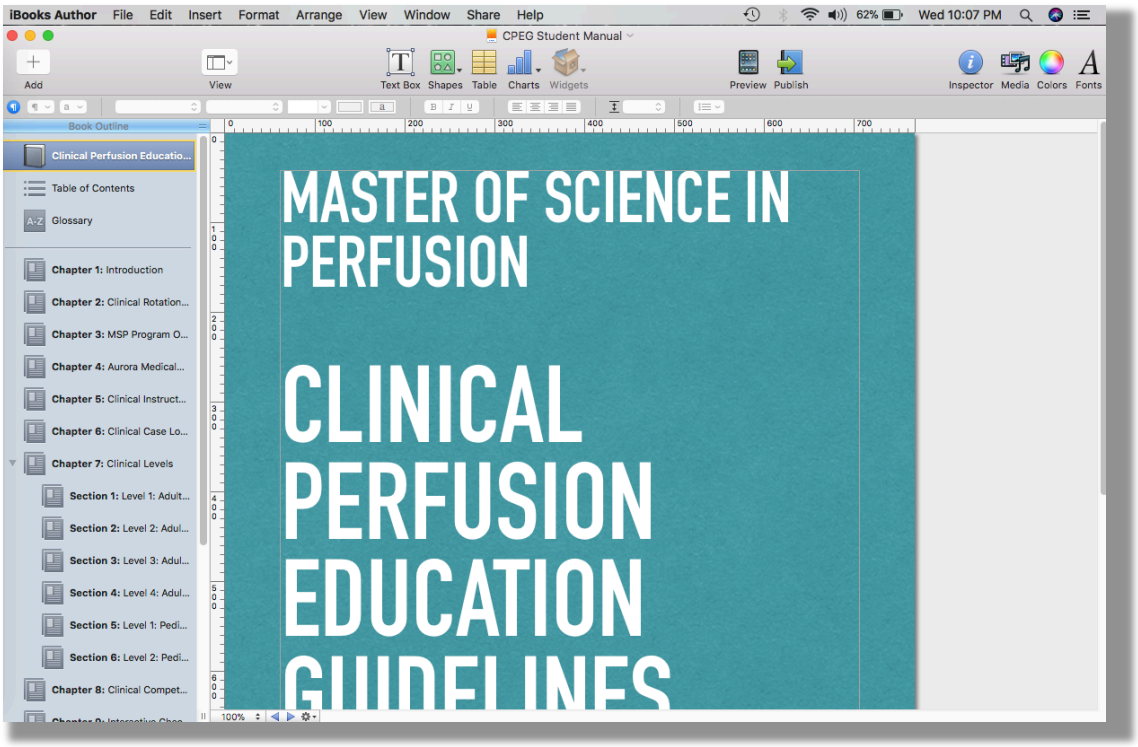


Step 2: Right click on either the CPEG Student Manual.iba or the CPEG Instructor Manual.iba to bring the menu bar up. Then click download.



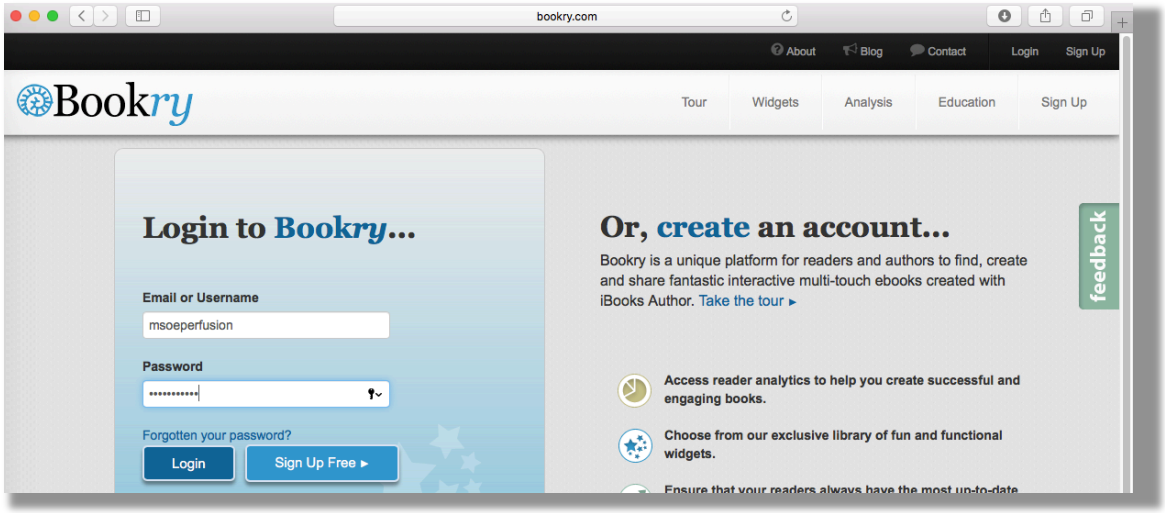
Step 3: Open the downloaded file in iBooks Author to edit content.

(Note: To edit and open the iba files, the user must have an Apple computer with the iBooks Author application.)

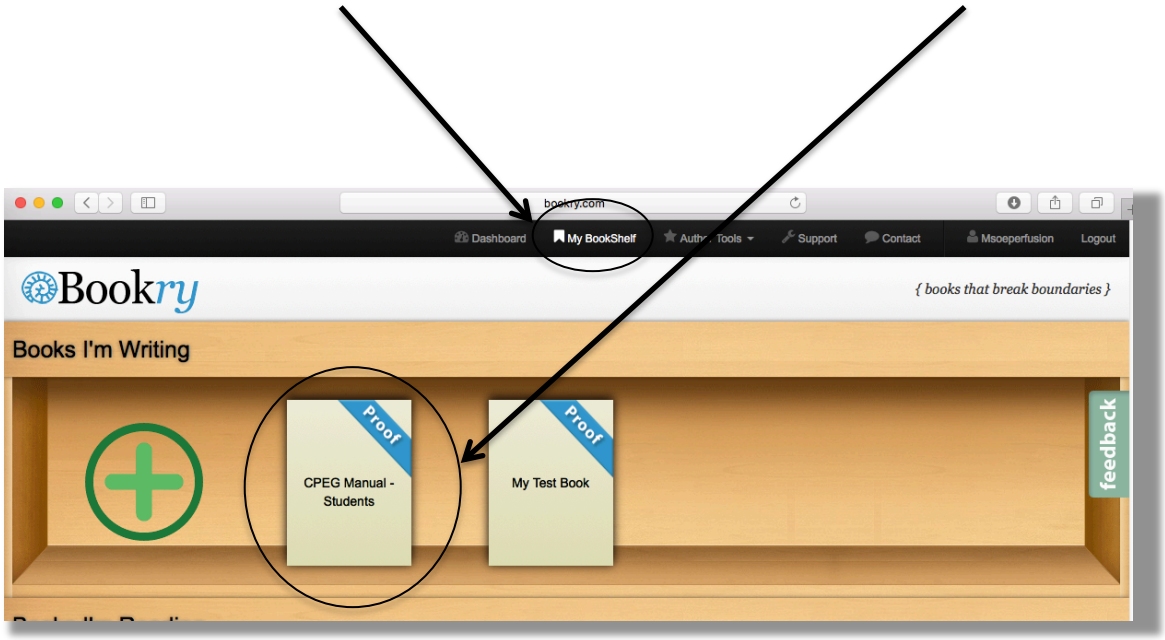


Accessing Bookry Account for Modifications to Interactive Checklist

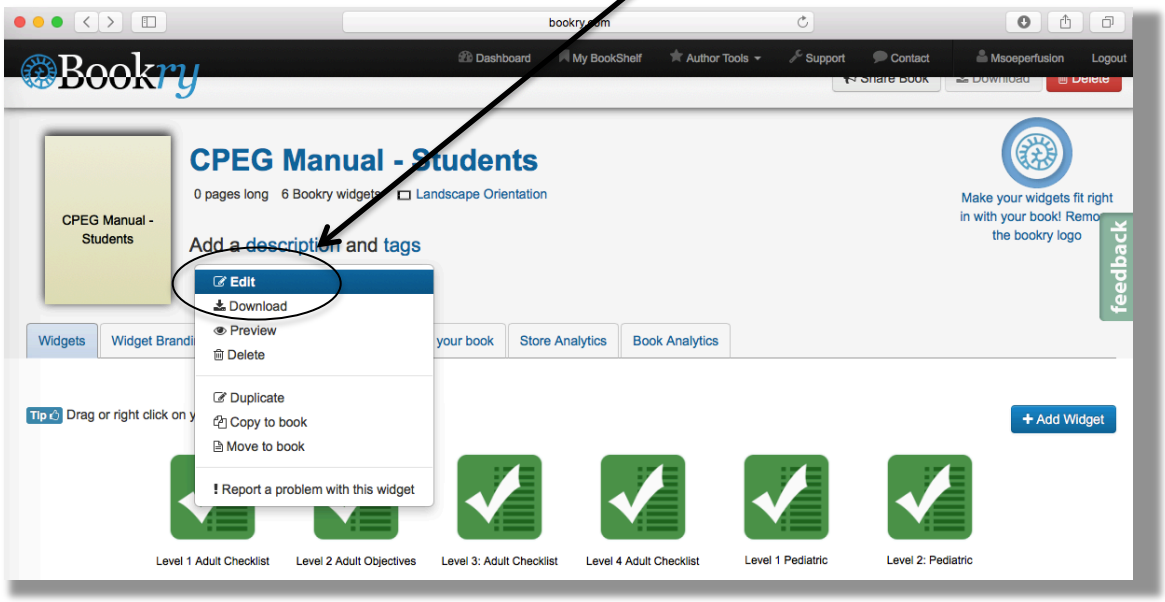
Step 1: Go to bookry.com and login using the msoeperfusion@gmail.com login.



Step 2: Click on My BookShelf and then open the CPEG Manual – Students book.



Step 3: Right click on the desired widget and click edit.



Perfusion

Thesis Approval Form

Master of Science in Perfusion – MSOE MSP

Milwaukee School of Engineering

This thesis, titled "Developing and Implementing an iBook of the Student and Instructor *Clinical Perfusion Education Guidelines Manual*," submitted by the student Kristina Cordes, has been approved by the following committee:

Faculty Chairperson: _____ Date: _____

Dr. Ron Gerrits, Ph.D.

Faculty Member: _____ Date: _____

Kirsten Kallies, MS, CCP, LP

Faculty Member: _____ Date: _____

Gary Shimek, M.L.I.S.