

Supplementary Material

Ward, E. J., & Lindshield, B. L. (2020). Performance, behaviour and perceptions of an open educational resource-derived interactive educational resource by online and campus university students. *Research in Learning Technology*, 28. <https://doi.org/10.25304/rlt.v28.2386>

Survey (Minorly edited to deidentify it)

Consent

Purpose: We want to ensure that we are providing resources which enhance learning. Your feedback with this short survey will help us understand behaviors and perceptions of the Top Hat Textbook™ version of the interactive educational resource that was used for the first time this semester.

Objectives: Our primary objective is to understand your interaction and perceptions of the interactive educational resource. Our secondary objectives are to determine your habits, motivations, and if you find value in the interactive educational resource, specifically the embedded questions.

Procedures: We will be collecting data anonymously with this survey. We will also be exporting question data from Top Hat™. We anticipate this survey will require less than 8 minutes of your time.

Benefits Anticipated: This is an opportunity for you to participate in research.

We believe features available in interactive educational resources may enhance student learning. We plan to publish the findings of this study so they are available for other instructors when considering alternatives to traditional textbooks.

Extent of Confidentiality: We will not be collecting identifying information in the survey. Your answers will remain confidential. We do not plan to distribute information collected in this research to other researchers. In the case we would choose to do so, it would be provided without identifiable information.

Terms of Participation: I understand this project is research, and that my participation is voluntary. I also understand that if I decide to participate in this study, I may withdraw my consent at any time, and stop participating at any time without explanation, penalty, or loss of benefits, or academic standing to which I may otherwise be entitled.

Demographics

1. Age: _____
2. Gender:
 - Male
 - Female
 - Other, please specify: _____
3. What is your highest level of education?
 - Some undergraduate education
 - Associate Degree
 - Bachelor Degree

- Some graduate education
 - Other, please specify: _____
4. What is your total percent of points earned currently in FNDH 400?
- 95.0-100
 - 90.0-94.9
 - 85.0-89.9
 - 80.0-84.9
 - 75.0-79.9
 - 70.0-74.9
 - 65.0-69.9
 - 60.0-64.9
 - 55.0-59.9
 - 50.0-54.9
 - <49.9
5. What total percent of points do you typically earn in courses?
- 95.0-100
 - 90.0-94.9
 - 85.0-89.9
 - 80.0-84.9
 - 75.0-79.9
 - 70.0-74.9
 - 65.0-69.9
 - 60.0-64.9
 - 55.0-59.9
 - 50.0-54.9
 - <49.9

Frequency

6. How often did you use the educational resource (any format: PDF, hard copy, Top Hat™)?
- Never
 - 6b. *If never*, What are your reason(s) for not using the educational resource?

 - *Skip to last question*
 - Less than once a month
 - At least once a month
 - At least once every 2 weeks
 - At least once a week
 - 2-3 times a week
 - More than 3 times a week
7. Which format of the educational resource do you prefer?
- PDF
 - Hard copy
 - Top Hat

8. Assign percentages (equal to 100) for how often you accessed the educational resource via each format:
- PDF: ____
 - Hard copy: ____
 - Top Hat™: ____
- *If Top Hat = 0, skip to questions 15-16, then last question*
9. We noticed the following trends in Top Hat™ use: 1) students answer questions while learning the material, after lecture or reading the material (progressor), 2) students start initially answering questions while learning the material, but answer the last questions on due date (part progressor, part procrastinator) 3) students answer all or nearly all questions on or very near the due date (procrastinator). Which best describes your use?
- 1. Progressor
 - 2. Part progressor, part procrastinator
 - 3. Procrastinator
 - 9b. *Optional*: Did Top Hat Textbook™ and/or embedded questions help you be more proactive with learning the material? Please describe why or why not. _____
10. Assign percentages (equal to 100) for how often you accessed Top Hat™ via different devices:
- Desktop/laptop (full site): ____
 - iPad/tablet app: ____
 - iPhone/android app: ____

Behaviors

11. What percentage of time on Top Hat™ were you answering questions and reviewing answers (vs. reading, watching videos, etc.)?
- *Slider*: 0 (none) – 100 (all)
12. At the beginning of the semester, what motivated you to use the Top Hat™ educational resource (drag and rank all that apply, 1 = most)?
- *Order randomized*
 - Desire for extra credit points
 - Desire to earn a good grade in the course
 - Ease of use/convenience
 - Helpfulness for learning the material
 - Usefulness as a study tool for quizzes and exams
13. Did your motivations change during the semester?
- Yes
 - No
- *If no, skip to question 15*
14. At the end of the semester, what motivated you to use the Top Hat™ educational resource (drag and rank all that apply, 1 = most)?
- *Order randomized*
 - Desire for extra credit points
 - Desire to earn a good grade in the course
 - Ease of use/convenience

- Helpfulness for learning the material
 - Usefulness as a study tool for quizzes and exams
15. What percent of the educational resource did you read?
- *Slider: 0 (none) – 100 (all)*
16. Of your total educational resource use, what percent was during class [while watching class videos]?
- For online section:
- 16a. Did you watch the class videos?
- Yes/No.
- If Yes, ask question 16b*
- If no, skip to question 17*
- *Slider: 0 (none) – 100 (all)*
 - *If >0, 16b. How did you use the educational resource during class (select all that apply)?*
 - Reading
 - Completing daily assignments
 - Note taking
 - Highlighting
 - Reviewing figures
 - Answering questions
 - Other:
17. When did you most often answer the Top Hat™ questions (drag and rank all that apply, 1 = most)? *Online survey text options in brackets.*
- Before class after/while reading [Before watching class videos after/while reading]
 - During class [While watching class videos]
 - Following class after/while reading [Following watching class videos after/while reading]
 - Following class after/while searching/skimming (did not read) [Following watching class videos after/while searching/skimming (did not read)]
 - After/while reading (did not go to class) [After/while reading (did not watch class videos)]
 - While searching/skimming (did not read and did not go to class) [While searching/skimming (did not read and did not watch class videos)]
18. How often did you look at the question explanations
- 18a. when you got the problem correct?
 - *Net Promoter Score 0-10: 0 Never – 10 Always*
 - 18b. when you got the problem incorrect?
 - *Net Promoter Score 0-10: 0 Never – 10 Always*
19. How helpful did you find the explanations?
- *Net Promoter Score 0-10: 0 Not Helpful – 10 Very Helpful*
20. How helpful did you find the questions for learning the material?
- *Net Promoter Score 0-10: 0 Not Helpful – 10 Very Helpful*

Opinions

21. Rate your level of satisfaction with the Top Hat™ educational resource.
1. Completely dissatisfied
 2. Mostly dissatisfied
 3. Somewhat dissatisfied
 4. Neither satisfied or dissatisfied
 5. Somewhat satisfied
 6. Mostly satisfied
 7. Completely satisfied
22. The questions and explanations provided in Top Hat™ improved my understanding of the material, comfort with the topics, and my overall confidence in the course.
1. Strongly disagree
 2. Disagree
 3. Somewhat disagree
 4. Neither agree or disagree
 5. Somewhat agree
 6. Agree
 7. Strongly Agree
23. I enjoyed using the Top Hat™ educational resource.
1. Strongly disagree
 2. Disagree
 3. Somewhat disagree
 4. Neither agree or disagree
 5. Somewhat agree
 6. Agree
 7. Strongly Agree
24. Because of the interactive questions in the Top Hat™ educational resource, I used the educational resource ____ frequently compared to how I think I would have used the educational resource PDF (if that was the only option).
- Much less
 - Moderately less
 - Slightly less
 - No more or less
 - Slightly more
 - Moderately more
 - Much more
25. I used the following features in the Top Hat™ educational resource (select all that apply):
- Highlighting
 - Commenting/Add a Note
 - Figures
 - Links to external articles, animations etc.
 - Videos
 - Questions (set to review after each chapters' due date)
26. How likely are you to recommend that future students use the Top Hat™ educational resource?
- *Net Promoter Score: 0 (Not likely at all) – 10 (Extremely likely)*

27. *Optional:* Please share any additional comments about your experience with the educational resource and Top Hat™.

Please include any additional information about your preferences to use the Top Hat™, PDF, and/or hard copy version(s) of the educational resource. Reference which version(s) you are discussing in your response.

We thank you for your time spent taking this survey.

Your response has been recorded.

Supplementary Material Table 1. Content availability in the Interactive Platform

Exam	Chapter	Date Open		Date Closed	Days Available	
		Online	Campus		Online	Campus
1	1	1/18/2019	1/18/2019	1/28/2019	10	10
	2	1/18/2019	1/18/2019	2/11/2019	24	24
	3	1/18/2019	1/18/2019	2/11/2019	24	24
2	4	2/9/2019	2/15/2019	2/25/2019	16	10
	5	2/9/2019	2/15/2019	2/25/2019	16	10
	6	2/9/2019	2/15/2019	3/4/2019	23	17
	7	2/9/2019	2/15/2019	3/18/2019	37	31
3	8	3/16/2019	3/20/2019	3/25/2019	9	5
	9	3/16/2019	3/20/2019	4/1/2019	16	12
	10	3/16/2019	3/20/2019	4/8/2019	23	19
4	11	4/6/2019	4/12/2019	4/22/2019	16	10
	12*	4/6/2019	4/12/2019	4/29/2019	23	17
5†	13*	4/27/2019	5/3/2019	5/10/2019	13	7

*Chapter 12 covered sections 12-12.74; Chapter 13 covered sections 12.8-12.9 and chapter 13.

†Exam 5 was a cumulative final which included content from all previous exams and new material from chapter 13.

Supplementary Table 2. Extra Credit Scale

Questions correctly answered (%)	Points earned per chapter
89.5 – 100	0.5
79.5 – 89.4	0.4
69.5 – 79.4	0.3
59.5 – 69.4	0.2
50.0 – 59.4	0.1

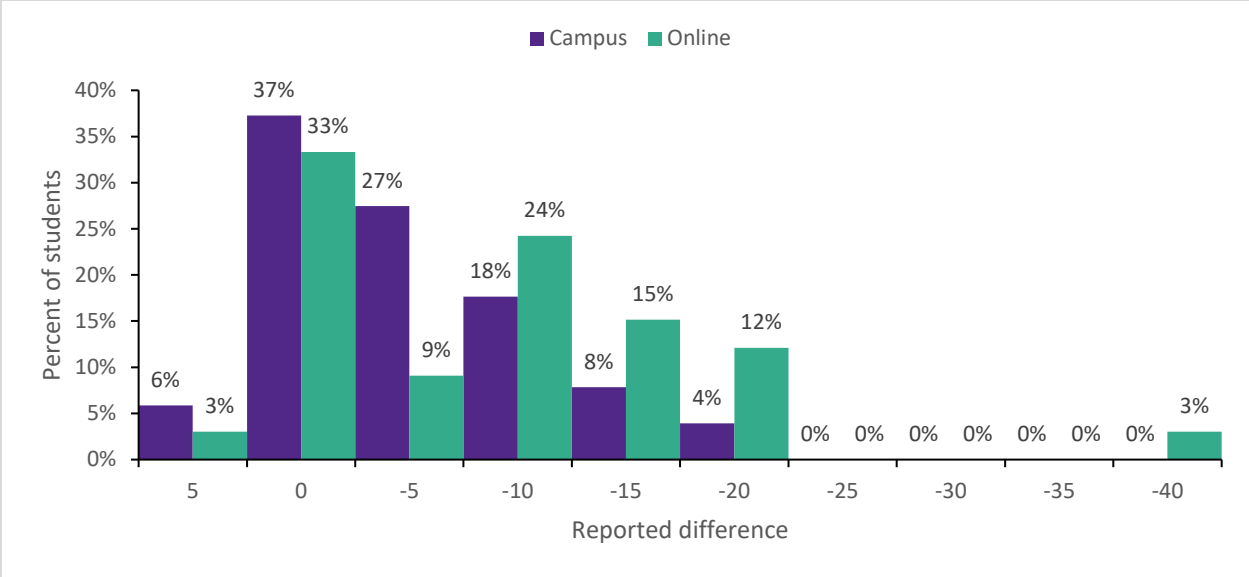
Supplementary Material Table 3. Interactive educational resource question performance

Exam	Chapter	Number of Questions	Campus (n=61)			Online (n=48)		
			Correct (%)	Incorrect (%)	Unanswered (%)	Correct (%)	Incorrect (%)	Unanswered (%)
1	1	25	83.6	10.4	6.0	82.4	14.8	2.8
	2	49	85.5	12.5	1.9	83.9	13.6	2.5
	3	29	80.8	14.2	5.0	75.3	15.3	9.4
	4	33	78.5	18.5	2.9	78.1	18.9	3.0
2	5	7	89.9	7.0	3.0	87.8	9.8	2.4
	6	35	81.8	13.3	4.9	78.4	14.2	7.4
	7	22	69.2	24.2	6.6	68.6	26.2	5.2
	8	13	84.0	12.6	3.4	80.9	13.8	5.3
3	9	38	80.3	15.5	4.2	74.2	15.0	10.7
	10	30	77.8	16.6	5.6	74.7	19.2	6.1
4	11	18	76.0	20.3	3.7	68.6	21.4	10.0
	12	61	68.0	23.4	8.6	57.0	21.8	21.2
5	13	20	67.3	20.3	12.4	56.3	21.6	22.2
Total	–	380	77.8	16.8	5.4	73.0	17.7	9.3

Supplementary Table 4. Demographic information of surveyed students

	Campus (n=51)	Online (n=33)
Age	21.1 ± 3.6	27.8 ± 8.3
Gender		
Male	9 (17.6%)	4 (12.1%)
Female	42 (82.4%)	29 (87.9%)
Education		
Some undergraduate	42 (82.4%)	12 (36.4%)
Associate degree	5 (9.8%)	11 (33.3%)
Bachelor degree	4 (7.8%)	7 (21.2%)
Some graduate	0 (0%)	3 (9.1%)
Self-Reported Grade in Nutrition Course		
<50.0%	0	0
50.0-54.9%	1 (2.0%)	1 (3.0%)
60.0-64.9%	1 (2.0%)	0
65.0-69.9%	2 (3.9%)	5 (15.2%)
70.0-74.9%	4 (7.8%)	3 (9.1%)
75.0-79.9%	5 (9.8%)	5 (15.2%)
80.0-84.9%	7 (13.7%)	7 (21.2%)
85.0-89.9%	10 (19.6%)	2 (6.1%)
90.0-94.9%	15 (29.4%)	9 (27.3%)
95.0-100.0%	6 (11.8%)	1 (3.0%)
Self-Reported Typical Course Grade		
<50.0%	0	0
50.0-54.9%	0	0
60.0-64.9%	0	0
65.0-69.9%	0	0
70.0-74.9%	2 (3.9%)	0
75.0-79.9%	1 (2.0%)	1 (3.0%)
80.0-84.9%	5 (9.8%)	2 (6.1%)
85.0-89.9%	10 (19.6%)	13 (39.4%)
90.0-94.9%	28 (54.9%)	16 (48.5%)
95.0-100.0%	5 (9.8%)	1 (3.0%)

Data are presented as means ± SDs for continuous variables or n (%) for categorical variables. Student grades are self-reported at time of survey completion which may or may not have been prior to taking and receiving final grade for the course.



Supplementary Figure 1. Differences in reported course percentage earned compared to typical reported course grades for student survey respondents

Percent differences calculated as nutrition reported course percentage bracket minus typical reported course percentage bracket for each survey respondent (positive value: higher score in nutrition course reported course grade, 0: same was reported, and negative values: lower score in nutrition course).

Supplementary Table 5. Grades of survey respondents compared to final course grades of all students in each section

Grade	Campus Section			Online Section		
	Survey* (n=51)	Course (n=61)	Proportion (%)	Survey* (n=33)	Course (n=48)	Proportion (%)
F	1 (2%)	2 (3%)	1/2 (50%)	1 (3%)	5 (10%)	1/5 (20%)
D	3 (6%)	8 (13%)	3/8 (38%)	5 (15%)	8 (17%)	5/8 (63%)
C	9 (18%)	13 (21%)	9/13 (69%)	8 (24%)	14 (29%)	8/14 (57%)
B	17 (33%)	18 (30%)	17/18 (94%)	9 (27%)	12 (25%)	9/12 (75%)
A	21 (41%)	20 (33%)	21/20 (105%)	10 (30%)	9 (19%)	10/9 (111%)

*Survey grades are self-reported at time of survey completion. Most students completed the survey before the final exam and therefore did not have their final course grade to report at time of survey completion.

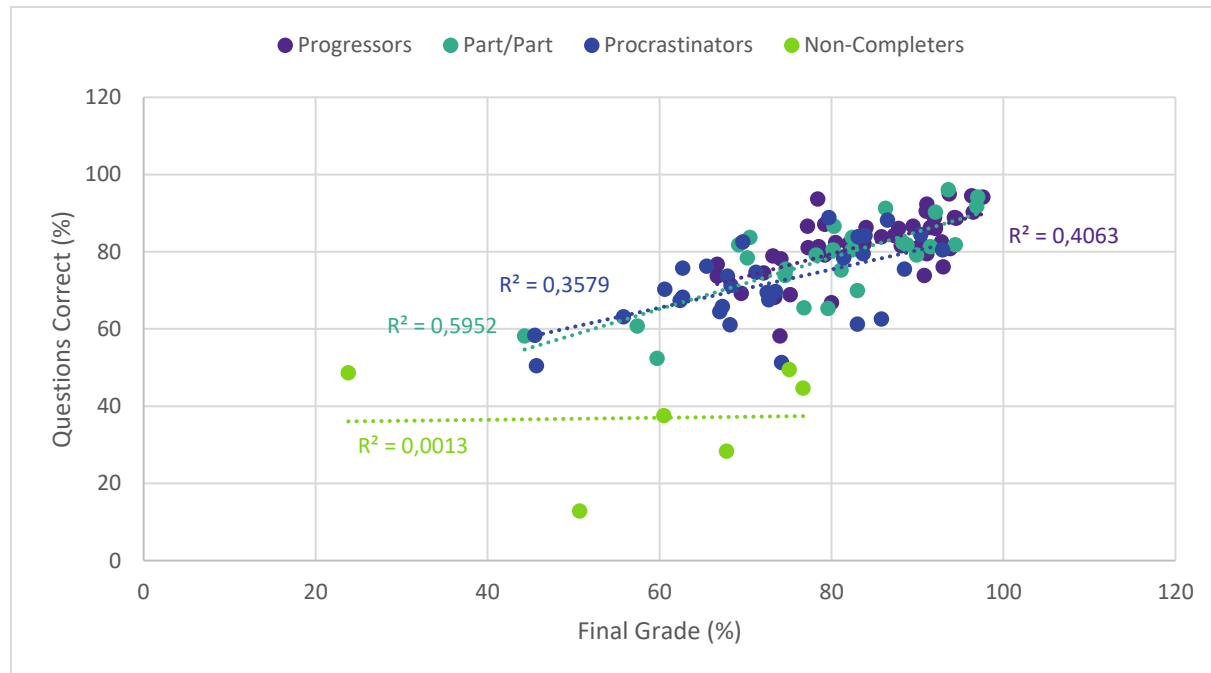
Supplementary Table 6. Student self-reported interactive educational resource user style

	Campus (n=50)		Online (n=32)	
Student self-described interactive platform user style*				
	Analyzed	Self-reported	Analyzed	Self-reported
Progressor	31 (50.8%)	15 (30.0%)	15 (31.3%)	13 (40.6%)
Part progressor, part procrastinator	12 (19.7%)	32 (64.0%)	15 (31.3%)	12 (37.5%)
Procrastinator	16 (26.2%)	3 (6.0%)	14 (29.2%)	7 (21.9%)
Non-completer	2 (3.3%)	NA	4 (8.3%)	NA
Optional: Did the interactive platform and/or questions help you be more proactive in learning the material?				
Yes	21/27 (77.8%)		16/18 (88.9%)	
No	2/27 (7.4%)		2/18 (11.1%)	
Uncertain†	4/27 (14.8%)		0	

Data are presented as n (%).

*Students were not asked if they were “non-completers.” Analyzed column is based on performance data pulled from the interactive platform.

†Summarized uncertain responses: helped to learn material, helped to think more about applying material, yes and no, forced to read text more in-depth



Supplementary Figure 2. Grade vs. question performance by student interactive educational resource user style

Supplementary Table 7. Mean grade and question performance by student interactive educational resource user style

	n	Final Grade	Questions % Correct
Progressors	46	84.6 ± 8.6	82.2 ± 7.9
Part Progressors/Part Procrastinators	27	80.1 ± 12.6	78.6 ± 10.9
Procrastinators	30	72.4 ± 12.2	71.6 ± 10.1
Non-Completers	6	59.1 ± 19.8	37.0 ± 14.2

Data are presented as means ± SDs

Supplementary Table 8. When campus students answered questions – total number of times selected and ranked (n = 50)

Times each option was selected and ranked in each position

	Before class after/while reading	During class	Following class after/while reading	Following class after/while searching/ski mming (did not read)	After/while reading (did not go to class)	While skimming (did not read and did not go to class)
#1	14	13	18	3	1	1
#2	6	7	22	6	1	2
#3	8	6	3	6	2	0
#4	2	2	0	5	1	1
#5	1	0	0	0	5	4
#6	2	0	1	0	2	5
Total	33 (66%)	28 (56%)	44 (88%)	20 (40%)	12 (24%)	13 (26%)

Data are count (n); total rows include percent.

Supplementary Table 9. When online students answered questions – total number of times selected and ranked (n = 31)

Times each option was selected and ranked in each position, Online (n=31)‡

	Before watching class videos after/while reading	While watching class videos	Following watching class videos after/while reading	Following watching class videos after/while searching/skimming (did not read)	After/while reading (did not watch class videos)	While skimming (did not read and did not watch class videos)
#1	11	1	5	0	11	3
#2	1	1	5	1	1	2
#3	1	0	0	2	1	1
#4	1	1	0	1	0	0
#5	0	1	1	1	0	0
#6	2	0	0	0	1	0
Total	16 (52%)	4 (13%)	11 (35%)	5 (16%)	14 (45%)	6 (19%)

Data are count (n); total rows include percent.

‡One student did not finish the survey, ending at this point.

n=31. Students were asked to select and rank all applicable options with #1 as most common scenario.

Supplementary Table 10. How students used the interactive educational resource during class/while watching class videos

	Campus (n=50)	Online (n=31)
Reading	32 (64%)	9 (56%)
Completing daily assignments	33 (66%)	3 (19%)
Note taking	21 (42%)	7 (44%)
Highlighting	20 (40%)	3 (19%)
Reviewing figures	16 (32%)	5 (31%)
Answering questions	31 (62%)	5 (31%)
Other†	1 (2%)	0

Data are presented as n (%).

†Other: “following along with presentation”

Supplementary Table 11. Reported use of interactive educational resource features

	Campus (n=50)	Online (n=31)
Highlighting	27 (54%)	2 (6.5%)
Commenting	13 (26%)	0
Figures	29 (58%)	7 (22.6%)
Links to external articles	17 (34%)	23 (74.2%)
Videos	23 (46%)	21 (67.7%)
Questions (for review)	42 (84%)	27 (87.1%)

Data are presented as n (%).

Supplementary Table 12. Students' ranked motivations to use the interactive educational resource at the beginning of the semester

	Campus (n=50)					Online (n=32)				
	Extra Credit	Good Grade	Ease of use	Learning	Study Tool	Extra Credit	Good Grade	Ease of use	Learning	Study Tool
Times Selected (%)	47 (94%)	43 (86%)	38 (76%)	44 (88%)	40 (80%)	31 (97%)	26 (81%)	26 (81%)	28 (88%)	26 (81%)
# times ranked in each position										
#1	21	8	2	11	8	12	11	2	5	2
#2	12	20	1	5	8	8	6	6	4	7
#3	7	7	4	15	13	4	3	3	11	8
#4	4	7	6	11	8	2	5	6	6	4
#5	3	1	25	2	3	5	1	9	2	5

Choices were presented to students in a random order.

Supplementary Table 13. Motivation changes in using the interactive educational resource.

	Beginning of the semester									
	Campus (n=15)					Online (n=11)				
	Extra Credit	Good Grade	Ease of use	Learning	Study Tool	Extra Credit	Good Grade	Ease of use	Learning	Study Tool
Times Selected	13 (87%)	12 (80%)	11 (73%)	11 (73%)	8 (53%)	11 (100%)	9 (82%)	9 (82%)	9 (82%)	10 (91%)
Rank*	1.6	2.4	3.8	3.3	2.3	2.8	2.1	4.1	2.4	2.1
	End of the semester									
Times Selected	11 (73%)	13 (87%)	9 (60%)	9 (60%)	12 (80%)	9 (82%)	10 (91%)	9 (82%)	8 (73%)	9 (82%)
Rank*	2.3	2.4	3.4	2.9	3.1	2.9	2.3	4.3	1.6	2.7

Choices were presented to students in a random order. Data are presented as n (%).

*Mean of rank from 1-5 where #1 = most motivating and #5 = least motivating.

Supplementary Table 14. Frequency explanations were reviewed and helpfulness of questions and explanations

	Campus (n=50)	Online (n=31)
Frequency reviewing question explanations when answered the problem correctly	6.1 ± 3.3	6.9 ± 3.7
Frequency reviewing question explanations when answered the problem incorrectly	9.3 ± 1.6	9.5 ± 1.2
Helpfulness of the explanations	7.6 ± 2.2	8.2 ± 2.4
Helpfulness of the questions for learning the material	7.5 ± 2.3	7.9 ± 2.7

Data are presented as means ± SDs reported on a scale of 0-10 where 0 = never and 10 = always.

Supplementary Table 15. Student responses on satisfaction, material understanding, enjoyment, and frequency of use

	Campus (n=50)	Online (n=31)
Rate your level of satisfaction with the interactive textbook. (1 = completely dissatisfied, 7 = completely satisfied)	5.6 ± 1.7	5.5 ± 2.0
The questions and explanations provided in the interactive textbook improved my understanding of the material, comfort with the topics, and my overall confidence in the course. (1 = strongly disagree, 7 = strongly agree)	5.8 ± 1.1	5.6 ± 1.6
I enjoyed using the interactive textbook. (1 = strongly disagree, 7 = strongly agree)	5.8 ± 1.2	6.1 ± 1.3
Because of the interactive questions in the interactive textbook, I used the textbook _____ frequently compared to how I think I would have used the educational resource PDF (if that was the only option). (1 = much less, 7 = much more)	5.2 ± 2.1	5.7 ± 1.8

Data are presented as means ± SDs for 7-point Likert scale questions. There are no significant differences between section responses as analyzed with Mann-Whitney-Wilcoxon test.

Supplementary Table 16. Summary of topics mentioned in final open-ended question

Comment Topics	Campus (n=11/50)	Online (n=8/31)
Appreciative of resource	6	1
Found the interactive textbook helpful/motivating	3	2
Main resource for learning material		2
Didn't care for navigation in the interactive platform	1	
Interactive textbook was not useful	1	
Liked extra credit	1	
Liked videos		1
Want more than 1 attempt to answer questions for credit	1	
Questions need to be more meaningful/better written	1	2
Content needs further editing		1
Prefer traditional textbook		1

Data are presented as count.