Anesthesia Learning in the Digital Age: Are Program Directors and Residents on the Same Page?

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Introduction

The 21st century, known as *The Digital Age*, is characterized by increased online media usage and widespread information access—a transition that significantly impacts medical education. Moving away from traditional textbooks and lectures, the new trend is toward *asynchronous education*, defined as online resources such as videos, podcasts, and question banks that are used by learners at their own time and pace, and curricula that attempt to take into account learner preferences for learning modality.[1] Accumulating evidence[2-4] suggests that these newer forms of scholarship are preferred by learners and may be more effective for knowledge acquisition when compared to more traditional forms of learning.

A study[1] of emergency medicine residents showed that podcasts were the preferred form of learning outside the hospital. Another study[5] showed that, between 2002 and 2013, the number of podcasts in emergency medicine increased from 1 to 42 to meet this high demand.

Anesthesiology, which initially lagged behind emergency medicine in terms of available online resources, seems to be equalizing. One study[6] showed that a high percentage of Canadian anesthesiology residents used podcasts. According to Podtrac Analytics (Washington, DC), a podcast audience tracking service, one anesthesia and critical care-themed podcast (Anesthesia and Critical Care Reviews and Commentary [ACCRAC]) has an audience that has increased from 400 listeners in 2016 to nearly 50 000 listeners in 2019.

Studies[3,7-9] have shown that trainees may learn better from online sources such as podcasts and videos than from more traditional formats like lectures. These findings apply across levels of training (undergraduate to graduate medical education) and across specialties, including anesthesiology, internal medicine, and surgical specialties.[3-9] It is unclear whether programs are integrating these resources into their curricula. Additionally, program directors (PDs) may not know which resources residents find useful. In this study, we attempted to compare PD understanding of how their residents prefer to learn with residents' own opinions and to identify the specific resources residents find most useful. We hypothesized that residents would rely on online/multimedia educational resources for their knowledge acquisition more so than PDs assume.

Methods

This was a national cross-sectional survey study, done between November 5, 2018 and January 30, 2019, designed to ascertain anesthesiology resident and PD perceptions of academic knowledge acquisition (knowledge of facts as typically found in textbooks and demonstrable on board exams) in the digital age. (Surveys are available as supplemental online materials: See Supplemental Online Material 1 for resident survey and Supplemental Online Material 2 for PD survey.) The study received an exempt status from the Johns Hopkins Medicine Institutional Review Board. The need for written informed consent separate from the survey was waived by the review board.

Survey Instrument

Based on a review of related literature, we developed an initial pool of survey items. Following questionnaire development guidelines,[10] we consulted 3 educational experts and 3 PDs and sought input from 5 anesthesiology residents. Residents reviewed their respective survey, and PDs and educational experts examined both versions. Upon 2 rounds of revisions for both surveys, a total of 2 items (the same in both surveys) were revised and 1 item was added to the resident survey. The final instruments included 18 items in the resident survey and 12 items in the PD version. Both surveys included demographic questions.

The first question asked both residents and PDs to indicate the extent to which residents use a number of traditional and alternative/digital educational resources either assigned/recommended by the program or as a means of self-directed learning. Response options ranged between *1* (*To a very small extent*) and *5* (*To a very large extent*).

The second set of questions asked specifically about the frequency with which the residency programs assign or recommend online educational resources. Response op-

tions were: *1 = almost never; 2 = 1-2 times a year; 3 = 1-2 times a month; 4 = 1-2 times a week; 5 = ≥3 times a week.*

Data Collection

We created online surveys for nationwide dissemination using Qualtrics software (http://www.qualtrics.com; Provo, UT). We used the Accreditation Council on Graduate Medical Education website to generate an email list that consisted of 155 anesthesiology PDs across the United States. Five programs were excluded because the email addresses of their PDs could not be located, and 1 was excluded because this program did not have a residency program. An email was sent to the PDs in November 2018. The same email also requested that PDs forward the survey to their residents. Three reminders were sent between November and December 2018; all data collection was completed by the end of January 2019.

Statistical Analysis

Categorical data are presented in frequencies (and percentages), and numerical data are provided as means (SDs) and median. Charts were generated in Microsoft Excel (Redmond, WA). A nonparametric Mann-Whitney *U* test was used to examine whether or not differences existed between resident and PD perspectives, as well as for subgroup analyses. These comparisons were between PD responses and resident responses as a whole. We did not collect identifiable program information to protect PD anonymity and so we did not compare residents and PDs within individual programs. Both kurtosis and skewness values were less than |1.5| for questions about the extent to which residents use educational resources and the frequency with which the residency programs assign or recommend online resources. Based on the Levene *F* test, the homogeneity of variances assumption was not met for all of the items. Hence, a nonparametric Mann-Whitney *U* test was used.

All statistical analyses were carried out with statistical package for the social sciences (SPSS Statistics for Mac, version 25.0, IBM Corp, Armonk, NY) and significance level was set at *P* < .05.

RESULTS

Demographics

Eighty-five of 149 PDs from 31 states and the District of Columbia responded to the PD survey, for a response rate of 57%. Table 1 shows demographic information.

Thirty-six PDs confirmed they had forwarded our request to their residents (n = 1414). Out of 1414 residents who received the survey, a total of 503 from 30 states responded, a 36% rate. Table 1 shows demographic information. The survey did not require participants to provide a response for each item. Some participants only responded to the initial set of questions and chose not to provide answers for other questions. This resulted in a different number of responses for some questions. This is also reflected in the sample sizes (n) shown in Tables 1 and 2. In calculating the statistics, the actual response count for each item was used as the denominator to obtain the corresponding percentage.

Residents' Use of Various Educational Resources for Academic Knowledge Acquisition

Overall, PDs thought that residents used traditional didactics, assigned reading materials, and scheduled simulation sessions to a larger extent than residents reported (*P* < .001). Residents reported using self-directed learning to a significantly larger extent (*P* = .004; Table 2). Response options were between *1* (*To a very small extent*) and *5* (*To a very large extent*).

The Frequency With Which Residency Programs Assign Online Educational Resources

Overall, residents and PDs agreed about the frequency with which the residency programs assign online educational resources (Table 3). However, PDs reported assigning textbooks or online reading materials significantly more frequently than residents thought (*P* = .002).

Residents' Use of Digital Resources for Knowledge Acquisition Beyond Their Program's Recommendations

Figure 1 highlights the frequency of resident self-directed use of different digital educational resources. The majority (74.1%) reported using textbooks or online reading materials, and approximately 36%

indicated using podcasts 1 to 2 times a week or more for learning beyond program recommendations. Additionally, a subset (n = 102) wrote-in *question banks* as another educational resource. Of which 74.5% reported using question banks 1 to 2 times a week or more.

The Most Beneficial Educational Resources Outside the Formal Curriculum

Of the 417 residents who responded to this item, residents reported that textbooks (n = 144/417; 35%), podcasts (n = 76/417; 18%), YouTube videos (San Bruno, CA; n = 39/417; 9%), and recorded lectures (n = 38/417; 9%) were the resources they considered most beneficial outside of their formal curriculum. In addition, many residents (n = 120/417; 29%) chose to *write-in* that question banks were a resource they considered most beneficial outside of their formal curriculum.

Resident Perspectives on Educational Podcasts

Over 50% (n = 209/412) of those who responded to this question indicated that they preferred audio podcasts (26% preferred video and 23% had no preference), and 45.9% (n = 189/412) preferred podcasts that are 16 to 30 minutes. Overall, residents who reported using podcasts did so because they are accessible anytime and therefore can be used while multitasking (Supplemental Online Material 1, Q17).

Additional/Subgroup Analyses

We also conducted subgroup analyses for gender, age, and In-Training Exam (ITE) scores related to residents' educational resource use. Neither gender nor age affected personal use of resources (*P* > .05). However, those who reported having an ITE score >70th percentile seemed to use textbooks or online reading materials more frequently than those who reported low ITE percentiles <30 (Mann-Whitney U = 3210, n_1 = 68, n_2 = 128, *P* = .001 two-tailed). No difference was observed between those residents reporting low ITE scores (<30th percentile) versus those that reported high ITE scores (>70th percentile) in terms of using podcasts, recorded lectures, or YouTube videos (*P* > .05).

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DISCUSSION

The major findings of this study are as follows: (1) a discrepancy exists between pooled PD and resident views on knowledge acquisition—PDs, in general, consider assigned resources more valuable, and residents, in general, deem their self-study more constructive; (2) residents, in general, think that the most valuable resource is written material (either textbooks or online); (3) the use of textbooks and online reading material for studying is associated with a higher self-reported ITE score than are other methods of studying; and (4) residents, in general, find audio-only podcasts and YouTube videos to be valuable resources, but PDs and residents in general agree that they are rarely assigned.

Boysen and colleagues,[11] who reported on generational differences in learning preferences, suggested that the current generation of millennial learners prefers asynchronous learning that includes podcasts, videos, and question banks for knowledge acquisition.[11] Other studies[12,13] have reported similar differences in the way that current resident trainees learn. Our findings support their conclusions, suggesting that there is, indeed, a difference between PD and trainee expectations.

Mallin and colleagues[1] showed that emergency medicine residents preferred podcasts to other forms of learning (though textbooks were also used frequently), and others have shown that trainees prefer digital, social, and mobile technology for knowledge acquisition.[14-16] Our results support the conclusion that trainees find resources such as podcasts and question banks to be useful but also suggest that anesthesiology residents preferred textbooks and online reading resources.

Manuel et al[17] found a similar preference for a mix of newer and more traditional material. However, they did not find a correlation between preferred study method and ITE score. We found that residents who preferred textbooks and online reading tended to report higher ITE scores. The sample of residents who self-reported ITE scores was larger in our study,[17] a difference that may account for the discrepancy.

We found that residents and PDs agreed that podcasts and YouTube videos are rarely assigned as part of an educational curriculum. In regards to podcasts in particular, prior research and our own findings suggest that residents appreciate the flexibility and self-directed learning that they afford.[4] There are downsides to podcasts as well, as it can be difficult to skip sections or go back and listen to a section again. Additionally, while learners appreciate being able to listen while accomplishing other tasks, this may also lead to distraction with less attention paid to the podcast itself. Finally, audio-only podcasts are likely more useful for nonvisual learners. Nevertheless, it is possible that if curricula are tailored to include podcasts and YouTube videos, residents might feel appreciative and supported by their programs in their study efforts for exams, a sentiment not currently reported.[17] The same may be true for assigned question bank sets, but this was not a specific survey question.

Indeed, by aligning assigned learning resources with what residents value, programs may help residents to feel supported in their studies. Programs should strive to provide multiple study options that will enable residents to prepare adequately for exams with their preferred learning modality. If the correlation between textbook and online reading and higher ITE scores is borne out in future studies, programs might want to consider asking all residents to use these resources as a backbone for study and supplement it with their additional preferred mode of learning for knowledge acquisition.

Almost 36% of resident respondents reported listening to podcasts at least once per week. Question banks are popular because they mimic the exams for which residents are preparing. In contrast, residents like podcasts in part because they allow them to learn while doing other things. Future studies could examine how learning while driving, biking, or running compares with learning while sitting and reading a textbook or listening in a lecture hall.

Several limitations of this study should be considered. First, because the survey was completely anonymous, we could not link resident results to their PD's results. Because of this, our conclusions and data are reflective only of average, pooled, resident and PD responses. The PDs may take our conclusions as an impetus to survey their own residents to see to what extent their opinions match up with our findings but, in the absence of that approach, cannot know for certain whether our data apply to their residents specifically. Second, by combining textbook with online reading, we are unable to conclude how frequently residents are assigned textbook reading. It is also possible that residents thought question banks were included in *online reading materials*, which may have made them more likely to say that they use this method of learning for knowledge acquisition. However, later questions addressing the frequency of residents' use of certain resources and most useful resource did separate out textbooks from question banks and showed that textbooks were still highly valued. Third, although many residents chose to write in question banks in the *other* category, question banks were not listed separately and so we cannot know how many additional residents would have chosen that option if it were available. Fourth, although the response rate of PDs was 57%, the response rate for residents was only 36%. It is possible that residents who are more comfortable with technology were more likely to respond and to list online resources as their preferred method of learning. It is also possible that because PDs decided whether to send the survey to their residents, the residents who received it were not representative of all residents. Fifth, residents who listen to the ACCRAC podcast may have recognized the PI's name as the host of the podcast and may have been more likely to respond. Sixth, we asked more questions about podcasts than other forms of asynchronous learning, which may bias our conclusions toward podcasts as a modality. Seventh, our survey assumed, but did not explicitly state, that we were asking about learning in the form of knowledge acquisition of the type that could be demonstrated on a board exam. Respondents may have been thinking of other forms of learning when answering the survey. Finally, we relied on self-reported ITE scores, which, like all self-reported data, are subject to recall bias.

CONCLUSION

This is the first study to examine a nationwide sample of both anesthesiology residents and their PDs. The discrepancy between what resources PDs think residents use for knowledge acquisition and what residents report actually using is important to address. Knowing what their trainees find useful will help PDs to better design their assignments and the resources they provide and may help their residents feel more supported by the program.

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Abstract

Background: In our current digital age, textbooks have been supplemented or supplanted by multiple online modalities for knowledge acquisition. Trainees, often from a younger generation than their program directors (PDs), prefer *asynchronous* options such as podcasts, videos, and question banks. We sought to identify whether an *educational gap* exists between PDs and trainees regarding what is assigned and what is used.

Methods: A national cross-sectional survey was conducted in the United States in 2018-2019 to characterize anesthesiology resident and PD perceptions of academic knowledge acquisition.

Results: Of the 149 PDs, 85 completed the survey (57%). Of the 85 PDs, 36 forwarded the survey to residents. Of the 1414 residents who received the survey, 503 residents responded to the survey (36%). The PDs thought residents used didactics, assigned reading, and scheduled simulations more than residents reported ($P < .001$). Residents reported using self-directed learning more ($P = .004$). Most residents (74.1%) reported using textbooks or online reading materials. Those residents reporting >70th percentile on the In-Training Exam used textbooks or online materials more than those who reported low scores (<30th percentile; $P = .001$).

Conclusions: There is a discrepancy between PD and resident views on where and how knowledge acquisition occurs. Asynchronous forms of education (especially podcasts) are popular, but they are rarely assigned by programs. Although residents have a wide variety of learning preferences, textbook and online reading may be associated with higher In-Training Exam scores (a common way that knowledge acquisition is measured). The PDs should consider providing multiple options for optimizing knowledge acquisition, including textbook reading, to meet resident preferences and maximize testing success.
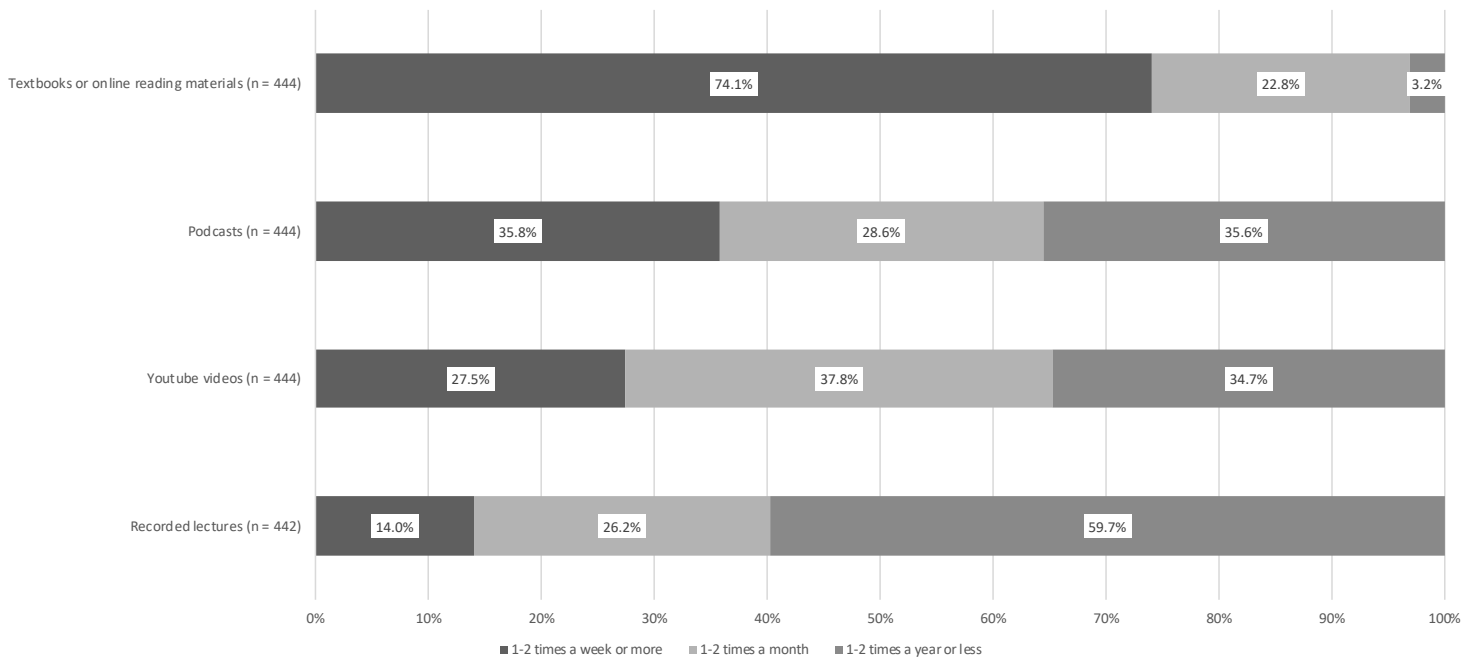
Keywords: Medical education, teaching and learning, residency education, residency curriculum

Figure

Figure 1. Frequency of residents' personal use of the learning resources beyond program recommendations.

Tables

Table 1. Demographics of Program Director (n = 85) and Resident Respondents (n = 503)

Characteristic[a]	n (%)
Program Directors	
Gender	
Female	35 (41.2)
Male	49 (57.6)
Unknown	1 (1.2)
Years as program director	
≤2	33 (38.8)
3-5	24 (28.2)
6-10	18 (21.2)
11-15	7 (8.3)
≥16	3 (3.5)
No. of residents in the program	
≤15	9 (10.5)
16-25	11 (12.9)
26-35	14 (16.5)
36-50	18 (21.2)
51-70	14 (16.5)
71-100	13 (15.3)
≥100	6 (7.1)
Institution location	
Northeast	29 (34.1)
Midwest	17 (20.0)
South	26 (30.6)
West	13 (15.3)
Institution type	
University-based	64 (75.3)
Community-based	18 (21.2)
Military-based	1 (1.2)
Other	2 (2.3)

Tables *continued*

Residents	
Gender	
Female	210 (41.7)
Male	289 (57.5)
Unknown	4 (0.8)
Age, y	
21-30	293 (58.3)
31-40	199 (39.6)
41-50	6 (1.2)
Unknown	5 (1.0)
Postgraduate year	
1	49 (9.7)
2	178 (35.4)
3	142 (28.2)
4	124 (24.7)
$\geq$5	7 (1.4)
Unknown	3 (0.6)
Institution location	
Northeast	160 (34.9)
Midwest	67 (14.6)
South	180 (39.3)
West	89 (19.4)
Unknown	7 (1.5)
Institution type	
University-based	439 (87.3)
Community-based	58 (11.5)
Military-based	2 (0.4)
Unknown	4 (0.8)

Tables *continued*

ITE percentile	
0-30	75 (14.9)
31-40	35 (7.0)
41-50	35 (7.0)
51-60	29 (5.8)
61-70	39 (7.8)
71-80	42 (8.3)
81-90	52 (10.3)
91-100	43 (8.5)
Not applicable	147 (29.2)
Unknown	6 (1.2)

Abbreviation: ITE, In-Training Exam.

[a] Values for *Unknown* are the result of no answers to those questions by a few respondents.

Tables *continued*

Table 2. Comparison of Resident and Program Director Perspectives on Residents' Resource Use for Academic Learning

Statement[a]	Residents			Program Directors			Z-Score	*P* Value
	n	Mean (SD)	Median	n[b]	Mean (SD)	Median		
Traditional didactic lectures provided by the program	459	2.85 (1.06)	3	77	3.58 (0.86)	3	−5.59	<.001[c]
Reading printed or online materials ASSIGNED by the program	459	2.26 (1.02)	2	77	2.82 (.93)	3	−4.66	<.001[c]
Watching/listening to ASSIGNED online resources (recorded videos, podcasts, etc)	457	2.18 (1.13)	2	77	2.43 (1.03)	2	−2.41	.016[c]
Scheduled simulation sessions/hands-on workshops	458	2.92 (1.06)	3	77	3.48 (1.11)	3	−3.89	<.001[c]
At the bedside during clinical rotations	459	3.83 (1.07)	4	77	4.04 (0.79)	4	−1.16	.245
Mentoring provided by attending physicians	459	3.45 (1.07)	4	77	3.61 (0.91)	4	−0.96	.339
SELF-STUDY/self-directed learning by reading books and other printed materials	459	4.20 (0.93)	4	77	3.88 (0.99)	4	−2.82	.005[c]
SELF-STUDY/self-directed learning using online resources (recorded videos, podcasts, etc)	459	4.07 (1.09)	4	77	3.78 (0.97)	4	−2.90	.004[c]

[a] Residents and program directors responded to the following prompt: To what extent do residents use the following for academic learning? Response options were between *1* (*To a very small extent*) and *5* (*To a very large extent*).

[b] A total of 8 program directors only provided partial responses, which resulted in missing data in this table.

[c] Indicates statistically significant difference.

Tables *continued*

Table 3. *Comparison of Resident and Program Director Perspectives on Frequency that Residency Programs Assign Various Learning Resources for Academic Learning*

Statement[a]	Residents			Program Directors			Z-Score	*P* Value
	n	Mean (SD)	Median	n	Mean (SD)	Median		
Podcasts	458	1.62 (0.98)	1	75	1.58 (0.88)	1	−0.17	.866
Recorded lectures	459	1.91 (1.13)	1	75	1.97 (1.10)	2	−0.78	.433
Textbooks or online reading materials	415	3.24 (1.10)	3	75	3.65 (1.00)	4	−3.03	.002[b]
YouTube videos	414	1.67 (0.99)	1	74	1.79 (0.88)	2	−1.86	.064

[a] How frequently does your program assign or recommend the following types of educational resources outside traditional lectures? Response options were: *1 = almost never; 2 = 1-2 times a year; 3 = 1-2 times a month; 4 = 1-2 times a week; 5 = 3+ times a week.*

[b] Indicates statistically significant difference.

Supplemental Online Material 1

Supplemental Online Material 1

Resident Learning Survey—Anesthesiology

Introduction

Q1 Dear Participant,

You are invited to participate in this survey (with Johns Hopkins IRB ID: IRB00130857) because you have been identified as an anesthesiology resident in the United States. The purpose of this survey is to seek your feedback about the ways in which you learn within a formal educational program as well as through your self-directed learning beyond the curriculum provided by your program.

Your participation in this survey is voluntary. You may choose not to participate. If you decide to participate in this survey, you may withdraw at any time. If you decide not to participate in this study, or if you withdraw from participating at any time, you will not be penalized. Below is a link to the online survey. This survey is completely anonymous. Responses will be reported in an aggregated format. The survey is brief, and you should be able to complete it within 5 minutes.

We really appreciate your willingness to participate and value your feedback. Our hope is that this will provide us with some insight into residents' preferred learning modalities in the digital age.

Your completion of this survey will serve as your consent to be in this research study.

Demographics

Q2 What is your post-graduate year?

▼ Select one ... [Listing included: PGY1; PGY2; PGY3; PGY4; PGY5; PGY6; >PGY7]

Q3 What was your PERCENTILE from the most recent In-Training Exam (ITE)? If you have not taken the ITE yet, please choose the N/A option.

▼ Select one ... [Listing included: 91-100; 81-90; 71-80; 61-70; 51-60; 41-50; 31-40; 0-30; N/A]

Q4 What is your gender?

○ Male

○ Female

Q5 What is your age?

○ 21-30

○ 31-40

○ 41-50

○ 51 or older

Supplemental Online Material 1 *continued*

Q6 Where is your institution located?

▼ Select one ... [Listing included: all states in the United States]

Q7 With what type of institution are you affiliated?

○ University-based

○ Community-based/university-affiliated

○ Military-based

○ Other (Please specify) _____

Q8 To what extent do you utilize the following for your academic learning?

	To a Very Large Extent	To a Large Extent	To a Moderate Extent	To a Small Extent	To a Very Small Extent
Traditional didactic lectures provided by the program	○	○	○	○	○
Reading printed or online materials ASSIGNED by the program	○	○	○	○	○
Watching/listening to ASSIGNED online resources (recorded videos, podcasts, etc)	○	○	○	○	○
Scheduled simulation sessions / hands-on workshops	○	○	○	○	○
At the bedside during clinical rotations	○	○	○	○	○
Mentoring provided by attending physicians	○	○	○	○	○
SELF-STUDY (NOT ASSIGNED)/self-directed learning by reading books and other printed materials	○	○	○	○	○
SELF-STUDY (NOT ASSIGNED)/self-directed learning using online resources (recorded videos, podcasts, etc)	○	○	○	○	○

Supplemental Online Material 1 *continued*

Q9 How frequently does your program assign or recommend the following types of educational resources outside traditional lectures?

	Almost Never	1-2 Times a Year	1-2 Times a Month	1-2 Times a Week	3+ Times a Week
Podcasts	○	○	○	○	○
Recorded lectures	○	○	○	○	○
Textbooks or online reading materials	○	○	○	○	○
YouTube videos	○	○	○	○	○
Other	○	○	○	○	○

Skip To: Q11 If response to – How frequently does your program assign or recommend the following types of educational resources outside traditional lectures? **– Other = Almost Never**

Q10 If your program assigns or recommends any other educational resources, please specify:

_____
_____
_____
_____
_____

Q11 How frequently do you personally use the following educational resources for your academic learning beyond your program's recommendations?

	Almost Never	1-2 Times a Year	1-2 Times a Month	1-2 Times a Week	3+ Times a Week
Podcasts	○	○	○	○	○
Recorded lectures	○	○	○	○	○
Textbooks or online reading materials	○	○	○	○	○
Youtube videos	○	○	○	○	○
Other	○	○	○	○	○

Supplemental Online Material 1 *continued*

Skip To: Q13 If response to – How frequently do you personally use the following educational resources for your academic learning beyond your program's recommendations? **– Other = Almost Never**

Q12 If you personally use any other educational resources, please specify:

_____

_____

Q13 Which of the following is the most beneficial for your academic learning outside the formal curriculum?

○   Podcasts

○   Recorded lectures

○   Textbooks

○   YouTube videos

○   Other (Please specify) _____

Q14 If you SELF-STUDY (NOT ASSIGNED) with podcasts, how do you choose which podcast to listen to at a given time (select all that apply)?

☐   Prior to a complex case (look up and review relevant podcasts)

☐   After a complex case (look up and review relevant podcasts)

☐   After a formal didactic to complement the content

☐   Prior to a test to review complex topics

☐   View podcasts as textbook supplement

☐   Randomly look up podcasts based on topics of interest

☐   Other (Please specify) _____

Q15 Which of the following do you prefer?

○   Audio podcast

○   Video podcast

○   No preference

Supplemental Online Material 1 *continued*

Q16 What length do you prefer your podcast episodes?

○   5-15 minutes

○   16-30 minutes

○   31-45 minutes

○   46-60 minutes

○   No preference

Q17 What are the reasons that you prefer podcasts (select all that apply)?

☐   Accessible (wherever/whenever)

☐   Better knowledge retention (when learned from podcast)

☐   Engaging (ability to select based on relevance and interest)

☐   Multitasking (ability listen to while doing other things, i.e. working out, commuting, etc)

☐   Self-pace (ability to pause/rewind and view multiple times)

☐   Other (please specify) _____

Q18 Which of the following podcasts do you listen to (choose all that apply)?

☐   OpenAnesthesia

☐   ACCRAC (Anesthesia and Critical Care Reviews and Commentary)

☐   Emcrit (Emergency Medicine and Critical Care)

☐   Ether

☐   Other (Please specify) _____

Supplemental Online Material 1 *continued*

Q19 Please rank the following podcasts in terms of usefulness for your learning. Please drag the most useful to the top, the second most useful to the second spot from the top, etc).

_____ OpenAnesthesia
_____ ACCRAC (Anesthesia and Critical Care Reviews and Commentary)
_____ Emcrit (Emergency Medicine and Critical Care)
_____ Ether
_____ Other (please specify)

Supplemental Online Material 2

Supplemental Online Material 2

Program Director Survey—Anesthesiology

Introduction

Q1 Dear Participant,
You are invited to participate in this survey (with Johns Hopkins IRB ID: IRB00130857) because you have been identified as a Program Director for an anesthesiology residency in the United States. The purpose of this survey is to seek your feedback about the ways in which residents learn within a formal educational program as well as through a self-directed learning beyond the curriculum provided by the program.
Your participation in this survey is voluntary. You may choose not to participate. If you decide to participate in this survey, you may withdraw at any time. Below is a link to the online survey. This survey is completely anonymous. Responses will be reported in an aggregated format. The survey is brief, and you should be able to complete it within 5 minutes.
We really appreciate your willingness to participate and value your feedback. Our hope is that this will provide us with some insight into residents' preferred learning modalities in the digital age.
Your completion of this survey will serve as your consent to be in this research study.

Demographics

Q2 How long have you been a program director?
▼ Select one ... [Listing included: 1 year; 2 years; 3 years; 4 years; 5 years; 6 years; 7 years; 8 years; 9 years; 10 years; 11 years; 12 years; 13 years; 14 years; 15 years; 16 years; 17 years; 18 years; 19 years; 20 years or more]

Q3 What is your gender?

○ Male

○ Female

Q4 How many residents are in your program (total approved positions)?
_____

Q5 Where is your institution located?
▼ Select one ... [Listing included: all states in the United States]

Supplemental Online Material 2 *continued*

Q6 With what type of institution are you affiliated?

○　　University-based

○　　Community-based/university-affiliated

○　　Military-based

○　　Other (Please specify) _____

Q7 To what extent do you think your residents utilize the following for their learning?

	To a Very Large Extent	To a Large Extent	To a Moderate Extent	To a Small Extent	To a Very Small Extent
Traditional didactic lectures provided by the program	○	○	○	○	○
Reading printed or online materials ASSIGNED by the program	○	○	○	○	○
Watching/listening to ASSIGNED online resources (recorded videos, podcasts, etc)	○	○	○	○	○
Scheduled simulation sessions / hands-on workshops	○	○	○	○	○
At the bedside during clinical rotations	○	○	○	○	○
Mentoring provided by attending physicians	○	○	○	○	○
SELF-STUDY (NOT ASSIGNED) / self-directed learning by reading books and other printed materials	○	○	○	○	○
SELF-STUDY (NOT ASSIGNED) / self-directed learning using online resources (recorded videos, podcasts, etc)	○	○	○	○	○

Supplemental Online Material 2 *continued*

Q8 How frequently do you assign or recommend the following types of educational resources outside traditional lectures?

	Almost Never	1-2 Times a Year	1-2 Times a Month	1-2 Times a Week	3+ Times a Week
Podcasts	○	○	○	○	○
Recorded lectures	○	○	○	○	○
Textbooks or online reading materials	○	○	○	○	○
YouTube videos	○	○	○	○	○
Other	○	○	○	○	○

Skip To: Q10 If response to -- How frequently do you assign or recommend the following types of educational resources outside traditional lectures? – **Other = Almost Never**

Q9 If you assign or recommend any other resources, please specify here:

_____

_____

Q10 How frequently do you think the residents personally use the following educational resources for their academic learning beyond the program's recommendations?

	Almost Never	1-2 Times a Year	1-2 Times a Month	1-2 Times a Week	3+ Times a Week
Podcasts	○	○	○	○	○
Recorded lectures	○	○	○	○	○
Textbooks or online reading materials	○	○	○	○	○
YouTube videos	○	○	○	○	○
Other	○	○	○	○	○

Skip To: Q12 If response to -- How frequently do you think the residents personally use the following educational resources for their academic learning beyond the program's recommendations? – **Other = Almost Never**

Supplemental Online Material 2 *continued*

Q11 If you think that residents use any other educational resources beyond the program's recommendations, please specify:
_____
_____

Q12 Which of the following do you think the residents find most beneficial for their academic learning outside the formal curriculum?

○   Podcasts

○   Recorded lectures

○   Textbooks

○   YouTube videos

○   Other (Please specify) _____

Q13 Which of the following podcasts, if any, do you recommend to your residents (choose all that apply)?

☐   OpenAnesthesia

☐   ACCRAC (Anesthesia and Critical Care Reviews and Commentary)

☐   Emcrit (Emergency Medicine and Critical Care)

☐   Ether

☐   Other (Please specify) _____

Supplemental Online Material 3

Supplemental Online Material 3

Resident ranking of the podcasts in terms of usefulness for their learning

Podcast	Ranked 1st		Ranked 2nd		Ranked 3rd		Ranked 4th		Ranked 5th		Total
	%	n	%	n	%	n	%	n	%	n	
Anesthesia and Critical Care Reviews and Commentary	70.7	229	17.6	57	9.6	31	1.9	6	0.3	1	324
Open Anesthesia	24.7	80	54.6	177	16.1	52	4.0	13	0.6	2	324
Emergency Medicine and Critical Care	2.2	7	19.1	62	56.8	184	19.4	63	2.5	8	324
Ether	0.3	1	6.8	22	13.9	45	71.0	230	8.0	26	324
Other	2.1	7	1.9	6	3.7	12	3.7	12	88.6	287	324