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Brief Report

Resident Engagement With a Web- and App-based Journal Club Curriculum Utilizing Email and Text Notifications

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Introduction

Recently, there has been a push for increased asynchronous and online learning for medical education, often as part of a flipped classroom model.[1,2] High engagement from learners is important for success of these models.

Ten years ago, more than half of medical trainees reported using medical mobile apps; more recently, almost 60% of anesthesia providers reported using medical apps weekly or more frequently.[3,4] In some instances, app-based interactions may provide more participation than email-based interactions.[5] It is also not fully clear whether using prompts by email compared with text promotes different levels of engagement.

Our overall goal is to increase engagement with our educational resources. We sought to investigate (1) if there were higher levels of engagement with an online curriculum using notifications of weekly curricular content sent via email as compared with via text, and (2) if there were higher levels of engagement with the mobile app or website format.

Materials and Methods

This prospective cohort study received institutional review board approval for exempt status with a waiver of documentation of informed consent by the Committee on Clinical Investigations at Beth Israel Deaconess Medical Center.

Curriculum

Using Kern's 6-step approach to curriculum development, we created a curriculum to increase evidence-based teaching and intraoperative discussion among trainees and faculty through a structured topic outline, an online asynchronous Journal Club, and other relevant resources to facilitate discussion of the topics.[6] This 1-year curriculum was designed and implemented for anesthesiology residents (postgraduate years [PGYs] 2-4) in our department (54 residents at the time of the study) and covered topics foundational to anesthesia in order to have more clinical relevance. It consisted of a cache of weekly primary and supplemental literature posted on our department's Moodle (Moodle Pty Ltd) learning management system (LMS). The articles were separated by weekly topics and supplemented with links to educational resources related to the respective topics for background information. The materials were accessible through the website with a browser or through the complimentary mobile app developed by Moodle. When opened on the app, journal articles and other documents opened directly in the app in full screen, whereas links to external resources opened in the device's default browser.

The curriculum was designed to begin in July (the beginning of the academic year) and end the following year in June (the end of the academic year). The first iteration began on July 24, 2020, and ended on June 30, 2021. Before this first iteration started, we piloted the curriculum for approximately 3 months at the end of the prior academic year (April 2, 2020, to June 27, 2020). Before and during this pilot, residents and faculty were sent instructions on how to install and set up the app. After the pilot, new residents and faculty were sent these instructions via email upon hire; new residents were also informed about the app during their orientation in early July 2020. Although residents were sent these instructions and were able to ask questions to the education administrative staff if they had any problems with the app, we did not force every resident to install the app because we did not want to influence their natural behavior and supported their individual preferences. For that same reason, we did not confirm whether all residents had smartphones, but they did all have mobile phones capable of receiving text messages. Although we did not confirm the former, it was highly likely that they all did have smartphones because our residency program uses various apps for educational activities like polling during lectures.

Throughout the curriculum, residents and faculty were notified each week on Friday in the late afternoon/early evening, Saturday during the day, or Sunday during the day (when most residents were not preoccupied with clinical duties) about the subsequent week's topic, with some weeks skipped because of holidays and exams. In

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the week 1 (July 24, 2020, to July 30, 2020) notification, the author who led the design and implementation of the curriculum (D.P.W.) introduced the curriculum to both residents and faculty; in addition, residents were informed of the study during their orientation before the start of the curriculum. Weekly notifications were sent to residents via email for weeks 1-10 (July 24, 2020, to October 1, 2020), text for weeks 11-20 (October 2, 2020, to December 10, 2020), then email for the remaining weeks (weeks 21-49 [December 11, 2020, to June 30, 2021]). Because we were unsure if resident engagement with the curriculum would be affected by the time of year, we performed our study to compare email versus text notifications toward the beginning of the year when engagement with our other educational activities tends to be higher. We returned to email notifications for the rest of the year because (1) email notifications were the original notification method for the curriculum, and (2) this setup gave us the opportunity to perform a secondary analysis to determine if time of year had any effect on resident engagement with the curriculum. Weekly notifications for faculty were sent via email for the whole curriculum. The timing of the notifications varied based on the availability of the authors who implemented the curriculum (D.P.W. and V.T.W.) and not based on the notification method (text or email). Email notifications for both residents and faculty included the week number, the topic, a link to the topic's materials on the website, and a link to the topic's materials on the app. Text notifications for residents included the topic and only a link to the topic's materials on the app.

Statistical Analysis

The department's Moodle LMS provides logs of individual user interactions for each course in the system, such as when a user downloads specific files, views or creates certain forum posts, or views links to other websites. These logs include the date and time of the interaction as well as the method of interaction (website vs app). After removing logs of administrative interactions, such as when materials were uploaded to the LMS, as well as faculty interactions, we analyzed each of the following with a Mann-Whitney *U* test using Stata/Special Edition 17.0 (StataCorp LP):

1. The weekly numbers of interactions when email notifications were sent (weeks 1-10 and weeks 21-49) compared with when text notifications were sent (weeks 11-20)
2. The weekly numbers of interactions via the app compared with via the website throughout the whole curriculum (weeks 1-49)
3. The weekly numbers of interactions when email notifications were sent before text notifications were used (weeks 1-10) compared with after text notifications were used (weeks 21-49)

The first 2 tests were our primary analysis. The third test was a secondary analysis to assess if time of year was a possible confounder for any differences detected in the first test. Because of multiple (2) comparisons for our primary analysis, we applied a Bonferroni correction and considered a P value of $< .025$ to be significant. For our secondary analysis, we considered a P value of $< .05$ to be significant. Numbers of interactions are summarized as median (interquartile range [IQR]).

Results

Thirty-eight of the 54 residents (70.4%; Table 1) interacted with the online Journal Club at least once throughout the study (17 PGY-2 residents, 10 PGY-3 residents, and 11 PGY-4 residents). There were a total of 892 interactions with the online Journal Club during the study period with 836 interactions (94%) via the website and 56 interactions (6%) via the app. Of these 892 interactions, 684 (77%) were viewing journal articles, 126 (14%) were viewing or posting forum posts, and 82 (9%) were accessing external links/resources (Figure 1).

The overall median weekly number of interactions was 10 (5.5-24.0). The weekly numbers of interactions with email notifications (median [IQR]: 13 [7-28]) were significantly higher than with text notifications (median [IQR]: 6 [4-8]) (P = .023, Figure 2). The weekly numbers of interactions via the website (median [IQR]: 9 [4-24]) were significantly higher than via the app (median [IQR]: 0 [0-1]) ($P < .001$, Figure 3). The weekly numbers of interactions for weeks 1-10 (median [IQR]: 19.5 [11-43]) were not significantly different than for weeks 21-49 (median [IQR]: 10 [3-28]) (P = .086).

Discussion

Resident engagement with our curriculum was higher when email notifications were used compared with text notifications. In our secondary analysis, we did not detect differences in resident engagement between earlier in the year and later in the year when residents were notified of the content via email, which suggests that change in engagement over time was not a likely confounder in the difference between notification types. Engagement was higher with the website to access the content than through the app.

Texting has been shown to facilitate engagement in various learning environments.[7] In one study, text notifications increased compliance with Accreditation Council for Graduate Medical Education duty hour compliance documentation.[8] Our experience did not show increased engagement with text messaging compared with email and demonstrated that email notifications are not the same as text notifications for our curriculum. This was possibly because the content of our curriculum (journal articles and links to online lectures and podcasts) was easier to go through and annotate via the website as opposed to using the app on a smartphone. Also, if consumption of the content will take longer than the available time when the message is accessed, the content may not be accessed immediately and may ultimately not be accessed at all. It is possible that when residents received the text notifications, they read the messages but did not have time to access the materials at that time and did not go back to access them later. In contrast, email notifications, along with the corresponding materials, can be reviewed at the residents' convenience (when they had time). Our differing results could also be related to when the notifications were received. One study suggests that residents engage in online curricula largely during

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the evening or night hours and largely when they are not scheduled for clinical work.[9] It could be possible that if the text notifications were received during clinical work hours, the residents were less likely to access the material as a result of that reminder. For example, this was likely the case for residents working in surge units due to subsequent waves of Coronavirus disease 2019 (COVID-19) even though caring for COVID-19 patients had become more routine after the initial wave. To accommodate these situations, future studies may consider sending multiple text notifications for each topic, such as one to advertise the topic and another in the evening as a reminder, which may result in more engagement. In addition, the differing results could potentially be influenced by differing interest levels on the particular topics for each week.

In one study on engagement with review questions from a general surgery educational database, more total residents interacted with the platform and did more questions on average with the app-based version compared with receiving questions via email.[5] Another study showed that app-based learning modules received higher subjective learner satisfaction ratings despite having poorer performance on medical reasoning questions compared with a traditional e-learning module.[10] For our curriculum, engagement with the website was overwhelmingly more than with the app. It is possible that the website was more user-friendly than the app or that our residents at the time of the study were biased toward reviewing materials on a computer rather than on a smartphone. The higher engagement on the website may also be related to more learners in general preferring to read journal articles and complete the online lectures and podcasts on a larger screen through the website rather than on a smaller screen through the app. It is also possible that an app may create more engagement with content that can be completed in a few minutes, such as review questions, as opposed to content that takes longer to complete, such as reading an article. Although accessing online educational materials through both a website and app requires time to go through the materials and reliable Internet access, additional barriers to accessing materials on a website include the need to log into the site each time it is accessed, browser compatibility, and (assuming the learner is not accessing the website through a mobile device) the need for a computer, which residents do not always have readily available. Meanwhile, although an app usually keeps users logged in, allows users to access materials directly in the app, and is readily available on users' mobile devices, apps also have additional barriers to accessing educational materials including smaller screens that may make reading/viewing the materials more difficult, the constant need for users to install updates, and the difficulty in downloading and storing large files directly on the device for later viewing. Different notification methods and platforms may not uniformly encourage higher or lower engagement and may be dependent on timing, curricula, or other unknown factors.

Because this was a single-center cohort, these results may not apply to every training program. Further research should include multiple institutions to increase the sample size and assess the generalizability of our results. Future studies should also randomize residents between email and text notifications to further analyze the effects of notification methods on resident engagement. These studies should also assess whether particular topics are associated with higher interest and engagement. Moreover, future research should better define engagement with the curriculum. For the purpose of this current study, we counted all types of interactions as equal engagement with the curriculum, but some interactions, such as posting or responding to a discussion point on a forum, likely should be considered as higher engagement than other interactions such as just reading a journal article. In addition, learners should be surveyed to determine their impressions on this experience. Finally, this curricular approach should be tested with different content, such as just-in-time teaching materials, to assess whether content type influences resident engagement. It also would be valuable to find the optimal type(s) of prompts needed to increase learner engagement for specific learning skills/behaviors so that those types of prompts can be used to increase engagement for those skills/behaviors.

Conclusions

Although mobile technology may increase engagement and participation for some educational resources, learners may prefer accessing others through more conventional methods. When deciding to use mobile technology in education, it is important to first determine if it is appropriate for the content and audience. Specifically with asynchronous online curricula for residents, we recommend discussing with residents what the content will be and then surveying them to determine how and when they want to be notified about the content and how they plan to access the materials. Based on this preliminary assessment, educators can design and implement curricula with the appropriate technology that optimizes resident engagement.

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Abstract

Background: High learner engagement is important for the success of asynchronous and online learning for graduate medical education. Medical trainees have recently reported using medical mobile apps. App-based interactions may provide more participation than email-based interactions. We sought to investigate (1) if there were higher levels of engagement with an online curriculum using notifications sent via email as compared with via text, and (2) if there were higher levels of engagement with the mobile app or website format.

Methods: We implemented an online Journal Club curriculum with weekly topics for anesthesiology residents (postgraduate years 2-4) from July 2020 to June 2021. Weekly notifications were sent to residents via email for weeks 1-10, text for weeks 11-20, then email for weeks 21-49. Based on activity logs, we compared (1) the weekly numbers of interactions when email notifications were sent with the weekly numbers of interactions when text notifications were sent, and (2) the weekly numbers of interactions via the app with the weekly numbers of interactions via the website.

Results: Thirty-eight of the 54 anesthesiology residents in our department at the time of the study (70.4%) interacted with the online Journal Club at least once throughout the study. The weekly numbers of interactions with email notifications (median [interquartile range (IQR)]: 13 [7-28]) were significantly higher than with text notifications (median [IQR]: 6 [4-8]) ($P = .023$). The weekly numbers of interactions via the website (median [IQR]: 9 [4-24]) were significantly higher than via the app (median [IQR]: 0 [0-1]) ($P < .001$).

Conclusions: Although mobile technology may increase engagement and participation for some educational resources, learners may prefer accessing others through more conventional methods.

Keywords: Graduate medical education, mobile technology

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Figures

Figure 1. *Types of interactions. Of the 892 total interactions, 684 (77%) were viewing journal articles, 126 (14%) were viewing or posting forum posts, and 82 (9%) were accessing external links/resources.*

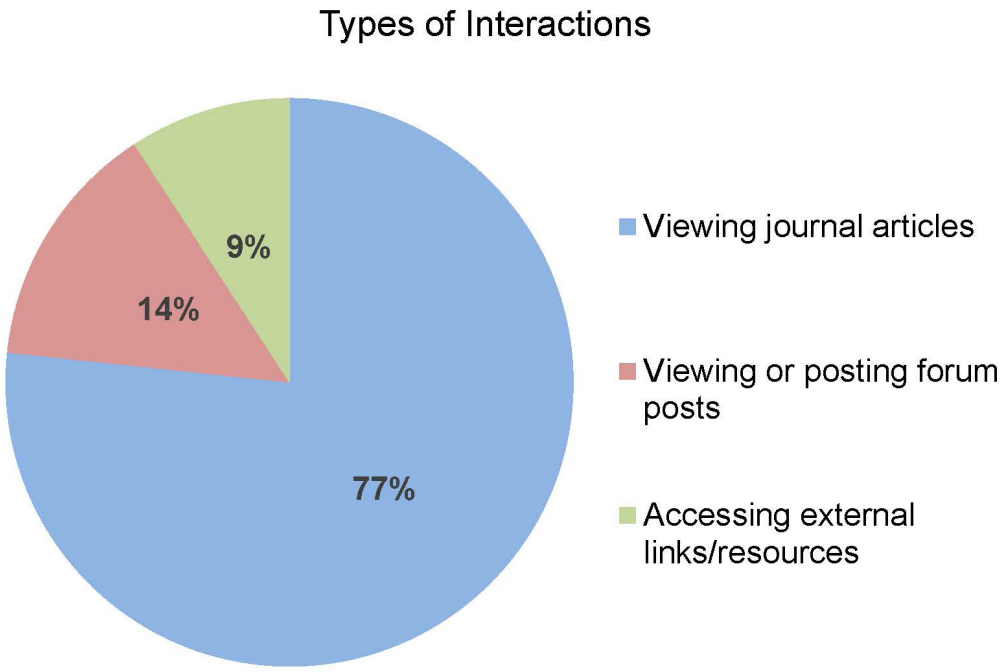

Figure 2. *Notification methods: email versus text. The weekly numbers of interactions with email notifications (median [IQR]: 13 [7-28]) were significantly higher than the weekly numbers of interactions with text notifications (median [IQR]: 6 [4-8]) (*P = .023).

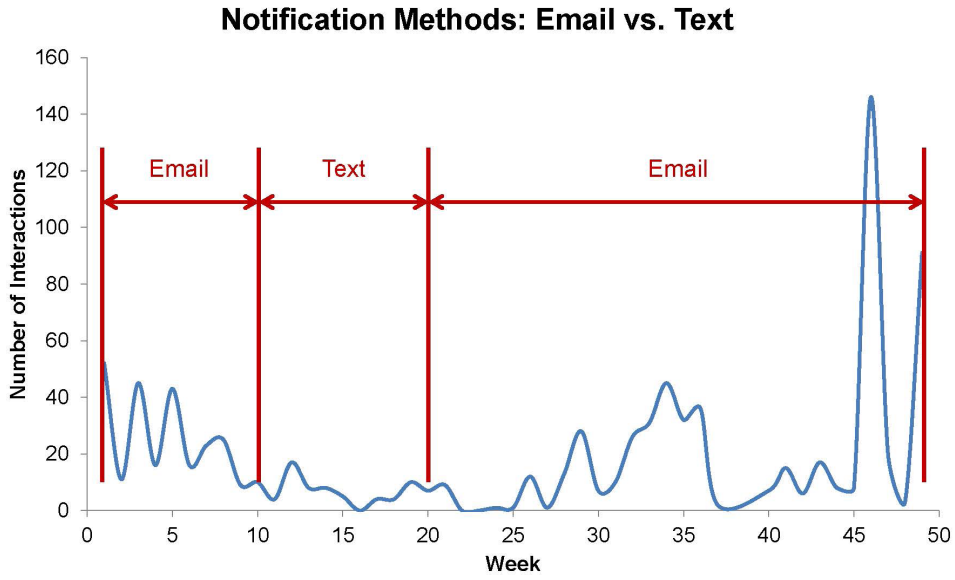

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Figure 3. *Methods of interaction: app versus website. The weekly numbers of interactions via the website (median [IQR]: 9 [4-24]) were significantly higher than the weekly numbers of interactions via the app (median [IQR]: 0 [0-1]) (*P < .001*).*

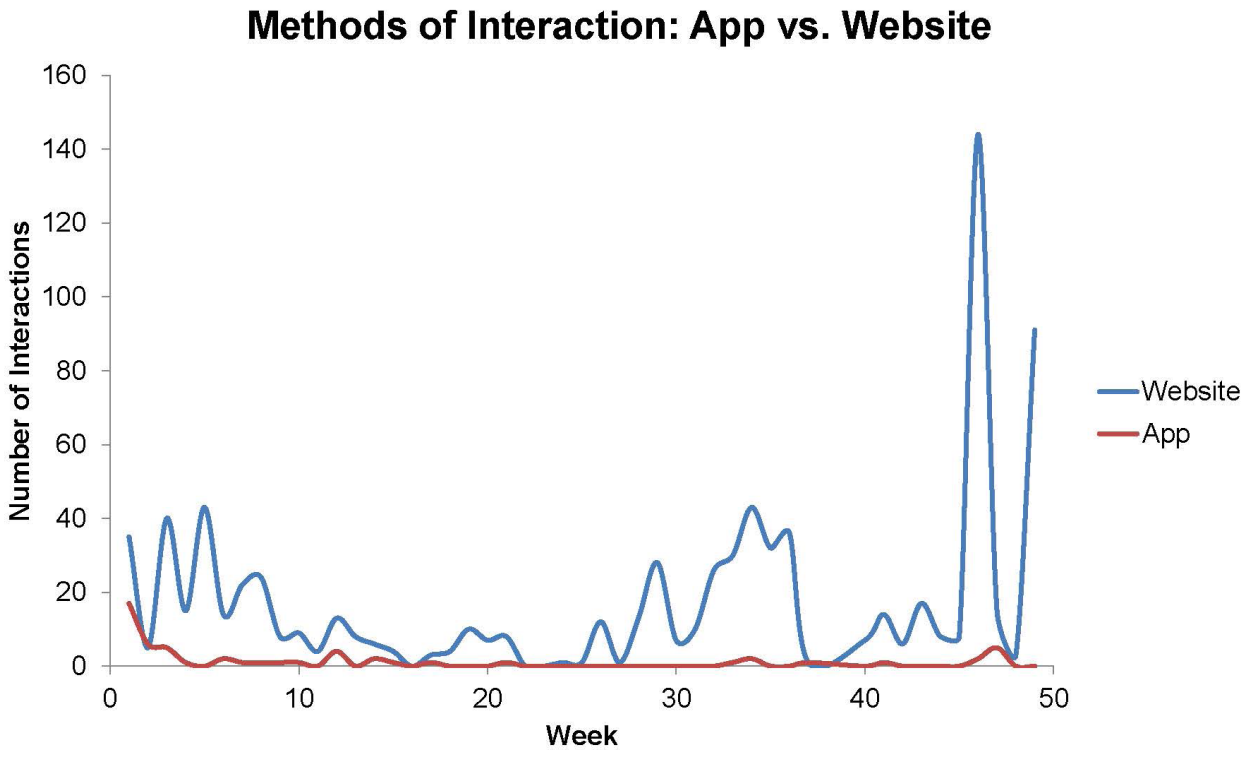

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Table

Table 1. *Postgraduate Year Levels of Participants*

Postgraduate Year	Number of Residents
2	17
3	10
4	11