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Revitalizing Physiology Education: Integrating Notability and Video-Based Learning

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Abstract: This article explores an inventive approach to teaching physiology that blends the use of the Notability app on the iPad with video-based learning to visually explain intricate physiological concepts in real time. The core idea is to offer students a more dynamic and interactive way to comprehend complex physiological concepts during review sessions and outside of class. Students actively participated by creating their own drawings and asking questions throughout each review session. At the end of these review sessions, students could obtain a copy of the Notability file from the professor. Additionally, a series of concise instructional videos were developed, where the professor explained physiological concepts by creating a diagram using Notability while simultaneously explaining the specific physiological process. These videos were then posted on Canvas, which allowed students the opportunity to review them at their convenience. Students self-reported increased understanding of the material. To gauge the effectiveness of this teaching approach, exam scores were analyzed. Students scored higher on questions related to topics with associated Notability videos compared to those without. These findings provide evidence that this novel teaching method improves student engagement and comprehension in physiology courses by leveraging technology, active participation, and visual aids to create an enriched learning experience. Ultimately, this helped improve student performance and understanding of complex physiological concepts.

Keywords: education, flipped classroom, technology, engagement

In recent years, the availability of educational technology for teachers and students has grown exponentially. These resources are especially important to educators who utilize flipped classrooms. Flipped classrooms require students to initiate the learning process before attending class, allowing class time to focus on answering questions and reinforcing preclass material. Although many technologies support this approach, this article will focus on the benefits of PlayPosit and Notability for students before, during, and after class.

To maximize in-class instruction, teachers often require students to watch videos prior to attending class, a trend accelerated by the recent COVID-19 pandemic (1). Often these preclass videos are full 50-min lectures. Anecdotally, students have expressed frustration with these videos for two primary reasons: the length (2, 3) and the inability to assess their knowledge (4).

Afifiy (2020) found that watching longer videos (e.g., a 50-min video without breaks) leads to increased cognitive load and decreased retention in students. This is likely because shorter videos focus on essential information, eliminating unnecessary details. Shorter videos help students use their time more efficiently by targeting specific concepts. Additionally, a 50-min recorded video often covers more material than a typical class session. For example, in a traditional 50-min lecture, the instructor is unlikely to talk the entire time, as students might ask clarifying questions.

Regardless of video length, students might struggle assessing their knowledge on specific topics. This challenge can discourage them from watching preclass videos, especially longer ones, as they might feel it is pointless without a way to gauge what they do or do not know, and without the ability to ask the instructor for real-time help.

One way to address both challenges is by creating shorter videos (e.g., requiring students to watch 2 or 3 shorter videos) with embedded questions (5, 6). Breaking a long lecture into manageable pieces makes students feel less overwhelmed and allows them to focus on specific topics to review. PlayPosit (https://go.playposit.com/) allows teachers to embed questions into videos, whether sourced from platforms such as YouTube or created specifically for their classes. These embedded questions encourage student engagement with the material and helps them assess their understanding.

During the spring 2024 semester, students in an introductory human physiology class with 270 students were assigned to watch 2 or 3 short videos (8–12 min each) before each class. These videos featured the instructor speaking while presenting PowerPoint slides. The Indiana University Faculty Media Group assisted in recording and editing these videos, which were then embedded with 3–5 questions using PlayPosit software.

At the end of the semester, a survey was administered to these students. Of the 209 students who completed the survey, 93% stated these videos were very helpful or somewhat helpful. Students reported these videos improved class preparation, allowed for increased engagement due to reduced need for extensive note-taking, optimized class time for reinforcement, and provided flexibility in their learning process.

Notability (https://notability.com/) is an app available on tablets, which can be useful in large classroom settings. This app allows users to create, save, and annotate drawings directly on their tablets. Additionally, users can record audio to capture their thoughts while they draw. Other similar apps include GoodNotes, Sketchbook, and AppleNotes. These apps can be powerful tools used inside and outside of the classroom.

One of the biggest challenges in large classrooms is the difficulty in illustrating concepts and projecting them in a manner that all students can easily see. Most large classrooms are equipped with the ability to project images from a computer onto a large screen, while also having a chalkboard or whiteboard available for use. Although most students can see projected images, many cannot see what is being written on the chalkboard/whiteboard owing to distance or layout. Using a tablet with a drawing app and projector allows teachers to project key points they are explaining visually and verbally (7, 8). Educators can use apps such as Notability, connecting their tablet to the classroom projector so all students can easily see what is being written, while simultaneously recording the visual and spoken explanation. This drawing app can replace or complement traditional lecture or PowerPoint slides. Instructors can then use premade drawings or create from scratch during the lesson to enhance student learning. These drawings and associated recordings can then be shared with students as an additional study resource.

Outside of class, the audio recording function of Notability can be used for screencasting, which involves recording a computer screen along with audio to create a video. Screencasting enables educators to explain processes while drawing them, similar to Khan Academy videos. One benefit of using these apps is that they require the teacher to slow down, as drawing and talking quickly is challenging. Anecdotally, students appreciated the slower pace as it created an environment more conducive to note-taking. Teachers can also combine these screencasts with PlayPosit, providing an additional method for students to assess their understanding.

Students from the same class were provided several short (i.e., 3–12 min) videos where the instructor reviewed a single physiological concept (e.g., cross-bridge cycling, synapse, cardiac cycle). In each video, the instructor drew a process while simultaneously explaining it. According to the survey, 97% of respondents stated the Notability videos were somewhat helpful or very helpful. Students stated these videos were beneficial because they:

- Allowed for better visualization of topics, making it easier to connect concepts

- Helped improve retention
- Combined multiple types of learning (e.g., visual and auditory)

The third exam of the semester focused exclusively on the cardiovascular system and, in the spring 2024 semester, included eight Notability videos for students to review. Exam 3 scores in spring 2024 (76.3% ± 15.5%) when students had access to Notability videos trended higher compared to fall 2023 scores (73.9% ± 16.2%, $p = .059$) when students did not have Notability videos. During spring 2024, Exam 3 included 39 questions, with students scoring higher on the 15 questions that covered material accompanied by Notability screencasts (80.7% ± 17.4%) than on the 24 questions without screencasts (73.6% ± 16.6%, $p < .001$). These findings suggest students retained information better when it was reinforced through Notability screencasts.

There are numerous technologies available to educators in large-enrollment classrooms. The integration of PlayPosit and Notability is one example of how technology can be leveraged to enhance student learning. Used individually or together, these tools facilitate better engagement, understanding, and retention. PlayPosit's interactive videos break down content into manageable pieces and provide instant feedback, and Notability's drawing capabilities enrich the learning experience through combined verbal and visual explanations. The positive feedback from students highlights the effectiveness of these technologies in improving class preparation, engagement, and overall learning flexibility. As educational resources continue to evolve, incorporating such innovative tools can significantly improve teaching practices and student outcomes in large-classroom settings.

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