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Independent Study Projects

Title

Streamlining neuroanatomy : a video guided tour of the nervous system by Abd-Elrahman Hassan

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Streamlining Neuroanatomy: A Video Guided Tour of the Nervous System by Abd-elrahman Hassan

ABSTRACT:

As the use of technology continues to increase in medical education, the utilization of video as a modality becomes apparent. This study is aimed at investigating the addition of video-guided anatomical discussions for the Mind, Brain and Behavior I (MBBI) course and its impact on student performance, specifically in the lab component, but also in the course as a whole. A series of videos were created that outlined a framework for how to approach neuroanatomy and then were provided on an online portal. An online survey was also provided to be used to assess use and provide a space for students to comment on the videos. Two successive classes (class of 2019 and 2020) were included in the data acquisition and analysis and compared with the class of 2018 (for which no videos existed). Performance was based on the mean score of each exam. “The class of 2020 (who had access to the videos) significantly outperformed the class of 2018 on the midterm and final (mean 85.0 +/- SD 11.1 vs. mean 86.9 +/- SD 9.3, $p = 0.05$) and (mean 87.9 +/- SD 7.9 vs. mean 90.5 +/- SD 6.1, $p = 0.003$), respectively. There was a trend toward improvement in the final exam between the class of 2018 and class of 2019 (mean 87.9 +/- SD 7.9 vs. 89.1 +/- 6.2, $p = 0.31$). All other comparisons were not significant. Further investigation into section-specific improvements as well as improving access to videos would further improve the utility of the video series.

BACKGROUND:

Medical education has been through many phases and continues to adapt and improve upon its successors. The largest of changes arrived in the 1900's with the Flexner Report, which revolutionized the timeline and standardization of an education in medicine¹. With a pattern of two years in pre-clinical curricula followed by two years of clinical rotations, much success has been seen in the field. Given that the trend in medical education has shown an increasing amount of material necessary in the pre-clinical years without a comparable increase in the time dedicated to preclinical curricula, it comes to no surprise that the medical student population is in a unique position, particularly as a population that understands the importance of effective time utilization and management.

With the success of the new UCSD curriculum in giving students more time to study and digest material on their own, it makes sense that technologies that further facilitate students' abilities to learn at their own pace provide better outcomes and learning opportunities for students. Furthermore, we do not want to shy away, but instead move forward in using technology to improve the learning capabilities of future students, especially with video education having demonstrated a positive effect on pre-clinical achievement².

Currently, there are a myriad of additional medical education resources available in video format online, on such popular websites such as Khan Academy, MedCram, Online MedEd, Pathoma and more. There is a commercial trend towards providing high quality video instruction for medical students that has been adopted by many other clinical educators. It is likely that medical institutions can further improve the edification of their students by providing their own course-tailored video education³.

While attending a live lecture carries certain benefit, there is no lab lecture component for the Mind, Brain and Behavior course. Given the currently constricting schedule, providing videos for students is a worthwhile and time-efficient solution to aid in mastery of the neuroanatomy. By creating videos for focused and specific instruction, students cannot only review material, but master it in a shorter amount of time and with more ease. Having access to these videos would allow students to associate

concrete images to the anatomical structures, enhancing their learning of a key component of neurology. This endeavor further supports previous work that has shown the benefit of video education, specifically for anatomical work⁴.

The videos created in this project were designed to serve as an orientation to the layout of lab. The lab component is arranged in such a way that students are given the opportunity to explore and learn the neuroanatomy on their own. These videos were by no means aimed at replacing the time spent in the lab, but more so intended as an additional aid for the students. The goal was to allow students more autonomy over their time, with the hope that the time spent in lab would be more focused and yield greater benefits. With the ease in which students are able to view videos on computers, laptops, iPads and cellphones, this method of providing access to a key preview/review of material is an excellent way for students to take ownership of their learning. The addition of original artwork would, once again, better aid students in learning and understanding the neuroanatomy and further supplement the videos' instruction.

Most importantly, with MBB-I being a core block for MSI's, this set of instructional material was intended to provide not only an advantage for subsequent matriculating classes, but also an excellent piece of review material for MSII's before they move forward and tackle the rigors of MBB-II.

METHODS:

PHASE 1: Study Design

Step 1: Population

The population studied included all first-year medical students enrolled in the MBB I course for the classes of 2019 and 2020.

Step 2: Video Criteria and Disbursement

There was no cap on the number of videos that would be created, but instead the videos were intended to parallel the neuroanatomy labs that were best complimented by visual instruction. As far as the length of each video, there was also no set limit, but the intention was to balance duration with information to create a video that hit high yield topics in a timely manner.

The videos created were advertised to the class by the members of the ISP committee involved with this project, during their respective lectures. Students were directed to where to find the videos as well as encouraged to view them and fill out the surveys for each video. The instructors were instructed to emphasize that the videos are supplementary and only intended to aid in their study, but were not required pieces of education to utilize.

Step 3: Data Collection

Data for the classes of 2019 and 2020 were derived from the class scores on the lab final exam, course midterm exam, and course final exam. Both class' data were compared to the scores of the class of 2018. Statistical analysis in the form of a two-tailed t-test would be performed to look for any significant differences in mean scores between class of 2018 and class of 2019, and class of 2018 and class of 2020 respectively.

Additionally, the surveys created would be analyzed for percent response rate, and the free form section of the survey would be read over for additional feedback.

PHASE 2: Video Development

Step 1: Decide What Core Information Will Be Included in the Videos

The video team, which was composed of Jeffrey Gold, MD (committee chair), David Carlson (MS4) and I, met and discussed sections of the lab course that would be best aided by instructional videos. The sections on the somatosensory system, cortical structures and cross-sectional anatomy were found to be the most difficult for students to master and were thus chosen for inclusion in the video series. Thus, videos were developed for labs 1a – Introduction, 1b – The External Brain and CNS, 3 – Cerebrovascular System, 4a – Principles of Brain Cross Sectional Anatomy and 4b – Additional Principles of Brain Cross Sectional Anatomy.

Step 2: Create the Script for the Videos

Relevant sections from the MBB-I lab manual were discussed with the committee chair and rewritten to work alongside the planned video content, such that the script would mirror the video itself while highlighting the key learning objectives for that section of the lab. The key relationship between neuroanatomy structure and function was the underlying theme for creating the script.

Step 3: Finalize Video Layout

The script was edited and approved by the committee chair. Additional classmates from the class of 2018 were questioned in person on what they would have liked to have seen in a series of neuroanatomical videos, had they had access to such resources. The majority of responses demonstrated a request for including highlighting of anatomical structures, as well as demonstrating the same structure on numerous samples. The thoughts and ideas were well-received and, to the best of my ability in terms of filming, editing, and access to anatomical specimens, included in the final video layout.

Step 4: Create the Videos

Anatomical samples and appropriate after-hours access for filming were obtained through the MDL staff. The videos were filmed and edited over several weeks, with appropriate alterations made for time and content. These alterations included organizing video clips into the correct order, using voice overs, and trimming video length. Once complete, the videos were shown to the committee chair for final approval and then given to the UCSD School of Medicine IT department to upload to a secure online server for storage and Phase 3.

PHASE 3: Implementation

Step 1:

- In Winter Quarter of 2016 the videos became available the week prior to the labs
- Students were encouraged to use the videos before and after they attended the labs
- Surveys were created for students to take post lab sessions to assess for strengths and weaknesses of specific lab videos, specifically questioning when they viewed the videos (before attending lab or after), did they find the videos helpful and room for additional comments about the videos
- Surveys were created for students to take upon completion of MBB-I for comments on usage/effectiveness of videos throughout the block
- The implementation was set to run for two consecutive years

Step 2: Analysis

- Survey results were reviewed after two years and it was decided what changes (if any) could and should be made for subsequent years

PHASE 4: Evaluation of Project and Analysis of Data

Step 1: Obtain Data and Perform Statistics

The source of data for each class was obtained from Dr. Kritchevsky, Professor Emeritus of Neurosciences and the course director of the MBB course series. The format was in paper and was manually entered into an excel sheet for ease of statistical analysis. The lab final, course midterm, and course final exam scores for the classes of 2018, 2019 and 2020 all underwent the same processing. Two-tailed t-tests were performed with an alpha equal to 1 (confidence of 95%) and standard deviations for the scores were included in the final results.

Step 2: Review Surveys

Each associated video's survey was transferred from the Google Poll document created for the purpose, to an Excel sheet for ease of review. The response rates for each lab were then calculated and the free-form responses were reviewed for feedback.

Step 3: Completion of Project

- A write-up and summarization of findings and comment on steps to be taken that may further the MBB curriculum were completed.

RESULTS:

Implementation

As delineated in the methods section, the process for how the videos were to be incorporated into the course was discussed with the committee chair and was thought to be the best way to introduce the new material into the course. At the beginning of the course for the first-year medical students of the classes of 2019 and 2020, the instructors (Gold, Evans, Kritchevsky) instructed the class that a new video series was created to serve as a supplement to the neuroanatomy lab specifically, but also to the course as a whole. The emphasis was made that these videos were by no means meant to replace the course lectures or the neuroanatomy labs, but rather meant to serve as additional tools to help in learning and understanding the course material. Where to find the videos, which labs they were associated with, as well as the surveys that went along with each video were discussed. Additionally, advice regarding how to use the videos alongside the course as a supplement (e.g. if one has time or needs further clarification) was provided. Because the videos were intended to run for two consecutive years, no changes were made to the videos in between the two classes; however, before the start of the class of 2020, all surveys were cleared and links updated to allow for their continued use during the second year of the projects run.

Lab Exam

When comparing the lab exam scores between the class of 2018 (year without the supplemental videos) to class of 2019 and class of 2020 (years with supplemental videos), we found that each class achieved a mean score of at least 90% (90.6, 90.1 and 90.2, respectively). There was no significant

difference in the scores between class of 2018 and class of 2019 (mean 90.6 +/- SD 8.3 vs. mean 90.1 +/- SD 7.4, $p = 0.58$) or in scores between class of 2018 and class of 2020 (mean 90.6 +/- SD 8.3 vs. mean 90.2 +/- SD 6.3, $p = 0.66$), as shown in Figure 1.

Mid-term Exam

When comparing the mid-term exam scores between the class of 2018 and classes of 2019 and 2020, we find that each class achieved a mean score of at least 85% (85.0, 85.6 and 86.9, respectively.) There was no significant difference in the scores between class of 2018 and class of 2019 (mean 85 +/- SD 11.1 vs. mean 85.6 +/- SD 9.1, $p = 0.66$). However, a statistically significant difference was seen between the class of 2018 and class of 2020 (mean 85 +/- SD 11.1 vs. mean 86.9 +/- SD 9.3, $p = 0.05$).

Final Exam

When comparing the final exam scores between the class of 2018 and the classes of 2019 and 2020, we found that each class achieved a mean score of at least 87% (87.91, 89.1 and 90.5, respectively.) There was no significant difference in the scores between class of 2018 and class of 2019 (mean 87.9 +/- SD 7.9 vs. mean 89.1 +/- SD 6.2, $p = 0.31$). However, there was a statistically significant difference between class of 2018 and class of 2020 (mean 87.9 +/- SD 7.9 vs. mean 90.5 +/- SD 6.10, $p = 0.003$).

Survey Responses

As shown in Figure 2, the only surveys that were included in the final analysis were from the class of 2019. The class of 2020 did not have any survey results at the end of their course and therefore no data was available. The response rate started off high, but eventually dropped with Lab 1a, Lab 1b, Lab 3, Lab 4a, and Lab 4b, each having a response rate of 25% (32), 25% (30), 5% (7), 0.7% (1) and 0.7% (1), respectively. Additionally, as shown in Figure 2, for Lab 1a, Lab 1b, Lab 3, Lab 4a and Lab 4b, 78% (25) 93% (28), 71% (5), 100% (1) and 100% (1) students watched the videos before the lab and 21% (7), 7% (2), 29% (2), 100% (1) and 100% (1) watched the videos after the lab, respectively.

Regarding the comment section of the survey (Appendix), the responses ranged from generally positive (*I love how the video pauses to visually highlight or circle important things; Clear concise, seems to be high-yield; Extremely clear, elucidated what the main idea behind MBB lab is*) to more constructive (*I do think there could have been more detail; Having an additional camera angle to view smaller structures would be helpful*).

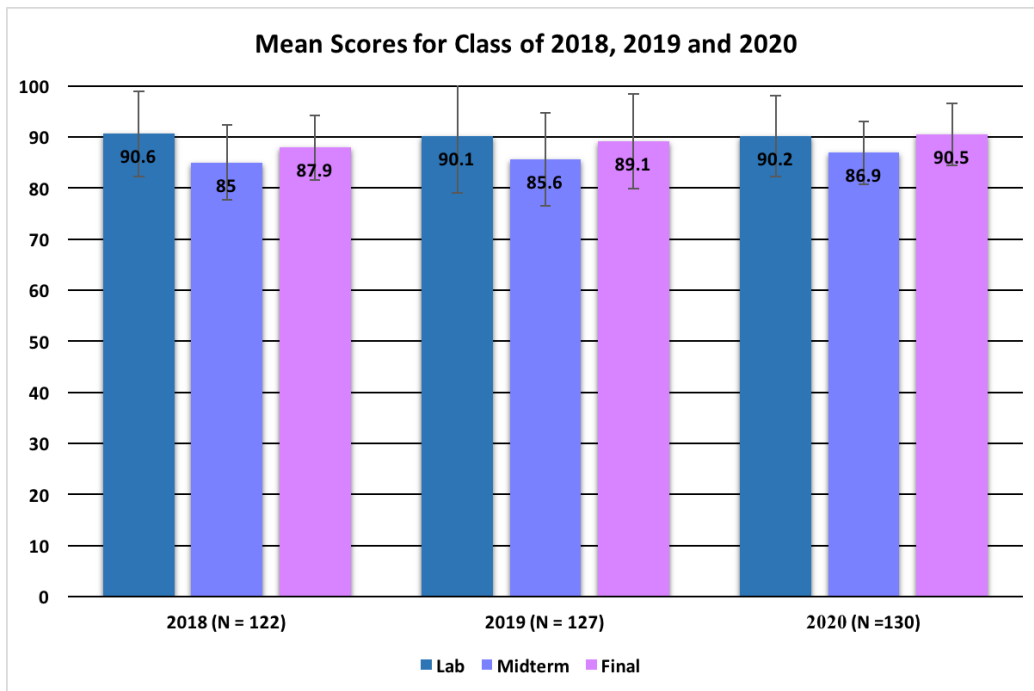


Figure 1: Mean Scores for Class of 2018, 2019 and 2020 (the error bars indicate standard deviation)

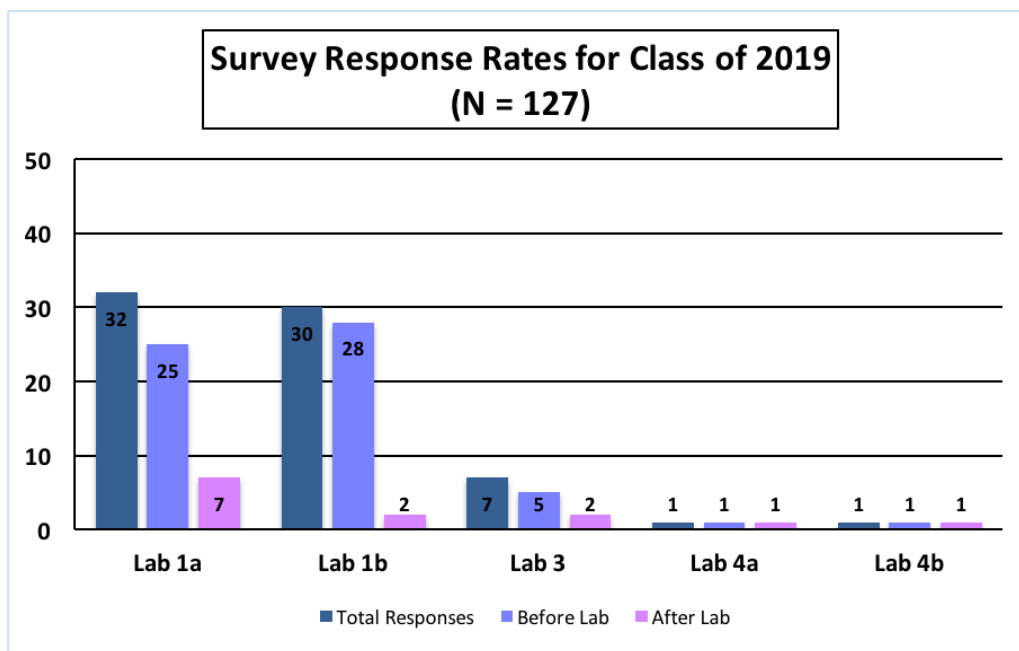


Figure 2: Survey Response Rates for Class of 2019

DISCUSSION:

The goal of this ISP was to supplement the neuroanatomy laboratory portion of the MBB course with videos that gave a cursory outline of actual anatomy and then focused on building a framework for how we use the neuroanatomy and the physical manifestations of a disease process to “find the lesion” in neurological disease.

With the exception of the midterm and final exams for the class of 2020, there was no statistically significant difference in scores between the two years in which the videos were run. Given this finding, further investigation was performed with the class of 2020 data, as there was a 0% response rate for the video polls. The initial conclusion was that the students were not made aware of the polls, but after polling for responses on the classes Facebook page, it appeared that the class as a whole did not utilize the videos in that year. Further investigation with students from the class of 2020 revealed that the videos, while still available, were difficult to find and access, which may explain the decreased response rate as well. While the difference in scores is commendable, it is unlikely due to the videos created. That being said, the main utility of these videos was supplemental, as discussed previously, but what may further explain the lack of responses and apparent under-utilization of the videos was the time between the two courses. In the first iteration for class of 2019, the author was very present within that class and also heavily pushed for lower classmen, many of whom were personal acquaintances, to use the videos. During the iteration of MBB for the class of 2020, the author was completing 3rd year clerkships and was thus much less present to actively encourage use of the videos.

During the first year of implementation, there was an increased amount of feedback from the students as well as support for the extra material provided. One of the considerations of the course is the already incredibly rich amount of information available within the syllabus as well as additional supplemental material. Additionally, students tend to do exceptionally well at baseline. The utilization of additional videos appeared to constitute a bottleneck of information for students. Granted, for those students who did find the time to use them, they were deemed useful and a worthwhile addition to the course, per the free response in the survey results. The course also has to cover a tremendous amount of material within 5 weeks, which may offer additional explanation for why the survey response rate declined, as it may have been easier to lessen utilization of supplemental videos in lieu of the course’s core material.

Another issue that may explain the decreasing number of poll results is the ever-evolving course organization. In an effort to continuously improve the course, the organization and content of lectures and labs often change between successive iterations. While this is helpful in creating a better course, having a more solid structure in which the videos could easily be implemented might improve their utilization. For example, some of the lab videos and associated surveys were renamed to reflect changes that were made to the organization of the lab. A possible solution to this issue could be creating a series of videos that are independent of the lab content and are instead used on case-by-case basis to teach basic neuroanatomy, which may be more appropriate to the philosophy of the course. The videos may also be utilized solely for remediation purposes, although the remediation rate for the course is historically small.

The analysis at the time of this report did not focus on specific sections of the course (e.g. somatosensory system, vestibular system, etc.), but instead took a global look at student performance in the course. Additional research should be performed looking at subsections of the exams to see if there is any change in scores on sections that were covered with the supplementary videos, which may lead to further development and creation of videos to address more specific topics within the course.

CONCLUSION:

In moving education forward, there seems to be a specific niche within a curriculum that would benefit from the addition of video instruction: namely, anatomical studies. Furthermore, video instruction is a particularly appropriate compliment to subject matter that requires additional materials in order for students to complete associated learning objectives successfully.

For Mind, Brain and Behavior, the videos appeared overall to be helpful to students, but only on a case-by-case basis. The course itself has been designed well enough to be the “complete package” in terms of neurological study. Although it cannot be concluded that any meaningful improvement in class mean scores was attributable to the videos, as the level of academic achievement within the course is already high, video instruction can and should remain a modality that is provided to students.

The hope is that additional courses will take advantage of the benefits provided by video instruction and continue to improve and build upon current educational methods, and that other courses will see the utility of designing videos specific to their course. While it may serve a daunting task to do such, the ever-increasing popularity of video education should be harnessed and implemented throughout the pre-clinical medical curriculum.

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b. Lab 1b: External Brain and CNS

Did You Find The Video Helpful?	When Did You Watch The Video	Comments and Suggestions
Yes	Before the lab	"I liked the pauses with the outlines of the structures being mentioned.
Yes	Before the lab	reading things offscreen or looking away from the camera can be a bit distracting"
Yes	Before the lab	
Yes	Before the lab	"I appreciated how the labeling and naming of the structures was
Yes	Before the lab	accompanied by a pause feature so that we could see the exact area being
Yes	Before the lab	referred to on video. Helpful!"
Yes	Before the lab	
Yes	Before the lab	"Thank you Abdul!"
Yes	Before the lab	
Yes	Before the lab	"I love how the video pauses to visually highlight or circle important things."
Yes	Before the lab	
Yes	Before the lab	"Thank you for putting this up as a resource!"
Yes	Before the lab	
Yes	Before the lab	"Is it possible to provide an alternate method of watching videos? Perhaps a
Yes	Before the lab	secret youtube channel? The video player on the webportal is fairly buggy for
Yes	Before the lab	me, keeps stopping, skipping or playing audio without video."
Yes	Before the lab	
Yes	Before the lab	"It was a little distracting to notice the speaker looking to the side of the
Yes	Before the lab	camera to read cue cards. However, I totally understand that is completely
Yes	Before the lab	necessary. Also, the way the speaker talks to us and to the camera is superb,
Yes	Before the lab	and the quality of this video is excellent. I really appreciate having these to
Yes	Before the lab	watch before the lab!!!"
Yes	Before the lab	
Yes	Before the lab	"Really well done and well spoken. The highlighting of structures was helpful
Yes	Before the lab	for me, as I haven't studies neuroanatomy before."
Yes	Before the lab	
Yes	After the lab	"Good job- I think having an additional angle when looking close up at the
Yes	Before the lab	brain may be helpful to focus on small, similar-colored structures (like CN VI vs
Yes	After the lab	backdrop). Nothing besides that! I really thought the yellow outlining was
Yes	Before the lab	helpful."
		"Video kept freezing a lot and reloading if I paused it while watching."
		"Great job!"
		"Clear, concise, seems to be high-yield - I really enjoyed and appreciated the
		clinical correlations that were included at the end of this video."
		"Very clear and good pace."
		"I think it was helpful, but I do think there could have been more detail given
		in the pre-lab video. The lab had many more "bold terms" than what was
		indicated on the video. I know the video is not supposed to be able to replace
		the lab or anything like that, but I think just including some of the anatomy
		that is more difficult to find in that particular lab would be more beneficial
		than just showing the easier ones (i.e. central sulcus...which isn't exactly easy
		to find either, but you get my point)"
		"I really liked the use of outlining and highlighting structures. Please keep this
		up! It makes all the difference when trying to learn the anatomy."
		"Maybe zoom in a little more. but this was really helpful THANKS!"

c. Lab 3. Cerebrovascular System

Did You Find The Video Helpful?	When Did You Watch The Video	Comments and Suggestions
Yes	Before the lab	"It was fantastic! I haven't gone to this lab yet, but I thought it was a great introduction to what we'll be seeing tomorrow. If anything, I wish it was a little longer, but I understand that students are more likely to watch it if it's kept between 3-5 minutes. Thanks Abdul!!"
Yes	Before the lab	
Yes	Before the lab	
Yes	Before the lab	
Yes	Before the lab	
Yes	After the lab	
Yes	After the lab	"This was super helpful thank you so much"
		"Abdul is great!!"
		"Very well explained and emphasized key parts of the vasculature of the brain. Thank You for this resource"
		"I forgot that these videos were posted after doing all of the online cases...I wish I watched it earlier! (we had difficulty locating our PICA, the rest was straight-forward). Note about following PComm was helpful!"
		"Thanks for the advice on tag and perspective on big picture of studying!"

d. Lab 4a. Principles of Cross Sectional Anatomy

No comments were obtained for this lab.

e. Lab 4b. Additional Principles of Cross Sectional Anatomy

No comments were obtained for this lab.