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EVALUATING THE UTILITY OF GROSS ANATOMY INSTRUCTIONAL VIDEOS IN DISSECTION HALL: A PILOT OBSERVATIONAL STUDY

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ABSTRACT

Introduction: Anatomy, being a highly visual and dynamic-experiential course, favours video based teaching to a larger extent. On the other hand, preparing a gross anatomy video is challenging, considering the cognitive load it imposes.

Aim: To investigate the utility and acceptance of video-based learning approach among the first year medical students and its optimal curricular implementation.

Materials and Methods: In this pilot initiative, we designed a two-stage revision method in head and neck regional anatomy teaching. To reinforce gross anatomy knowledge, we displayed the videos prepared by us in concordance with the learning objectives. We conducted a questionnaire based survey to determine the effects of these videos on anatomy learning. Descriptive statistical analysis was used to quantify the received responses.

Results: Out of 100 students, who gave feedback on voluntary basis, 48 students agreed and 24 strongly agreed that the videos were adequately representing the structures they have seen in the dissection hall. 40 students felt that displaying the structures along with description provided by the teacher after completion of dissection of that region, has affected their positive learning. 28 agreed and 21 strongly agreed that the videos helped them in repeating and reinforcing the structures. 79 students agreed that the quality of the video demonstrated were good to appreciate the structures and 91 students accepted to extend the video-based demonstration to other regions of gross Anatomy as well.

Conclusion: Incorporating videos would contribute to the success of a subset of students by reinforcing gross anatomy learning. We suggest that developing user friendly videos which maintains optimal cognitive load is critical in enhancing student engagement and knowledge retention.

KEYWORDS: gross anatomy videos, cognitive load, blended learning, and dissection hall

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INTRODUCTION

The student – faculty course contact hours available for teaching gross anatomy have been reported as decreasing in many medical curricula all over the world [1].

Although cadaver dissection is still considered as the best tool for learning gross anatomy, attempts are being made to enhance the anatomical sciences instruction with technologies such as computer assisted learning, virtual dissection tables, three dimensional mobile software applications and so on [2]. The fact that, dissection helps the students acquire three dimensional and tactile / sensory learning experience, is undeniable. However, packing of enormous amount of information in the available time and scarcity of cadavers, often disadvantages the student from gaining the optimal level of gross anatomy knowledge [3]. In a traditional dissection hall setting, we could often see the students crowding around the instructor to visualize the structures being dissected and students lacking a better view, as such, lacks interest in gross anatomy itself. Yet another problem, we encounter in gross anatomy teaching is inconsistency in dissection protocol amidst instructors and students, which leads to significant disparities in gross anatomical knowledge among medical students [4].

Millennial generation students live in a world different from that of previous generations. Even though their fundamental process of learning remains the same, the accessibility to technologies, they have, has convinced anatomy departments of many medical schools to switch the focus from passive learning in large groups to active, technology mediated self-learning in small groups [5,6]. As an attempt to make the educational practices appropriate for the societal changes, traditional face-to-face methods are supplemented with newer methodologies. These aim at delivering the content without direct contact with the students, by incorporating computer assisted aspects to the typical classroom based learning environment [7]. By achieving effective "blending", students are offered the benefits of convenience and flexibility, thereby providing a rich and engaging learning experience [8].

Anatomy, being a highly visual and dynamic-experiential course, favours video based teaching to a larger extent. Studies [9,10] have suggested the usage of videos either as an aid to traditional dissection based teaching or as sole alternate to dissection. Despite of the glaring popularity for the videos in present day medical education, evidences regarding the correlation of learning outcomes and video production styles are scarce [11]. Also, video based teaching lacks the benefit of 'contingent' teaching, whereby the instructor can adjust the teaching according to the level of understanding expressed by the learner [12]. A comprehensive review by *Kay RH* [13], postulates that the videos stimulate the affective components of learner, thereby making it popular. At the same time, students might not prefer watching videos that demand too much time to watch. Preparing a gross anatomy video is still more challenging, considering the cognitive load it imposes in the form of identification of numerous structures and recognizing anatomical relationships [14]. Because of the intricacies involved in producing the videos appropriate to the specific learning needs of first year medical students, multimedia learning resources are ranked lower in usefulness compared to other resources, such as learning from prosected specimens [15]. Another study [16] cautions that visual learning aids might repel the students having poor spatial abilities from learning anatomy particularly, if too many different spatial orientations are provided.

In the present study, gross anatomy videos produced by us were tailored according to the existing dissection schedule, with the aim of providing demonstration and task-relevant knowledge (identification of structures) and thereby improving students' self-efficacy. We investigated whether video-based learning approach is well accepted, perceived as being effective by the first year medical students and how its curricular implementation can be optimized.

MATERIALS AND METHODS

To enrich the students' anatomy learning experience at our institute, we had recently upgraded our gross anatomy laboratory with an overhead liquid-crystal display (LCD) projector, flat screen and sound system [closed circuit audio-visual system]. This system allows live streaming of videos so that students receive clear audio-visual access to demonstrations performed in real time by faculty members. In this pilot initiative, we planned a two-stage revision method in head and neck regional anatomy teaching. In the first stage, students underwent traditional dissection of head and neck, under the faculty guidance. As head and neck dissection involves visualization of many structures within a small area, we chose this region for our pilot initiative.

In the next stage, we created 6 informative application videos (maximum duration of 18 minutes) compassing various dissection subdomains. These videos were made competent with the learning objectives, voice over was given by an experienced anatomist with the best specimen and well-arranged subject plan. The presentations were displayed in dissection hall via overhead projector in practical classes after completing the dissection of the corresponding subdomain. Uniform and detailed information transfer was ensured and hence the consolidation was accomplished.

Participants and video development: This initiative included all 150 first year medical students (2017-18 batch) with a median age of 18 years and 65% of the students were female.

The videos recorded with a Sony® CX405 handycam recorder, were completed following scripted instructions adapted from anatomy syllabi. All of them contained introductory learning objectives, followed by an overview of the area being demonstrated. Demonstration of anatomical landmarks and structures were then shown in the area of interest. General editing, voice clearing, addition of transitions, and the title screens were made digitally using a computer with Camtasia Studio (http://www.techsmith.com/camtasia.html) video editing software. Care was taken to make the videos in concordance with the current theory of multimedia learning and irrelevant information was trimmed to avoid extrinsic cognitive overloading [17]. Videos were edited in a linear format and we ensured that the tone of the presenter was not monotonous and enthusiastic all throughout the video, so that we could gain maximum learner engagement (11).

We used an initial wide-angle camera view to provide satisfactory orientation of the dissection area. Two or three views were tested and the best one, in terms of orientation to the specimens and visibility of the structures was used for video production.

Post-production: once the shooting is over, the videos were subjected to post-production. Our main objective was to stream the videos anchored to the multimedia theories of video designing. To achieve this, we used signalling techniques such as zooming-in and highlighting to vital structures, as these tend to draw the attention of the students [18][Fig 1 & 2 showing Screen shots of video presentation]. Continuity among the individual sequences in videos was maintained with consistent camera angles. This would help in reducing the extraneous load by helping the students determine which elements are important within a moving frame and also help in increasing germane load by emphasizing the organization of information [19]. Some areas in the video were segmented and information that were considered to be redundant or distracting or not fitting to the learning goal were removed. The modalities (audio and video) were synced to provide complementary benefits. The edited videos were twice peer-reviewed and suitable corrections, which would have emerged from the learner perspective was made. Options like fast forwarding or dampening the speed of the video were avoided to maintain the "conversational" tone. Considering practicality, we decided not to upload the videos in our e-learning platform (MOODLE).

To determine the effects of these videos on anatomy learning, we planned to conduct a cross sectional descriptive survey. The questionnaire consisted of nine items which were adapted and modified from a previously validated questionnaire based study [20] on the usage of web based educational video packages in anatomical education. We conducted the face validity of the survey items by asking three anatomists who were not included in the study to review the items. Based on the feedback, we modified the questionnaire before administering. We requested all the students who had attended the sessions to render their responses on voluntary basis. The survey asked the students to rate each of the items on a Likert scale with options of strongly agree, agree, neutral, disagree and strongly disagree. Responses were collected using anonymous audience response system (clickers) and tabulated. Descriptive statistics (mean and standard error of mean) were used to report students' perceived efficacy of the videos.

Fig. 1: Screenshots of video presentation showing dissection of anterior triangle of neck.

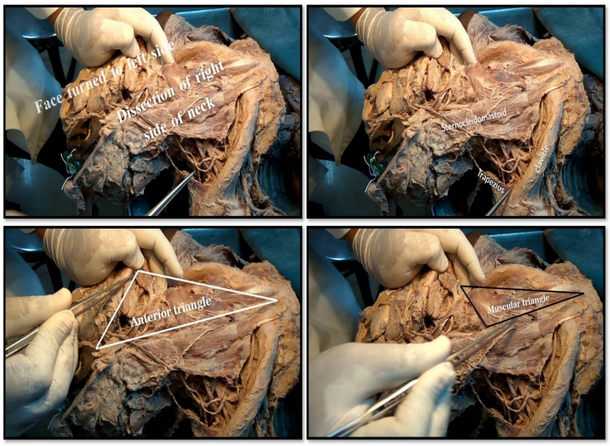
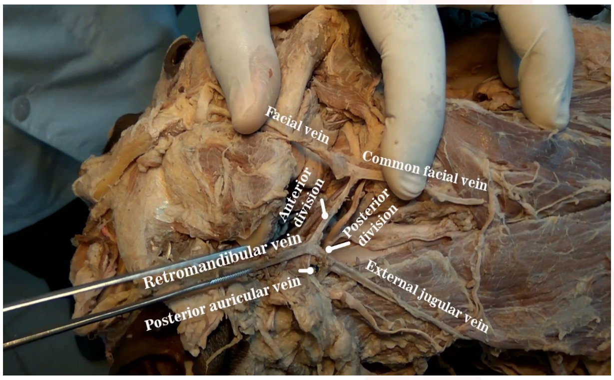


Fig. 2: Screenshot of video presentation showing dissection of submandibular region.



RESULTS

We collected anonymous feedback on voluntary basis and 100 students responded to us. The results were tabulated as percentage with mean scores and standard error of mean (Table 1). 48 % students agreed and 24 % strongly agreed that the videos were adequately representing the structures they have seen in the dissection hall. 32% agreed & 30% strongly agreed to the fact that the demonstrated video made by selecting the best specimen helped them in learning anatomical structures better with the mean response score being 3.88. When asked about the video has provided equal opportunities in receiving the information, 34% agreed and 22% strongly agreed with the mean score being 3.62. 40% agreed and 17% disagreed that the video-based tutorial helped in assessing the structures in a layered manner and remaining students expressed a neutral standpoint (Mean score is 3.31). 40% students felt that displaying the structures along with description provided by the teacher after completion of dissection of that region, has affected their positive learning with the mean score being 3.26. 28% agreed and 21% strongly agreed that the videos helped them in repeating and reinforcing the structures while 35% were neutral. 76% students strongly agreed and 11% agreed that if the videos are shared in learning platforms, they can use it when needed and that can positively enhance their learning process (Fig.3). When asked about their improvement in spotter based practical exam after seeing the videos, 24% agreed and 11% strongly agreed to it while 42% were neutral. Majority of students (79%) agreed that the quality of the video demonstrated were good to appreciate the structures. 91% of students accepted to extend the video-based demonstration to other regions of gross Anatomy as well but 9% have not agreed to that (Fig.4).

Table 1: Students' perceptions on video-based demonstration of gross Anatomy specimens.

S.No	Question	LIKERT scale (1- strongly disagree, 5- strongly agree) (% no. of students)					Mean(±SEM)
		1	2	3	4	5	
1	The videos displayed adequately represented the anatomical structures I viewed in the dissection hall	6	8	14	48	24	3.76(0.10)
2	Demonstration of a video made by selecting the best specimens of anatomical structures helped me in learning better	1	2	35	32	30	3.88(0.09)
3	Video based tutorial provided an equal opportunity to receive information	3	10	31	34	22	3.62(0.10)
4	Video based tutorial helped me in assessing structures in a layered manner	4	13	43	28	12	3.31(0.09)
5	Displaying the structures along with the description provided by the teacher, after completion of dissection has affected my positive learning	7	15	38	25	15	3.26(0.11)
6	Video based tutorial helped me to repeat and reinforce a particular topic	8	8	35	28	21	3.46(0.11)
7	If these videos are shared in learning platforms, I could use it when needed and this would have a positive impact on my personal learning process	0	1	12	11	76	4.62(0.07)
8	Videos helped me in improving the performance in spotter based practical examination	7	16	42	24	11	3.16(0.10)
9	The quality of the video is good to appreciate the structures	0	3	18	43	36	4.12(0.08)

Fig. 3: Perceptions of students on sharing the videos and its impact on their learning process.

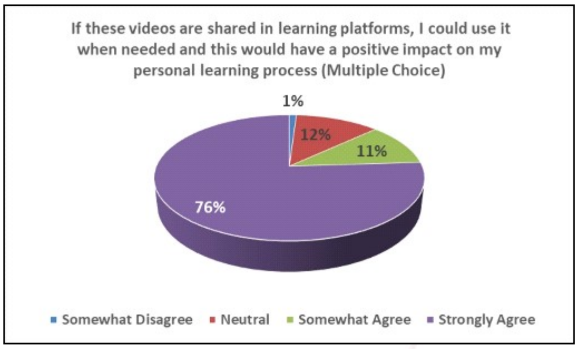
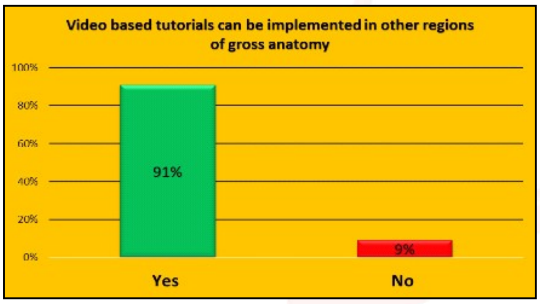


Fig. 4: Students' response for implementation of video-based tutorial in other regions of gross Anatomy.



DISCUSSION

The main focus of this initiative was to provide a primer for optimal visualisation of structures in prosected specimens. Our survey reveals a moderate acceptance for the use of instructional videos in gross anatomy teaching. The constructive alignment with the existing teaching activities is often considered to be the key for successful implementation of learning activities [21]. Previous studies [10,22] have shown that a large number of students who utilized gross anatomy videos as preparatory learning have got benefited. Also, video based learning provides equal and standard learning opportunity to learners [20]. Technology has become a large component of the contemporary medical landscape [23] and incorporation of audio-visual system in dissection hall enables the instructor to be seen and heard by all the students at the same time. It can be said that flexible delivery of e-learning resources can reduce the cognitive load offered in the dissection classes to certain extent and improve the self-efficacy of the students through better understanding of the practical activities along with their theoretical basis [24,25,26]. A study [27] showed that supplementing dissection videos to traditional cadaver dissection had improved the anatomy examination scores among veterinary students. Similarly in another study [28] students perceived that custom-made dissection videos helped them in identiûcation of structures and preparation for examinations.

A study by *Mahmud W et al.* [29] showed that despite majority (93%) of the students favouring regular inclusion of dissection videos in curriculum and half of the students terming it as the best source for learning gross anatomy, the post-intervention test scores of the study group were not significantly different compared to control group. Among the negative aspects of dissection videos, 35% of the students had opined that they didn't provide the much needed sensory experience, required for understanding and retaining factual information related to anatomy. This could be the possible reason for relatively lesser acceptance for the question in our study that video based anatomy teaching helped the students to perform better in spotter based practical examination. *Topping* [30] had replaced faculty-led demonstrations of prosected cadaver specimens with dissection videos and documented minimal increase in the performance on practical examinations. One hypothesis could be that students require sensory (tactile / kinaesthetic) experience for long term retention of learned content required for practical examinations.

Our results were in concordance with Saxena V et al [31], who had postulated that these videos likely produce a series of mental reference images which could possibly enhance anatomy laboratory learning. In that study, majority of the students has reported (mean score = 4.20) that videos were helpful and met their expectation. In our study, the responses were comparatively less (mean score = 3.31). Nevertheless, majority of students (mean score = 4.12) rated the quality of videos to be satisfactory. An ideal video lecture must harness learning motivation, increase learning performance and satisfy individual learning needs with different learning styles [32]. We used the concept of visualizer – verbalizer hypothesis [17] whereby individual differences in learning styles are addressed to an extent, by syncing the information of both audio and video formats. However, a study [33] based on the impact of student learning styles on their performances in a multimedia lecture presentation setting, didn't observe significant difference. A study [34] after comparing the impact of interactive videos and non-interactive video on students' learning found that students who were able to control the movement through the video, picking up important sections to review and moving backward when desired, demonstrated better achievement of learning outcomes and greater satisfaction.

The equivocal response, we received from the students in this initiative, could be due to the time of video display. We played the video during the fag end of dissection classes of head and neck, when students had received a hands-on experience of dissection. We presume that the "burn-out" experienced by the students during this period and decrease in the level of motivation among students are possible reasons for this response. Secondly, we presume that students with relatively lesser spatial ability would have experienced some difficulties in video based learning, particularly in getting oriented to the structures and relationships. Thirdly, we feel that some students, who had varied learning styles, would have discovered that videos are not conducive for them. Richness of a medium can be ascertained based on the ability of the students to reproduce the information transmitted by it [35]. If a medium is rich enough, then the uncertainty and equivocality associated with the learning task decreases [36]. In our further endeavours, we would like to work upon the enrichment of the media to reduce the equivocality associated with it.

Considering the limitations we had encountered during the process of producing and displaying the videos, we could ascertain that video based learning shall be a useful adjunct in the gross anatomy laboratory. As the specimens shown in the videos were previously given in a table teaching scenario, where the instructor guided small groups in dissecting, this methodology served the purpose of demonstrating to peers i.e. the "prosection effect" [37].

We had chosen the best specimen available for demonstrating to the students. This could have caused unfamiliarity because the students mostly get acquainted to the structures they had dissected in the cadaver. Nevertheless, we opine that specimens are more appropriate than cadavers, for recording videos, considering the possible malleability in position and visualisation angles. Some students who are extremely sensitive to formalin and those who refrain from cadavers due to psychosomatic aversions lack concentrating on the course of dissection. We strongly feel that, these students could get the equitable privilege as others, by this method. This pilot initiative serves as a baseline to conduct further studies such as evaluating the effectiveness of the methodology using randomized cross over design, determining the attitude and perception of faculty members and analysing the benefits and consequences for incorporating it in existing curriculum.

Limitations: Among the theoretical and methodological limitations faced by us, the prime issue was not enabling the students to pause and play the video at their own pace. The pause and play effect would have made the students achieve comparatively better learning outcomes [20]. Secondly, owing to copyright issues, we had decided not to upload in learning platforms. Informal interaction with students suggested that videos require repeated usage and it would have been better if videos were catered to them via learning platforms. Thirdly, we could not rule out the effect of confounding factors such as learning from other modalities, varied learning styles, attention span, cognitive load imposed and so on. Although our videos were framed according to the learning objectives of that particular topic, we could not confirm the stand alone acceptability of them. Comparing the resultant effect of two groups [video usage vs. non video usage] could have been the ideal way to curb these limitations. Similarly, the level of engagement demonstrated by the students' needs to gauged. Incorporation of assessment questions in the videos is a feasible suggestion for improving the student engagement. Anyhow, we believe that this modality enhances learning by minimalizing the information complexity and reinforcement.

CONCLUSION

Teaching gross anatomy in existing curriculum demands packing an enormous amount of information into a small period of time. Video based learning in the gross anatomy laboratory can be considered beneficial in imparting anatomy education. It serves in reinforcing the prosected specimens and enhances understanding. These instructions are most effective when they conform to the theories of multimedia learning and needs of the students. Even though the responses regarding the effectiveness are equivocal, we believe that incorporating videos would contribute to the success of a subset of students. Thus, developing user friendly and flexible utility videos is critical in order to increase student engagement and knowledge retention.

Conflicts of Interests: None

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