Use of Labeled Histology Images with Key Identification for Histology Teaching Learning

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Abstract

Background and Objectives Histology learning conceptualizes the photographic memory of the observed section, which is not only tedious but also confusing in nature. The main objective of the present study was to evaluate the effectiveness of labeled histology images, with key identification points shared on WhatsApp (or other social media) during the identification process of histology slides among first year medical undergraduates.

Methodology In a quasi-experimental study involving medical first year undergraduate students of two medical colleges from south India, from October 2018 to May 2019, the learning outcomes were evaluated. A total of 242 students participated in the study. Group A received labeled histology images with key identification points through WhatsApp (or other social media or by a blog post) 2 days after the routine test. It was followed by a surprise test for the whole batch. Group B students received labeled images after the surprise test. Two weeks later, a revision test was conducted. Learning outcomes of spotter test scores were compared with Student *t*-test.

Results Students of group A have scored significantly more marks in the surprise test in both colleges compared with group B. The results indicate that groups that have been exposed to the labeled images with key identification points resulted in significant improvement in the scores in histology slide identification.

Conclusion Use of labeled images with key identification points and sharing with students improves histology-learning outcomes.

Keywords
- histology
- labeled images
- teaching-learning
- spotter test

Introduction

Learning histology by observing tissues under microscope hovers around critical objective evaluation of the components. The process conceptualizes the photographic memory of the observed section, which is not only tedious but also confusing in nature. The traditional method of using microscope allows viewing the slides individually. This paves the way for interpersonal differences in identification and understanding of the key elements of the slide.[1] This is evident from the wide variations in perception of colors and shapes of specific structures in a given slide. To overcome this, many methods have been employed by universities across the globe. There are efforts to test team-based learning for evaluation of histological sections to alleviate inter-individual differences.[2] Few medical schools have successfully attempted and implemented use of interactive virtual microscope to demonstrate the tissue details on bigger screens.[3-5] However, implementation of virtual microscope methods is logistically demanding. It starts with digitization of the images, and these images are used as a teaching aid with a remote-controlled microscope with scanning, zooming, and panning functions.[6] These methods are not only costly but also require special faculty training to handle the computer software and microscope. There have been attempts to create virtual libraries of histology, where images are created.[7,8] These image repositories, not only encourage students to explore deeper, but also play a major role in reviewing the content and immortalize the slide collection of the department.[2]

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Complicating this scenario, in most of the colleges, students are required to draw diagrams of the histological images. Even though, these diagrams are schematic representations of the histoarchitecture, many a time, there exists a huge mismatch between the microscopic picture and the diagrammatic representation of the same. There is every possible chance that students may resolve to unscientific shortcuts to overcome these limitations. Minimal representation of the histology in the summative assessment is perpetuating all the irrational methods followed by the students. As there is no deeper evaluation of histology comprehension, students tend to limit their efforts for the knowledge level only in Bloom's taxonomy.[9] Current-day teaching and learning methods are undergoing persistent churning to address applicative, analytical, and creative application of histology learning. Such efforts are important in preparing undergraduates for the clinically relevant comprehension of histopathology.

Considering the resource constraints, a learning method made of indigenous teaching aids in eliciting interest and built-in interactivity can bring a meaningful change in the learning outcomes. Teaching and learning in histology must address all the irrational practices prevailing among students for slide identification. It must aim for greater comprehension of histology knowledge. To imbibe proper methods of identification during slide identification, we have attempted to use images with key points written over it, highlighting the tissue components. The main objective of the present study was to evaluate the effectiveness of labeled histology images with key identification points shared on WhatsApp (or other social media) during the identification process of histology slides among first-year medical undergraduates.

Methodology

Study design and setup: In a quasi-experimental study involving medical first-year undergraduate students from two medical colleges from south India (different states), from October 2018 to May 2019, learning outcomes were evaluated. A total of 242 students participated in the study. The Institutional Ethics Committees (IECs) of both medical colleges approved the protocol before the study.

Inclusion criteria: Students who were using WhatsApp and part of the larger classroom group were included. A separate WhatsApp group was created just for sharing images. Students were free not to use WhatsApp. Those who were not using were asked to access the same images via the web link shared.

Exclusion criteria: Students who do not consent to this teaching-learning method were excluded.

This teaching-learning method was an adjunct method used along with routine sessions in histology. After the initial orientation to histology and classes on general and systemic histology, a routine test was conducted.

Routine histology test: This included identification of 20 slides without elaborate scanning of the various fields. Students were instructed that they should not change the field of focus. They were free to use fine adjustments during slide focusing. After identification of each slide, students were asked to write two specific identification points for each slide. Two marks were allotted for correct identification of slide with correct key identification points.

After this routine test, computer-generated random numbers were used to divide students into the following two batches: batch A and batch B.

Batch A: received labeled histology images with key identification points through WhatsApp (or other social media or through a blog post) 2 days after the routine test. A surprise test was conducted using the same 20 slides (with different fields of focus) with varied order. The timing of this test was not announced and it was a surprise test.

Batch B: Students of this group did not receive labeled images. A surprise test was conducted to assess the identification abilities in the next week. After the test, labeled images were shared with batch B students as well; scores were compared with the initial routine test.

A *revision test* after 2 weeks with histology images was conducted. The images were projected on the screen. This is deviation from the regular practice of slide focusing. In this revision test, assessment of deeper comprehension was attempted. The revision test had same first 10 spotters as that of the routine test, but from different source. For this purpose, images obtained from the worldwide web (copyright free, open source) with tissue components and details as discussed were shared during the routine class. These 10 images occupied question number 1 to 10 during the test. All the images were projected in the classroom and all students were asked to identify the images. Scores were tabulated separately and compared with the results of the first 10 questions from the routine test.

Image preparation: Photographs of the histology slides were obtained with a morphometric microscope of the central research laboratory of the institution. Most important identification points of each slide (image) were imposed over the images (representative images ►**Fig. 1**). Resolution of

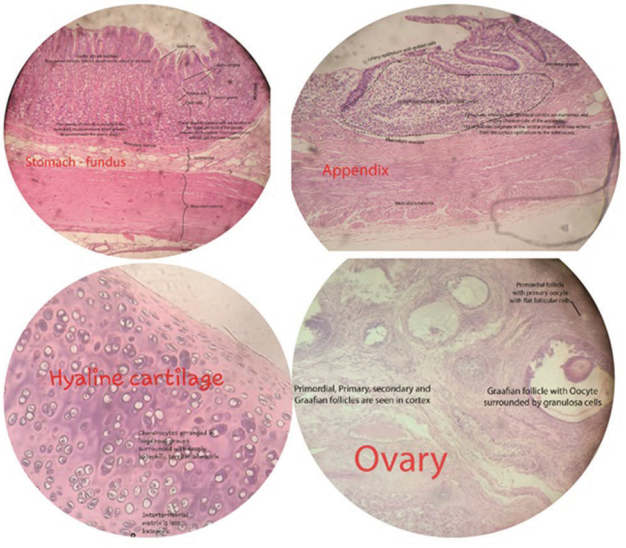

Fig. 1 Histological images of stomach fundus, appendix, hyaline cartilage, and ovary with key identification points on them.

these images was at minimum of 800 × 600 dpi, so that on zooming, tissue details were not lost.

Statistical analysis: Results were tabulated and significance of difference, if any, was evaluated with *paired student t-test* between the routine test and surprise tests of the groups. Revision test scores were compared with scores of the pretest and surprise test. Any statistical improvement was noted. The difference was the measure of applicability of concepts learned from labeled images with the identification of histology images taken from different source.

Results

A total of 92 students from medical college A (McA) and 148 students from medical college B (McB) participated in the study. ►**Table 1** shows the tabulation of scores of routine tests, surprise tests, and revision tests. Image 1 shows a sample of the histological depiction of stomach, ovary, stomach, and hyaline cartilage with salient features.

Even though McA scores were significantly lesser than McB scores in the routine test, there was no intergroup difference within the college. Students of group A scored significantly more marks in the surprise test in both colleges compared with group B. However, in both colleges, this difference is nullified in the revision test. There is significant improvement in the scores between routine test, surprise test, and revision test. The results indicate that groups that have been exposed to the histology images via WhatsApp have resulted in significant improvement in the scores of histology slide identification.

Minimum scores in the routine test, surprise test, and revision test in McA were 0, 2 and 6, respectively. Similar scores in McB were 2, 3 and 10, respectively. This indicates that even though the overall means of the scores of the class improved over three tests, the use of images with key points present on it has marginally helped poor performers to improve. The number of students who failed to score 50% marks in revision tests stood at 8 in McA and 5 in McB.

►**Table 2** shows the tabulation of the first 10 questions. There was significant improvement in the scores of the first 10 slides of the routine test and the first 10 images of the revision test in both colleges. The result shows that students were effective in learning the concepts and apply the same in identification of histology images taken from different sources.

Discussion

Learning how to identify the slide in histology is often limited to knowing the color of the slide, shape of the section, and similar nonscientific and irrational methods.[10] There have been many attempts by many anatomy and pathology teachers to imbibe good practices during slide identification. Virtual image libraries and atlases are generated in few departments, replacing the slides to facilitate easy learning, retrieval, and revision of histology and pathology.[2,4,8] In a study by Veena and Colleagues, students have opined that the image databases are more effective than the slides.[11] In a flipped classroom study for imbibing higher order thinking, Rajprasath et al were successful in eliciting deeper interest and interaction of the students during the in-the-class activity of histology learning. They shared the presentations via the WhatsApp platform before the flipped classroom sessions.[12] Similar flipped classroom results having the effect of improving the learning outcomes are also reported by Cheng et al.[13]

In the present study, continuing the current practices in histology teaching learning, an attempt was made to display the key identification points and salient features over the images. Such marking of the images provides first-hand pictorial representation of the micro-anatomical details creating a greater impact during learning. For this process, images are taken from the slides that were available in the department, more so those that are expected to be used during the summative practical spotter test. The images, with almost the same key field of focus, create a lasting impression during the slide identification. Typing key features delineating its margins and highlighting the location makes learning easy and interesting.

Images once generated, and key features typed, has to reach the students in an effective way. Creating robust database and restricting it to the department systems may not serve students. Therefore, an effective social media, pertinent to current generation, was chosen. Sharing images on a WhatsApp platform gets these images to everyone's mobile phones. Students can zoom in and navigate across the images with ease. The biggest advantage of such method of sharing is easy retrieval of the images and revision. Students can revise entire histology images at a convenient time.

Even though WhatsApp has been shown to be an exciting new method of sharing subject content,[14] this platform has its own limitations. Through this method, one cannot ascertain

Table 1 Tabulation of scores of routine tests, surprise tests, and revision tests

	Routine test (Max 40)	Surprise test (Max 40)	Revision test (Max 40)
McA			
Group A	16.4 ± 7.3	30.3 ± 5.3	32.3 ± 6.4
Group B	15.5 ± 4.4	22.8 ± 6.1	30.4 ± 5.1
McB			
Group A	21.8 ± 5.6	32.5 ± 5.4	34.7 ± 6.4
Group B	20.5 ± 6.4	25.5 ± 4.1	32.5 ± 4.8

Abbreviations: McA: medical college A; McB: medical college B.

Table 2 Tabulation of first 10 questions from routine test and revision test

	Routine test (Max 10)	Revision test (Max 10)
McA		
Group A	2.5 ± 0.3	5.6 ± 1.2
Group B	3.1 ± 0.4	6.8 ± 1.7
McB		
Group A	2.8 ± 1.6	6.4 ± 1.4
Group B	2.5 ± 1.3	6.1 ± 1.1

Abbreviations: McA: medical college A; McB: medical college B.

whether student has really concentrated on the various components of the images by zooming and panning. It can only specifically notify when a member of a group accessed the image. Therefore, a better method with inbuilt interactive and quantifiable method is required for sharing educational material, especially in image-rich topics like histology.

Labeled histology images, indeed, results in deeper comprehension, not just in slide identification. Students were able to identify images from different sources effectively after the exposure to labeled images. This transformative learning shall form a strong basis for the histopathology understanding.[15] After all, apart from the functional correlation of the structures, the singular reason for learning normal histology of various tissues is to prepare students to understand abnormal histoarchitecture in disease processes.

Limitations of the Study

As it is an educational learning outcome study, it is bound to be influenced by the many factors. Students' intellectual abilities have strong influences on the learning outcomes. Inclusion of students from two different medical colleges is considered to reduce this difference to some extent. Only one group received the labeled images before the surprise test. We cannot rule out sharing of these images with the other group.

Conclusion

Use of labeled images with key identification points and sharing with students improves histology-learning outcomes.

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Conflict of Interest
Authors declare no conflict of interest.

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