Medical Education

A WhatsApp-based introductory histopathology and cytology course for first-year pathology postgraduate students

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ABSTRACT

Background. The first-year pathology postgraduates can take a long time to learn the basic skills of microscopy, which can become a barrier to learning.

Methods. A WhatsApp group comprising all 14 postgraduate first-year students with one senior resident and one faculty as group administrators was formed. For the study, 50 routine cases (35 histopathology cases and 15 cytopathology cases) captured by using a smartphone camera and annotated using image-editing software, along with relevant descriptions and weblinks, were sent to the WhatsApp group. A pre- and post-test comprising 15 cases each was conducted and the results were compared by non-parametric Wilcoxon rank test. A feedback form about the effectiveness of this method of learning was circulated at the end of the study.

Results. The results of the post-test were better than the pre-test by the non-parametric Wilcoxon rank test. Both the active participants (>10 posts) and passive participants of the study group showed statistically significant improvement in the scores and posted a similar number of intellectually thought-provoking posts. The students' responses to the questionnaire also indicated that they liked the new method of instruction.

Conclusion. This pilot study shows that smartphone-based learning methods can supplant the traditional methods of teaching for pathology postgraduates.

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INTRODUCTION

With the advent of high-speed internet and better and cost-effective smartphones, social media has become ubiquitous in our lives. WhatsApp is one such social media platform that has caught the imagination of the masses. It is one of the most popular social media apps and is particularly popular among the younger generation.

The first few months of training are particularly challenging for the pathology first-year postgraduates. They have to face multiple challenges such as adjusting to long hours of microscopy and learning the language of morphology. Students can take a long time to learn the basic skills of microscopy, which can become a barrier to learning.[1] The other barrier is lack of interest. An important reason for this lack of interest is the limited exposure to histopathology and cytology during undergraduate training. The usual method of teaching first-year students is to take multiheader slide-viewing sessions exclusively for first-year postgraduates. However, this method can be supplanted by a WhatsApp-based introductory course. In this course, microscopic images of routine histopathology and cytopathology cases were captured by a smartphone camera and annotated in a photo-editing software. These images along with relevant descriptions and weblinks were sent to the WhatsApp group for pathology learning comprising the first-year pathology postgraduate residents. Appropriate weblinks and videos can also be shared on the group to arouse interest in pathology.

The aim and intent of training the postgraduate students was to help them achieve competency in diagnosing common lesions in histopathology and cytopathology practice.

METHODS

The study was conducted in the Department of Pathology of a tertiary care hospital in northern India. Fourteen first-year pathology postgraduates were included in this pilot study. The students were given a brief overview of the methodology of the course, and informed consent was taken for participation in the study. A WhatsApp study group named 'Pathology Dream Batch' was formed. The group comprised all 14 postgraduate students with one senior resident and one faculty as facilitators and group administrators.

For the study, 50 routine cases (35 histopathology and 15 cytopathology) were captured using a smartphone camera (One plus A5000, 16MP, made in China). The images were annotated using image-editing software (Fig. 1). Morrison's technique was used to capture the images (Fig. 2). Only the best images with optimum morphological details and picture clarity were included in the study. Each picture was followed by a short description of the features (Fig. 3).

A pre-test was conducted before the start of the course comprising 15 cases (12 histopathology and 3 cytopathology). The images of these 15 cases (without annotations) were uploaded on the group simultaneously. The students were given 45 minutes to write the diagnosis on a sheet of paper after all the images had been downloaded on their smartphones. The individual scores were kept confidential and not revealed to the students. The main purpose of the pre-test was to compare it with post-test scores and not to assess their knowledge or competence.

Over the next 10 weeks, 50 routine cases (35 histopathology and 15 cytopathology) were uploaded on the WhatsApp group.

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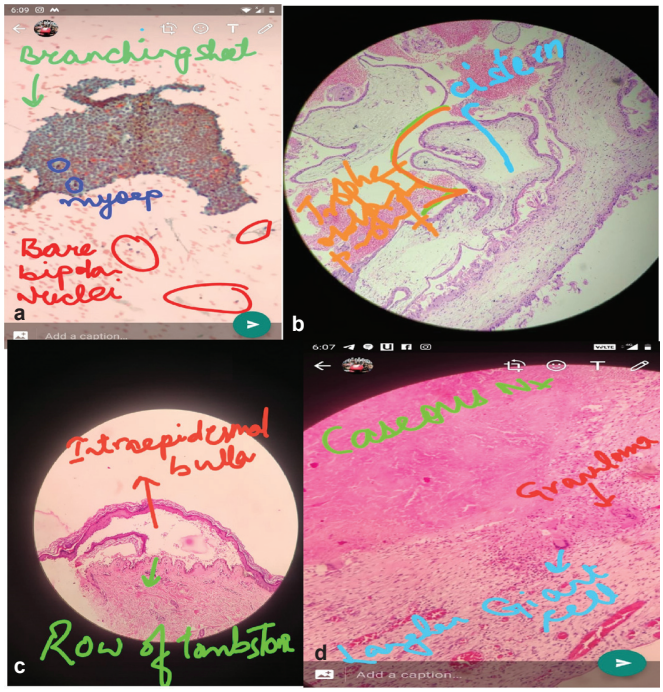

FIG 1. (a–d) Annotated images shared on the WhatsApp group; (a) Papanicolaou stain, ×400, showing cytological features of fibroadenoma-branching sheets, bipolar nuclei; (b) histological features of hydatidiform mole-central cistern and trophoblastic proliferation (H and E, ×100); (c) histological features of pemphigus vulgaris—row of tombstone appearance and intra-epidermal bulla (H and E, ×100); (d) histological features of tubercular lymphadenitis-necrosis, granuloma and Langhans type giant cell (H and E, ×100)

FIG 2. Images being captured by Morrison's technique without the use of an adaptor

The time of the case discussion was 5 p.m. each day excluding weekends. This ensured that there was no disruption in the day-to-day functioning of the department. The annotated images of each case at different magnifications were uploaded and were followed by descriptions of the morphological features and snapshots from textbooks and relevant links to web resources such as web pages, articles and images. The students were encouraged to ask questions and all the queries were answered promptly. To arouse interest in histopathology and cyto-pathology, links to YouTube videos relevant to basics in pathology were also shared.

The tone of the conversations was informal so that the students do not hesitate to ask their questions. At the end of

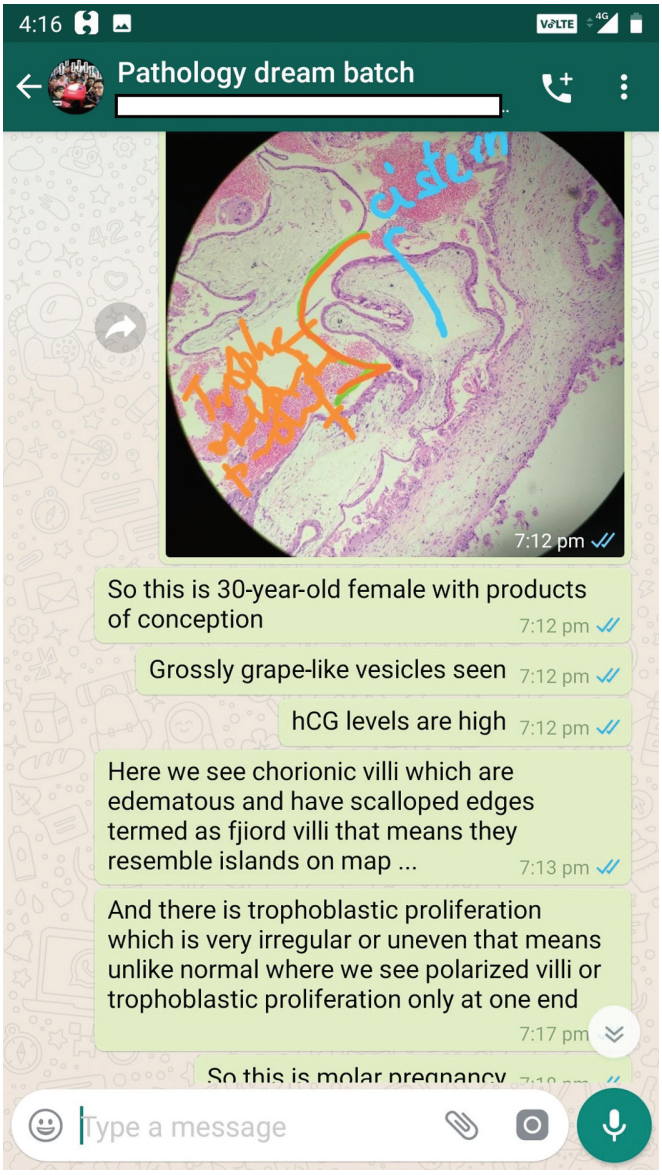

FIG 3. A screenshot of the smartphone screen showing the histomorphological details being discussed after the image is posted

the course (10 weeks after the pre-test), a post-test comprising 15 cases of similar difficulty level as the pre-test was conducted by the same methodology. All the images of the test cases were uploaded at one go on the study group. The students were asked to download these images on their smartphones. They were given 45 minutes to write the diagnosis on a sheet of paper and submit on WhatsApp. The individual scores were again kept confidential, and the average scores were compared to that of the pre-test score by non-parametric Wilcoxon rank test. A p value <0.05 was considered statistically significant.

A feedback questionnaire using Google Forms was also circulated among the students.

RESULTS

Student participation in the group was encouraging. A total of 445 posts were shared by the students with an average of 31.8 posts per student. The number of cases discussed, total number of posts by the students, average number of posts per member,

number of active (>10 posts) and passive (≤10 posts) participants and number of weblinks shared are given in Table I. Five students had more than 10 posts (active participants) and 9 students had ≤10 posts (passive participants). The mean (SD) post-test scores (12.85 [3.17]) were better than the pre-test scores (5.04 [0.87]). The difference in the pre-test and post-test scores was statistically significant by the non-parametric Wilcoxon rank test with p=0.00096 (Table II).

A pre-test versus post-test comparison done separately for the active and passive participants by the paired Student *t*-test showed statistically significant improvement for both the groups (Table II).

The number of posts by students showed an increasing trend as the study progressed (Fig. 4). The cases were categorized into the following three categories based on the difficulty level:

- Cases 1–22: Easy
- Cases 23–42: Moderately difficult
- Cases 43–50: Very difficult.

Though the number of posts by the passive participants increased towards the end of the study, their proportion out of

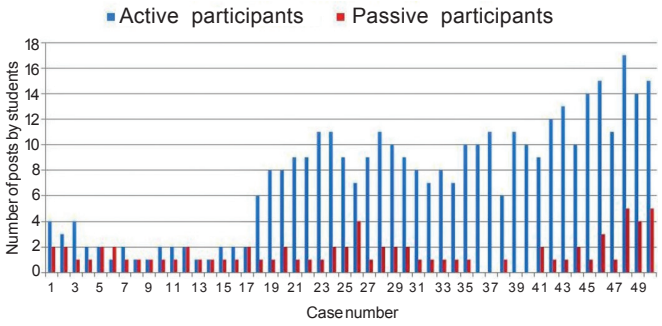

FIG 4. A bar chart showing the trend of WhatsApp posts by active and passive participants of the study as the study progressed.

TABLE I. Details of student participation in WhatsApp-based teaching–learning activities

Item	*n*
Total number of cases discussed	50
Total number of posts by students	445
Total number of weblinks	9
Active participants (>10 posts)	5
Passive participants	9
Total number of intellectually relevant/ thought-provoking posts	35
Intellectually relevant/thought-provoking posts by active participants	13 Mean (SD) 2.6 (1.14)
Intellectually relevant/thought-provoking posts by passive participants	22 Mean (SD) 2.44 (2.35)
p value for comparison of intellectually relevant/thought-provoking posts by active and passive participants	0.89 (not significant)

TABLE II. Comparison of pre- and post-test scores of students

Score	Value
Test scores (whole batch)	
Pre-test score (mean [SD])	05.04 (0.87)
Post-test score (mean [SD])	12.85 (3.17)
Non-parametric Wilcoxon rank test for pre-test versus post-test comparison for the whole batch	
Z	–3.2958
p value	0.00096
W value	0 (critical value at *n*=14 is 21)
Paired Student t-test for pre-test versus post-test comparison for active participants	
Pre-test score (mean [SD])	05.90 (0.548)
Post-test score (mean [SD])	14.90 (0.224)
p value	<0.0001
Paired Student t-test for pre-test versus post-test comparison for passive participants	
Pre-test score (mean [SD])	04.56 (0.583)
Post-test score (mean [SD])	11.72 (3.501)
p value	0.0004

TABLE III. Students' response to the feedback questionnaire

Question	Response (%)
Did you find the introductory course useful?	No (0) Yes, somewhat (14.3) Yes, very much (85.7)
What was your first reaction to being asked to join the study group?	Not sure (14.3) Somewhat excited (78.6) Very much excited (7.1)
Did you find the discussions useful?	No (0) Yes, somewhat (7.1) Very much (92.9)
Did you follow the discussions (actively or passively)?	All posts (35.7) Most (42.9) Some (21.4) None (0)
Did you get annoyed by numerous posts at odd hours?	No (92.9) Sometimes (7.1) Many times (0)
Was there any interference with your routine work?	No (100)
Would you like the group to continue the discussions and tests?	Yes (100)
How useful is the internet for pathology teaching in the present times?	Very useful (100)
Was the group helpful in breaking the ice with the seniors?	No (7.1) Yes, somewhat (71.4) Yes, very much (21.4)
Your suggestions for improvement of the programme	Fewer cases to be discussed per week (42.9) Some multiple-choice questions should be asked (7.1) Few cases can be discussed on the multiheader microscope every Saturday (7.1) Include haematology slides also (7.1) No suggestions (35.8)
What did you like the most about this group?	Learned the basics (7.1) Image-based approach (28.6) Easy accessibility and revision (28.6) Easy to understand (7.1) More interactive (21.4) Can study anytime (7.1)

the total number of posts remained low. On analysis of the posts, it was found that both the active and passive participants posted a similar number of thought-provoking/intellectually relevant posts (Table I). The majority of these were posted by the students towards the end of the study period.

The students' response to the questionnaire is summarized in Table III.

DISCUSSION

There are many advantages of such a course. It overcomes the skill barrier because the students are new to microscopy. The microscopic images taken by the smartphone camera can be viewed on the smartphone screens. It also allows students to learn anytime and anywhere. The images are always in focus with optimum illumination. They can look at the images multiple times during the day, which can make learning easier.[2,3] Thus, it is possible to reach a large number of students without any variation in the quality of the teaching material. There is also no problem of the maintenance or loss of teaching slides.[1] In each batch, there are slow and fast learners, and the WhatsApp-based course allows students to learn at their own pace.

The WhatsApp messenger has been tried as a teaching aid for a wide variety of medical specialties. The present generation of medical residents belongs to the group of millennial learners.[4] They are digitally literate experiential learners. The use of social media in teaching is broadly based on two theories: connectivism and constructivism.[5]

In the present era of information overload, it is imperative to introduce the students to a wide variety of internet resources of learning at an early stage and help them in identifying useful information.[6] The role of the teacher is that of a facilitator who simply guides the students to find the right answer. This is the essence of the student-centric approach of using social media for education.

A WhatsApp-based introductory course serves two purposes. One is to teach the students common cases encountered every day in routine practice at a leisurely pace. The second is to acquaint them with the internet resources available at their disposal for learning pathology. However, just like any other tool, WhatsApp messenger needs to be used carefully for instruction purposes.

Because the students were given adequate time and opportunity to learn at their own pace, their interest and participation in the teaching–learning activities improved as the study progressed. This is reflected in the increased number of posts towards the end of the study. Both the active and passive participants of the study benefited equally from WhatsApp teaching (Table II). This disproves the hypothesis that students who are more active in the group are better learners. Similarly, a closer analysis of the posts also shows that both active and passive participants posted a similar number of intellectually relevant questions and ideas. These findings suggest that more posts do not indicate better interest.

Furthermore, as the study progressed from easier to more challenging cases, the number of posts increased, which is a positive outcome. This could be due to familiarity with the teaching platform, students becoming more comfortable in the new surroundings or genuine interest in the topic.

The four cases which did not elicit any question from the passive group were: tuberculous lymph node cytology, intestinal tuberculosis histopathology, pleomorphic adenoma cytology and *Trichomonas* infection on Pap smear.

The reason for no posts for tubercular lymph node cytology and intestinal tuberculosis histopathology by the passive group could be that tuberculosis had already been discussed in detail earlier, under the topic histopathology of the tuberculous lymph node. No specific reason could explain the lack of response to the other two cases by the passive group.

The training aimed to help the postgraduate students achieve competency in diagnosing common lesions in histopathology and cytopathology. Ideally, both pre- and post-tests should have been conducted on microscopes because it tests the higher-order skills of the selection of appropriate patterns for comparison with memorized patterns. However, both the pre-test and post-test were conducted on the smartphone because the students were being introduced to microscopy and may not be adept at handling the microscope. The teaching was also done with the help of captured images and not slides and microscope. Hence, it would have been unfair to test the students on a skill which has not been taught in the course. It is presumed that the students will acquire these skills as they progress in their training with conventional methods.

The image transfer on WhatsApp reduces the size of the image file and lowers image quality.[7] Hence, to teach the histopathological features by WhatsApp transfer, the images need to be of a high resolution and the exact area needs to be pointed out by annotation. Low-resolution images will get pixelated on zoom in. The other inherent limitation is the problem of eye strain if too many images are sent at the same time. Hence, it is important to not exceed the limit of one or two cases per day. It is equally important to restrict the conversations to academics and not discuss general topics as it will defeat the purpose of creating a teaching group. All social media platforms have an inherent problem of addiction. Social media addiction can have grave consequences for the emotional and physical health of the participants.[8] The group administrators have to ensure that the participants spend only a limited time discussing the case. No posts should be allowed late at night or during the business hours of the department.

The e-learning theory used in the present study is based on the premise of cognitive load. The cognitive load of performing a task can be divided into three categories namely germane, intrinsic and extraneous.[5] The germane load is the effort required to make sense of the task. The intrinsic cognitive load is the effort required to perform the task. The extraneous cognitive load is the load generated by how the information is delivered to the learner.[5,9] It is under the control of those who formulate the learning environment.

The use of WhatsApp for teaching pathology to first-year postgraduate students uses these principles in the following way:

1. It reduces the extraneous load by putting the images and their descriptions straight into their mobile phones.
2. It also reduces the germane load because the students participating in the group are aware that the images and descriptions are posted for them to make a visual impression of these entities in their mind.
3. The students can go over the images at leisure and at their own pace. This helps them to manage their intrinsic cognitive load.

Because the target audience in our study was first-year pathology postgraduate students, the facilitators needed to use a pre-defined set of cases with a suitable difficulty level.

Goyal *et al*. previously studied the utility of WhatsApp-based case discussions in teaching pathology postgraduates. However, this study did not have a pre-defined selection of cases as the target audience comprised postgraduates with varying experience and seniority. Another difference was that the images were posted as a quiz to start the discussion and were not annotated.[10]

A similar attempt to teach histology to undergraduate medical students by using images captured by smartphone camera yielded encouraging results.[1] Another study explored the use of WhatsApp for teaching microbiology to undergraduate students.[11]

Similar attempts have been made in teaching psychiatry, preventive and social medicine and other medical specialties.[12,13]

The feedback from the students was encouraging. All the students expressed their desire to continue with the group and no one reported any interference in their day-to-day activities. The majority of students suggested that fewer cases should be discussed per week so that they can assimilate them better. Only a small minority of students (7%) reported some annoyance with frequent posts on the group. Hence, care should be taken to not go overboard with the discussion timings and the number of cases.

The use of WhatsApp for discussing cases also has the added advantage of sharing weblinks and videos so that the students are exposed to e-learning resources at an early stage in their careers.

One limitation of this study is the absence of a control group taught by conventional methods to compare the learning outcomes. Use of the Likert scale in the student feedback form, a pre-test and post-test by conventional microscopy and a larger cohort of students from multiple centres would improve the quality of future studies on this topic.

Conclusion

Annotated images sent by smartphone to the postgraduate pathology students can be used to supplant traditional teaching methods for better learning outcomes. The judicious use of technology is needed to reap the benefits of 'anytime learning' while keeping the problems of social media addiction at bay.

Conflicts of interest. None declared

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