Pak J Med Res
Vol. 57, No. 3, 2018

Original Article

Effect of Drawing Microscopic Images on Students' Retention of Knowledge of Histology

Aisha Rafi[1], Ayesha Rauf[2], Muhammad Idrees Anwar[3]
Department of Anatomy[1], Department of Health Professions Education[2], Shifa College of Medicine, Shifa Tameer-e-Millat University, Islamabad, Department of Surgery[3], Rawalpindi Medical College, Rawalpindi.

Abstract

Background: A move towards integrated curriculum questions the desirability and application of image sensitive disciplines like histology. It calls for redefining the role of drawing in learning.
Objective: To determine the effect of drawing microscopic images on retention of knowledge of histology.
Study design, settings and duration: The quasi experimental study was conducted at the histology laboratory of Anatomy department, Shifa College of Medicine (SCM), Shifa Tameer-e-Millat University, lasting from January 2017 to September 2017.
Subjects and Methods: The second year MBBS students were selected by purposive sampling technique. The study was conducted during an eight week duration module of endocrine and reproductive system. The class of 100 students was divided into group A and group B, comprising of 50 students each. During the first four weeks, students in group A were required to draw the histological image. The students in group B did not draw the microscopic image. During the next four weeks, the two groups were flipped over by a cross-over design. The group A became the no drawing group and group B became the drawing group. The MCQ test was taken at the end of four and eight weeks respectively.
Results: The students scored better when they drew the images compared to when they did not draw. The results are statistically significant (p <0.05).
Conclusion: Drawing is an effective teaching strategy for knowledge retention.
Key words: Drawing, knowledge retention, microscopic images.

Introduction

Anatomy, among all the basic sciences is generally acknowledged as the essential foundation for training doctors in medicine.[1] The curricula for health professions education teach anatomy as a study of normal structure and function of the body. It is complemented by histology, embryology and comparative anatomy. Anatomy is regarded as mother of all sciences[1] because it integrates structure and function. Application of knowledge, regarding the normal and abnormal structure, forms the basis of clinical disciplines like surgery, radiology and emergency medicine. The conventional undergraduate medical curriculum makes the implicit assumption that the understanding of the basic science disciplines is an essential prerequisite for starting clinical studies.[1,2]

Abraham Flexner also emphasized the desired relation between basic and clinical sciences almost 70 years ago. He was of the view that demonstration of basic science knowledge should be adequate for the commencement of clinical studies. This can only be successful if the students remember what they have to practice; therefore, the retention of basic science knowledge has always been a matter of great concern since mid 1800s.[3]

It is a common belief among the physicians and medical educators that a substantial portion of the basic science information learnt in preclinical years, in traditional medical schools, is lost during the final, predominantly clinical years.[4]

Review of literature regarding the lack of retention has dated back to almost more than a

Corresponding Author:
Aisha Rafi
Department of Anatomy
Shifa College of Medicine, Shifa Tameer-e-Millat University, Islamabad.
Email: rafi.aisha@gmail.com

Received: 23 November 2017, **Accepted:** 09 August 2018, **Published:** 29 September 2018

Authors Contribution

AR[1] & AR[2] conceptualized the project. AR[1] did the data collection and literature search. AR[1], AR[2] & MIA performed the statistical analysis, Drafting, revision and writing of manuscript.

century. Some of the older studies stated that drawing improves the power of observation which in turn leads to appreciation of less obvious features of the specimen; this facilitates long term retention of knowledge.[5] Similarly in 1928, Bethe asserted that knowledge of anatomical details quickly vanishes and student can no more apply it in the clinical side.[6] Later, in 1932, Cole used the word `disuse atrophy' for the loss of knowledge retention in the clinical years. He used the term in context of loss of application of knowledge in the clinical years.[7]

One of the reasons for lack of retention of basic science knowledge is that the timing or context of basic science knowledge presentation is inconsistent with its need and relevance. This necessitates that the relevant content should be memorized by the student in a way that he/she should be able to access the related detail in the context of medical practice.[8]

Recent evolution of medical curricula and calls for change has revolutionized the image sensitive basic science disciplines like histology and pathology. The medical schools are abandoning the use of microscope over digital images or virtual microscopy.[9]

There has been a steady decline in the laboratory hours of histology teaching in U.S medical schools between 1967 and 2001. This has led to replacement of histology laboratories with digital microscopy system in most medical schools across the globe.[10]

Heated debates have opened up, among many anatomy and pathology educators, that image sensitive technology is not imparting the type of learning required for long term application of knowledge. The above review of literature calls for reform of the objectives, content, and context of the learning in medical school preceding the clinical years. Keeping in view the above discussion we hypothesize that drawing of microscopic images of the tissues results in long term retention of knowledge. It will further help in identifying the competencies that students need in order to progress to clinical studies.

Subjects and Methods

All students of second year of MBBS at Shifa college of Medicine for the academic year 2016-2017 were selected.

The purposive non-probability sampling technique was used because the nature of research design, objectives and research instrument focus over a particular subgroup i.e. medical students of second year that addresses the specific purpose related to research objective.

Score sheets of MCQ paper. The MCQs of higher level of application of knowledge and minimal recall were developed by the faculty of anatomy. Item writing flaws were corrected by experts and questions of recall were minimal.

The following measures were taken to ensure the internal validity of the study.

1. Selection of participants: The participants' represent the population to whom this research is supposed to be generalized.

The students were randomly assigned to experimental groups.

2. Intervention: Drawing of histological images is the intervention used. The experimental group drew the histological images and control group did not draw.

Retention of knowledge is assessed by administering the MCQ test.

This study was carried out at histology laboratory of department of Anatomy, Shifa College of Medicine (SCM), Shifa Tameer-e-Millat University from January 2017 to September 2017.

The selected module matched the project time line. The ENR module is organized around eight themes. The themes were based on clinical context integrated with relevant histological, gross structure, physiological and biochemical aspects of the endocrine and reproductive system.

The duration of module is eight weeks which was conducive for my research because it could be split into equal halves, thus switching over of the group between drawing and no drawing was convenient. Assessment of the module was done through selected response (multiple choice items) mostly A type.

The project was started after Institutional Review Board approval. Recommended logistic arrangements were ensured, like large group classroom, practical histology laboratory and OMR (Optical Mark Reader) sheets for assessment.

The students attending Endocrinology & Reproduction module of year II undergraduate medical curriculum were included in the study, with drawing and no-drawing as the two interventional/experimental factors. Those students who did not appear in the test were excluded. All the students' gave a written consent for their participation in the study.

The students were reassured that the marks obtained in the assessment would not contribute towards their summative examination. The students' names along with their college roll numbers were entered in Microsoft Excel to generate a random number using random number function in Excel. The class was divided into group A and group B, comprising of 50 students each. The experimental

intervention was scheduled and executed in a weekly time table. The histology of endocrine organs was taught during the first four weeks of the module.

All students were exposed to similar instructional strategies; a senior faculty member taught the histological organization of the organ in a large class format, this was followed by a practical session in the histology laboratory.

Practical histology laboratory session: A junior faculty member demonstrated the slide on a closed circuit television screen as well as the teaching microscope. Students in group A were required to draw the histological picture by taking help from the microscope and image displayed on LCD as well as from histology atlas. The working time was one hour. The students in group B were encouraged to study the slide and relate it to the theoretical knowledge being taught in large class format but they did not draw the microscopic image.

After four weeks, histology of reproductive organs was taught in the same way. During the second half of the module, the drawing and no drawing groups were flipped by a cross-over design. Group A students were placed in no drawing group and group B students were placed in the drawing group (experimental)

The dependent variable is the score in MCQ test I and score in MCQ test II. The independent variables are microscope slide image with no drawing and microscope slide image with drawing.

A set of 30 MCQs were administered to the class at the end of the completion of the histology sessions at the four weeks and eight weeks. The test was conducted in the lecture theater. The time duration of the examination was 30 minutes keeping the standard one minute for each MCQ. The students were instructed to fill the right option on the OMR sheets. The computer software was used to mark the OMR sheets according to the key provided.

The scores in the two tests were entered in SPSS version 23. Difference in mean scores of the same group with and without drawing images was compared using the paired sample t test to determine any significant difference in the means of the scores when the students draw and when they did not draw.

Ethical approval was taken from the Institutional Review Board (IRB) & Ethics Committee (EC) of the Shifa International Hospitals Ltd., Islamabad.

Results

Group A Tests I & II score analysis

Group A scored better in test I where they draw the histological images (14.3±3.2) compare to when they did not draw (11.2±3.7). The result showed a statistically significant difference (p <0.05*) (Table).

Group B, Tests I & II score analysis

The mean scores values obtained by group B during test I and II were statistically significant (p <0.05*) (Table). Group B students scored better in test II (15.4±3.5) when they draw the microscopic image compare to test I (1.7±4.9). When they did not draw the microscopic images.

Table: Mean score obtained by group A & B in tests I & II.

	MCQ Test	*Score (Mean±SD)*	*p Value*
GROUP A	Test I (n=47)	14.3±3.2	p <0.05*
	Test II (n=44)	11.2±3.7	
GROUP B	Test I (n=51)	11.7±4.9	p <0.05*
	Test II (n=47)	15.4±3.5	

n = Number of students, p <0.05* = Significant

Discussion

This study shows that the drawing of histological images is an important strategy for the retention of histology associated knowledge. The students who participated in the study marked more correct items in MCQs after four week time in both tests. Irrespective of the type of drawing and type of learners (superficial and deep), the results support the drawing strategy for better learning and knowledge retention. The results of the present study support the previous studies that drawing of histological images enhances the students' involvement with the practical material and they understand the slide material thoroughly if they drew them.[11] When a student is actively involved in drawing picture, the motor visual and verbal component are integrated in tracing, labeling, coloring the picture. All these processes have positive impact on learning outcome.[12] Similarly actual drawing of histological images for long term knowledge retention was assessed in a study in which the students were divided into drawing and no drawing groups. The students were given a free recall test questionnaire and drawing exercise. The data from the study showed that drawers performed better than non-drawers and reproduced more features in free recall tests and performed better in drawing task.[13] The results of this study suggest that drawing of histological images has an advantage over learning without drawing in knowledge retention.[14]

It should be emphasized over here that the results of the present study may not be generalized to all types of knowledge and skill required in the

medical field, yet we can say with confidence that they can be applied across various academic courses in the undergraduate medical curriculum.

Basic medical science knowledge need to be retained over prolong period of non use so it may be wise to take note of the studies highlighting the factors that enhance the long term retention of knowledge.

The factors like individual student abilities for long term retention of knowledge are not under the control of instructors or educators. So the cross-over design used in the study ensured that each student participated in the experimental group. The study also provided each student the benefit of self-reflection and self-assessment. This study adds to the significance of hand drawing for devising better teaching strategies by the educationists and curriculum planners.

The study demonstrates that the histo-morphological knowledge was better retained by the students when they draw the images. Drawing can be an effective learning tool for better understanding and application of knowledge.

The manuscript is a part of a thesis project of MHPE. The time period of the study was during the regular curricular course so we cannot claim that the knowledge retention was over the period of nonuse.

Acknowledgement

Department of examination, SCM, STMU for compiling the test score.

Conflict of interest: There are no financial, personal, or professional interests that could be construed to have influenced the work.

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