Role of Innovations in Pathology Museum in Imparting Knowledge among Medical Students – A Hospital based Prospective Study

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ABSTRACT

Introduction: Medical school museums are a permanent educational resource that provides access at the individual's convenience. Many factors contributed to the decline of museum use: the high maintenance costs and the large amount of floor space. So, the objective of the present study was to assess the effect of "upgraded museum" settings on medical student's satisfaction, knowledge, attitude and skills and to compare with traditional teaching settings.

Material and Methods: All the 148 students were taught breast and thyroid topics during lecture hours. Pre-test was conducted for whole batch before the tutorials, using 50 multiple choice questions. For tutorials, students were divided into two groups (A and B) of 74 and 74 respectively. Group A (control group) were subjected to the traditional museum setting tutorials of having question / answer session and clarifying student doubts. Group B (experimental group) were exposed to innovative teaching &Learning aids like QR code generation and pasting it on museum specimens and corresponding slides and reading them by using smart phone applications. At the end of the two tutorial topics, all students (both control group and experimental group) were subjected to an examination having 50 multiple choice questions.

Results: Group wise analysis of motivational levels based on Post-test Score (Experimental Group vs. Control Group) (Both topics). The significant t-value in the post tests indicates that the motivational levels of the Experiment group are much more than the control group of II year MBBS students.

Conclusion: Innovative teaching &Learning methods at museum contribute to the improvement of skills; they provide a means for fun in the course, enrich the educational environment, encourage active participation and contribute to the reinforcement of knowledge gained in the course.

Keywords: Innovations, Pathology Museum, Quick Response (QR) Code.

INTRODUCTION

A Museum by definition is "An institution that houses and cares for a collection of artefacts and other objects of scientific, artistic or historical importance and makes them available for public viewing through exhibits that may be permanent or temporary".[1]

Medical school museums are a permanent educational resource that provides access at the individual's convenience. Historically, medical school museums were a principal resource for teaching anatomy and pathology and were considered superior to most other educational materials since they allowed both self-directed learning and group study, providing a means to develop better professional communication skills, objectives that currently are emphasized in medical education.[2]

Many factors contributed to the decline of museum use: the high maintenance costs, the large amount of floor space, which otherwise can be used for research activities that may attract extramural funds to the institution, and the remarkably widespread adoption of information technology and multimedia in medical education, including pathology.[2]

Consequently, some medical schools have updated their medical museums and equipped them with new technologies. The Anatomical Museum of Leiden University Medical Centre in The Netherlands and the Medical Museum of Kawasaki Medical School in Okayama, Japan, are two examples of such upgraded museums.[3]

Hence a prospective study was thought and implemented to upgrade the pathology museum with innovations {QR code generation and pasting it on museum specimens and corresponding slides and reading them by using smart phone applications at one go, using AV aids/ technology for better understanding, including interactive sessions in the form of think-pair-share, think-pair-share-write, clinico-pathological correlations (CPC's) Etc.,} and compare it with traditional tutorial settings and later on taking perceptions from II year medical students to know its effect on imparting knowledge.

Objectives

General Objective

To provide options for students and teachers to use fixed learning modules corresponding to key topics in pathology, this would encourage the students to use the pathology museum.

Specific learning objectives

To compare knowledge gained by traditional museum settings and upgraded museum settings in medical students.

To assess the effect of "upgraded museum" settings on medical student's satisfaction, knowledge, attitude and skills.

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To organize better educative sessions for students in learning pathology, in addition to the usual didactic lectures.

To encourage the students to utilize the medical museum facility.

To find out the barriers in upgraded museum settings.

Hypothesis

There are high chances that the students undergoing tutorials through innovative T&L methods at museum will have more knowledge than traditional tutorials

There would be a significant improvement in the knowledge, attitude and skills after the exposure to this innovative module of T&L at museum.

MATERIAL AND METHODS

The study design was a "before and after comparative study with Educational intervention". The study was conducted from 1st June 2018 to 31st July 2018. II year medical students from Mahavir Institute of Medical Sciences, Vikarabad i.e., 148 students were the sample size.

Data collection

An informed consent was taken from those who agree to participate in this planned study. One hundred and forty eight students of MBBS Year II, Semester IV of our medical College are the subjects of this study.

All the 148 students were taught various topics in pathology by power point presentations during lecture hours. Pre-test was conducted for whole batch before the tutorials, using 50 multiple choice questions (item analysis will be done for this).

For tutorials, students will be divided into two groups (A and B) of 74 and 74 respectively. Group A (control group) were subjected to the traditional museum setting tutorials of having question / answer session and clarifying student doubts. Group B (experimental group) were exposed to "upgraded museum settings" like innovative teaching and learning aids like QR code generation (Figure 1) and pasting it on museum specimens (Figure 2) and corresponding slides and reading them by using smart phone applications (Figure 3) at one go, using Audio and video technology for better understanding, and also including interactive sessions in the form of think-pair-share, think-pair-share-write, clinico-pathological correlations (CPC's). etc.,

At the end of the two tutorial topics in pathology (within a span of two months), all students (both control group and experimental group) were subjected to an examination (same paper) having 50 multiple choice questions of graded difficulty based on must to know (70%), desirable to know (20%) and nice to know (10%).

Analysis of results was done with the case and control groups and level of significance was calculated. Pre-test and post test results were analysed.

Later on perception of medical students was undertaken by giving them a questionnaire regarding the effect of "innovations in upgraded Pathology Museum" on medical students' satisfaction, knowledge, attitude and skills.

No.	Group	Pre-test	Intervention	Post-test
1	Experimental group	√	√	√
2	Control group	√	.....	√

Research Instrument

Figure-1: QR Code; **Figure-2:** Specimen with QR Code; **Figure-3:** App for QR Code

Selection criteria

Inclusion Criteria: Medical students who have signed the informed consent form were included in the study

Exclusion Criteria: Medical students who have not signed the informed consent form were not included in the study

STATISTICAL ANALYSIS

Obtained data was checked for errors and then data entry was completed and finally data was analyzed by using recent SPSS 11.0 software. Analysis of MCQ test results was done for both the control and experimental groups and level of significance was calculated by using t- test. Pre-test and post test results were also analysed.

Questionnaire was undertaken to know the effect of "Upgraded Pathology Museum" on medical students' satisfaction, knowledge, attitude and skills from experimental group students and was analysed and discussed.

RESULTS

Out of 74 students from Experimental group, only 65 students attended both pre-test and post-test in experimental group, so 65 students were included and 9 students were excluded, for the sake of calculation.

As the t value was found to be significant it can be concluded that there is significant difference between the pre-test and the post-test which implies that students undergoing tutorials through innovative T&L methods at museum have a significant effect in motivating the II Year MBBS students. Hence, the hypothesis was accepted (Table No.1).

Sl. No	Test	Sample	Mean	Mean Def	S.D.	S. Ed.	t- value
1	Pre-Test	65	38.21	9.79	3.40	0.91	10.64**
2	Post-Test	65	48		4.79		
** Significant at 0.05 and 0.01 levels.							

Table-1: Test wise Knowledge and Motivational Difference Of Experiment Group I (**One** Topic – Breast Pathology)

Sl. No	Test	Sample	Mean	Mean Def	S.D.	S. Ed.	t- value
1	Pre-Test	65	37.62	10.88	4.69	1.12	9.70**
2	Post-Test	65	48.5		6.18		
** Significant at 0.05 and 0.01 levels. Note: Out of 74 students (Control group), only 60 students attended both pre-test and post-test in control group, so 60 students were included and 14 students were excluded, for the sake of calculation.							

Table-2: Test wise Knowledge and Motivational Difference of Experiment Group II

Sl. No	Test	Sample	Mean	Mean Def	S.D.	S. Ed.	t- value
1	Pre-Test	60	37.10	0.3	3.54	0.84	0.36^{NS}
2	Post-Test	60	37.40		4.76		
NS: Not significant							

Table-3: Test wise knowledge and motivational difference of control group 1

Sl. No	Test	Sample	Mean	Mean Def	S.D.	S. Ed.	t- value
1	Pre-Test	60	37.2	0.62	3.10	0.76	0.81^{NS}
2	Post-Test	60	37.82		3.72		
NS: Not significant							

Table-4: Test wise Knowledge and Motivational Difference of Control Group II

Sl. No	Test	Sample	Mean	Mean Def	S.D.	S. Ed.	t- value
1	Experimental	65	48	10.6	4.79	1.00	10.6**
2	Control	60	37.40		4.76		

Table-5: Group wise Motivational Difference: (Experimental Group I vs. Control Group I) (Breast pathology topic)

Sl. No	Test	Sample	Mean	Mean Def	S.D.	S. Ed.	t- value
1	Experimental	65	48.5	10.68	6.18	1.06	10.7**
2	Control	60	37.82		3.72		

Table-6: Group wise analysis of motivational levels based on Post-test Score (Experimental Group II vs. Control Group II)

Statement	N = 136	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Innovations in Pathology Museum contributed in the improvement of my skills	N	98	30	06	02	–
	%	72.05	22.05	4.41	1.47	–
Innovations in Pathology Museum made me to visit Museum regularly	N	88	40	08	–	–
	%	64.70	29.41	5.88	–	–
Innovations in Pathology Museum boosted my motivation towards the subject	N	14	110	06	06	–
	%	10.29	80.88	4.41	4.41	–
Innovations in Pathology Museum increased my interest in this course.	N	30	100	04	02	–
	%	22.05	73.52	2.94	1.47	–
Innovations in Pathology Museum provided a means for fun in learning	N	92	36	06	02	–
	%	67.64	26.47	4.41	1.47	–
Innovations in Pathology Museum contributed to an enrichment in the educational environment	N	100	30	04	02	–
	%	73.52	22.05	2.94	1.47	–
Innovations in Pathology Museum helped decrease the anxiety level in the museum	N	30	102	02	02	–
	%	22.05	75	1.47	1.47	–
Innovations in Pathology Museum helped reinforce the knowledge gained in the course.	N	14	110	06	06	–
	%	10.29	80.88	4.41	4.41	–
Innovations in Pathology Museum contributed to a better comprehension of the course's subjects.	N	16	108	06	06	–
	%	11.76	79.41	4.41	4.41	–
Innovations in Pathology Museum helped us to actively participate in the course	N	98	30	06	02	–
	%	72.05	22.05	4.41	1.47	–
Innovations in Pathology Museum helped structure the knowledge more easily	N	20	103	11	02	–
	%	14.70	75.73	8.08	1.47	–
I think the Innovations applied in Pathology Museum should be applied in other medical museums as well.	N	10	114	08	04	–
	%	7.35	83.82	5.88	2.94	–
I find Innovations in Pathology Museum practices boring	N	–	02	11	11	108
	%	–	1.47	8.08	8.08	79.41

Table-7: Student's perception about Innovations in Upgraded Pathology Museum

Sl. No	Statement	Chakravarti S Study[4]	Our Study
1	Innovative T&L methods at pathology museum influenced more enthusiasm in learning pathology	84%	94.1%
2	Both museum exercises and a clinico-pathological discussion in the form of case studies were necessary to achieve those skills	76%	92.2%
3	Pathology rotation sessions led to a sense of personal development as a student	71%	90%

Table-8: Comparing perceptions of students related to upgraded museum settings with study done by Chakravarthi S5

Figure-4: Students using the QR Code

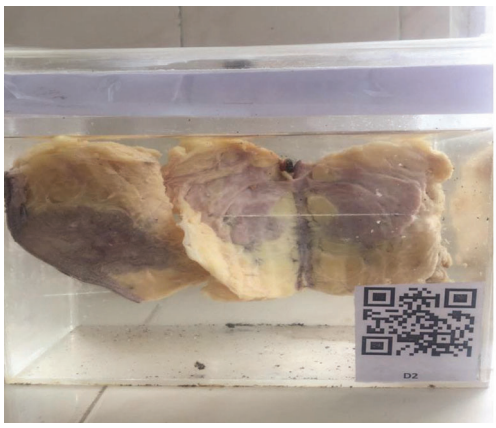

Figure-5: D2 Label: Breast Specimen (Infiltrating ductal carcinoma) with QR code

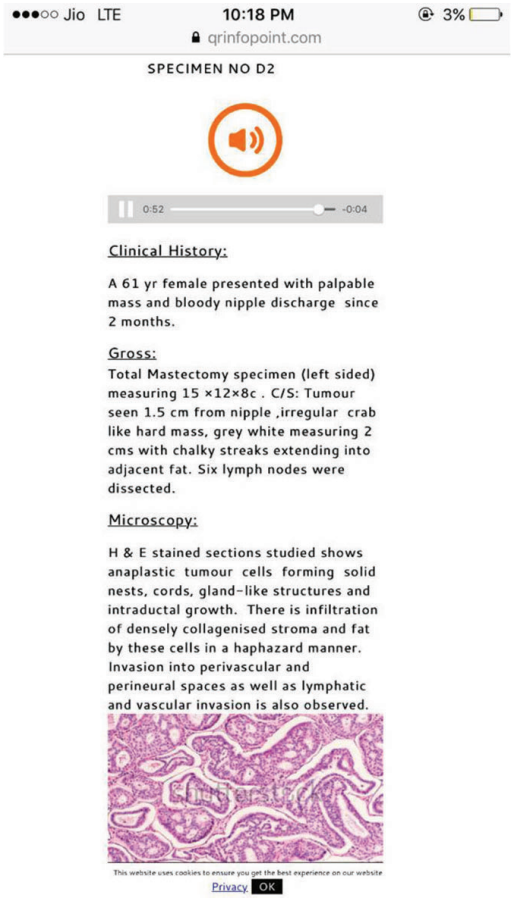

Figure-6: D2 Label: Mobile display (QR code) of Breast specimen (Infiltrating ductal carcinoma)

As the t value was found to be significant it can be concluded that there is significant difference between the pre-test and the post-test which implies that students undergoing tutorials through innovative T&L methods at museum have a significant effect in motivating the II Year MBBS students. Hence, the hypothesis was accepted (Table No.2).

As the t-value was not significant, it can be concluded that the traditional methods has no effect on the motivation of II Year MBBS students in learning Pathology (Table No.3).

As the t-value was not significant, it can be concluded that the traditional methods has no effect on the motivation of II Year MBBS students in learning Pathology (Table No.4).

The significant t-value indicates that the motivational levels of the Experiment group, was much more than the Control group of II year MBBS students with regard to motivation. Hence, the hypothesis was accepted (Table No.5).

The significant t-value indicates that the motivational levels of the Experiment group, was much more than the control group of II year MBBS students with regard to motivation. Hence, the hypothesis was accepted (Table No.6).

It is obvious that there was a significant improvement in the motivation levels of experimental groups than that of control groups, which did not receive tutorials through innovative T&L methods at pathology museum.

Educational Implications

1. The tried-out package of tutorials through innovative T&L methods at museum can be introduced for II year MBBS students in motivating the pupils towards learning Pathology.
2. The tried-out package of through innovative T&L methods at pathology museum can be introduced for II year MBBS students in learning Pathology easily in their syllabus.
3. The package of through innovative T&L methods at pathology museum will be useful for medical teachers in their program.
4. For low achievers the package would be a boon to improve their skills.

5. Medical colleges must focus on conducting workshops for teachers for orienting them about usage innovative T&L methods at pathology museum in teaching Pathology.

Pre-validation of the questionnaire: Pilot testing was done on ten (10) II year MBBS students who were asked to opine regarding the content, consistency and clarity of the questionnaire. Necessary modifications were made as per the feedback given by the students. The pre-validated questionnaire based on 5- point Likert scales, ranging from strongly disagree to strongly agree was administered to the study sample to elicit their perceptions on the interactive sessions they had attended. Out of 148 II year MBBS students, 136 students returned the questionnaire (Table No.7). The reliability of the questionnaire was done by calculating the chronbachs alpha which showed the value of 0.901 indicating a highly reliable one.

DISCUSSION

To be able to be at par with the changing times, we have upgraded our pathology museum by adopting the QR system for gross specimens in our museum. The students were made aware to download any of the free QR code scanner applications or paytm app available in the app stores of Google Android®, Apple iOS® and Windows® store to read the codes. The scanned descriptions were saved in the history tab of the app. With the introduction of this system in the department, we found the number of students reading the descriptions from the app had increased. Their number was even more than the students who used to ask for the description from the teachers or refer to the catalogues made available in the museum. This also helped them in reading the descriptions then and there without any help. The descriptions of the specimens were complete and accurate without any ambiguity.

We also found out that the students were very curious and showed positive response towards QR-based learning as it deviated from routine practice. They felt QR-based activities were motivating and were enthusiastic to learn via new methodology. The scanning of QR codes on flat surface was a smooth affair, whereas scanning on curved surfaces of cylindrical jars was problematic. To overcome this, the QR codes were pasted on top of the covering lid which provided the flat surface.[4]

QR-based learning sheds light on personalized learning and helps in minimizing the ambiguity. QR system provided the information instantaneously on the mobile screen and eliminated the need for paper-based file systems (Figures 4, 5, 6).

According to Student's perception about Innovations in Upgraded Pathology Museum, 72% of the student's stated completely agreement with the item, "Innovations in Pathology Museum contributed in the improvement of my skills" and 67.6% with the item, "Innovations in Pathology Museum provided a means for fun in learning." Likewise, 73% also stated complete agreement with the item, "Innovations in Pathology Museum contributed to enrichment in the educational environment", 72% with the item, "Innovations in Pathology Museum helped us to actively participate in the course." and 64.70% with the item, Innovations in Pathology Museum made me to visit Museum regularly.

In addition to this, the majority of participants chose the "I agree" option for the following items: "Innovations in Pathology Museum boosted my motivation towards the subject." (80%); "Innovations in Pathology Museum increased my interest in this course." (73%); "Innovations in Pathology Museum helped structure the knowledge more easily." (75%); "Innovations in Pathology Museum contributed to a better comprehension of the course's subjects." (79.2%); "Innovations in Pathology Museum helped reinforce the knowledge gained in the course.." (80%); "Innovations in Pathology Museum helped decrease the anxiety level in the museum." (75%) and "I think the Innovations applied in Pathology Museum should be applied in other medical museums as well." (83%). These items are those upon which the student mostly agreed.

Thus, it can be concluded that just as innovative T&L methods at pathology museum contribute to the improvement of skills, they provide a means for fun in the course, enrich the educational environment, encourages active participation, help structure the knowledge more easily, and contribute to the reinforcement of knowledge gained in the course.

Moreover, students expressed positive opinions about having innovative T&L methods at pathology museum. According to these results, using innovative T&L methods at pathology museum makes the content more clear, and the level of understanding higher. Furthermore, innovative T&L methods at pathology museum also help turn theory into practice, encourages active participation, and eases the gain of knowledge and skills related to primary reading and writing instruction.

Comments from the student opinions on the use of innovative T&L methods at pathology museum in classes are as follows: "We used to get bored in traditional practical classes. However, innovative T&L methods at pathology museum helped us to understand the content of the course and reinforce our knowledge.

We had the opportunity to turn traditional museum into practically active museum. Innovative T&L methods at pathology museum actually raised our awareness. The practices were very enjoyable. I participated in the activities. I didn't just listen, I applied them as well." By taking these results into consideration, it might be stated that using innovative T&L methods at pathology museum scenarios will provide positive gains for students as well as for the teaching faculty.

In this study, a course was been designed to explain and explore students perceptions toward upgraded pathology museum. The results of the study reveal that instruction based on the use of innovative T&L methods at pathology museum increased their knowledge and skills.

Students also stated that it helped them to structure their knowledge easily, understand the content of the course better,

and put theory into practice. In addition, the process helped to reinforce the information gained in the course by actively using it. They pointed out that as a result of the innovative T&L methods at pathology museum, the course included more "fun" activities (QR code generation) and promoted a rich learning-teaching environment.

Two most liked innovations in "Upgraded Pathology Museum" for most of the students (92%) were QR codes with audio and image settings on mobile app followed by clinico-pathological discussions during museum settings.

In the design stage of the Museum, the barriers most frequently faced cited were feeling anxious about the possibility of failing to prepare an age- and content-appropriate mobile app, its being time consuming, and students' having insufficient time. In development of innovations in museum, teachers' most frequently expressed challenge was feeling anxious about the possibility of failing because mobile app was requiring internet connectivity for opening of app. Interestingly, Kapse[4] also stated that participants' perceived lack of time as well as technical issues to be the most significant barriers to using games in education and in our study, from student's point of you, few faced internet connectivity problem for the first session (breast pathology) because of overload of students using the internet data, which was solved then and there, by using extra wifi routers.

Limitations of the study: However, one of this study's limitations lies in the number of participants surveyed. In addition, encouraging the use of innovations in T/L methods in museum, in different areas of education and supporting those studies promoting teachers to use various scenarios in different courses may be beneficial. Finally, another promising area for research might be to explore the effect of innovations in T/L methods in museum, on various subjects/ courses by using different sample groups and sampling techniques.

CONCLUSION

An interactive discussion with the students revealed that they were interested and quite enthusiastic to gain knowledge by this module, which depicted the picture, gross and microscopic with some salient text notes, and they felt that this would also be useful for them in tackling the examinations, and in future, during their clinical exposure.

Innovations in Medical Museum are need of the hour for training undergraduate medical students because it's very important to impart a structured module that facilitates observational skills used in successful self-guided learning, and better understanding of pathology.

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