MILA in Dental Education

Edited by

Dr. Deepak Nallaswamy Veeraiyan

Published by

Centivens Institute of Innovative Research Private Limited

MILA in Dental Education

ISBN 978-81-949297-6-5

DOI: 10.47059/CIIR/BP20005

Editor

Dr. Deepak Nallaswamy Veeraiyan

Centivens Institute of Innovative Research

307, 5th Street Extension, Gandhipuram,

Coimbatore - 641012, Tamilnadu, India.

E-mail: publications@centivens.com

Website: www.centivens.com

Preface

MILA, Multiple Interactive Learning Algorithm is a wonderful protocol that was developed and refined at Saveetha Dental College and later spread on to the various institutions across the Saveetha Institute of Medical and Technical Sciences. What is interesting is that this protocol has been universally adopted whether it is maths, science, school teaching, dental education or anything for that matter. It shows that it's a simple and versatile tool used for all forms of education and educational pedagogy. One of the major things we really enjoyed about the MILA protocol is that it allows us to cover the portions much faster; it keeps the students tempo longer and also the retention rates are much higher and the students' performance in various exams are also much better. So, it is no surprise that this protocolis been followed across many other places. One of the more common systems which was independently developed similarly mimics MILA is the POMODORA methods of learning which also involves some form of a break for every kind of session. However, MILA is special in that the way the interactive activities are tied into the primary curriculum and how the successive activities are mend to keep diversity in the teaching style have also been a great boom in enhancing both the teachers creativity and students aptitude in learning. We believe that this literature shows extensive use of MILA in various forms of dental education. However, we would say that it would be a wonderful platform for every other dental educator to adopt into their day to day teaching policies or protocols. We would also suggest that many people from every other profession can also adopt this because it is a truly versatile system and we hope that it is of great use to the society.

Acknowledgement

It would be impossible to limit the acknowledgement for this project, because it's been an all-time enduring process that has been spanned over multiple months. However, the first and the main person I would like to thank is Dr.M. Subha, without whom literally this project would not have taken off through the wheels and got completed on time. She had very organized and ardently finished the whole job and I would really thank her with all my heart for her wonderful contribution. The next major acknowledgement I would like to give is for the faculty of the department of anatomy, physiology, biochemistry, general pathology, microbiology, pharmacology and our fraternity from the departments of oral medicine and radiology, oral and maxillofacial pathology, oral pathology, public health dentistry, conservative dentistry and Endodontics, Periodontics, Prosthodontics, Pedodontics, orthodontics for being a part of the team and executing various analysis and research regarding with the MILA and the MILA protocol. It's very easy for anybody to come up with new ideas and formulate them for the betterment of education. However, when you are going to get a huge team involved and try to get all these departments work together, we need to have open minded people who really look forward for the betterment of the education. In that context I am really grateful that we are blessed with one of the best faculty teams in the country who are able to not just follow it, they also try to bring in their own sets innovation and improvise the overall concept and take it to the next level. Finally, I would like to thank the almighty, my parents, my wife and children for their constant support and motivation throughout the course of this project.

Editor Profile

Dr. Deepak Nallaswamy Veeraiyan is a Prosthodontist & Implantologist and currently the Director of Academics and also Professor and Head, Department of Prosthodontics in Saveetha Dental College, Chennai, Tamil Nadu, India He completed his graduation in Dental Sciences (BDS) in 2001 in Saveetha Dental College, Chennai when it was affiliated to Dr MGR Medical University, Chennai. He received 6 gold medals for securing the highest scores in various subjects during his period of study and was also the recipient of the 'Best Outgoing Graduate' when he graduated in 2001. He completed his postgraduate program (MDS) in Prosthodontics and Implantology at Saveetha Dental College in 2005 and secured the highest score for all basic science subjects.

Dr. Deepak Nallaswamy Veeraiyan has authored and published two editions of the bestselling "Textbook of Prosthodontics" which is considered the definitive textbook for prosthodontics by clinicians across the country. He completed his Master's program in Prosthodontics (MS. Prosthodontics) in the University of Toronto, Canada during which time he served as a Clinical Demonstrator and awarded the 'Best teacher' and 'Most Motivating Teacher' awards by the University of Toronto. He is an avid researcher with a keen, analytic mind which has helped him design and guide a variety of research projects with his team. He has over 50 research papers in his academic portfolio. He has also completed the Management Development Program in Harvard University, Boston, USA. He has singlehandedly spearheaded the implementation of sophisticated devices such as CADCAM machines and 3D printer in the Department of Prosthodontics in Saveetha Dental College to aid in research and to develop newer and more efficient protocols for treating patients. His clinical interest is "Prosthognathics", a combination of Orthognathic surgery and Prosthodontic techniques to manage Full Arch restorations cases with Aesthetic deficiencies.

He is also known for his prowess in advancing Dental Education through the implementation of MILA (Multiple interactive learning algorithm) in Saveetha Dental College, for which he was awarded the 'Best Pioneer in Dental Education' in the World Dental Congress held in London in April 2017.

TABLE OF CONTENTS

MILA in Teaching General Pathology for Dental Students

Dr. Deepak Nallaswamy Veeraiyan, Director for Academics, SIMATS.

Professor, Department of Prosthodontics, Saveetha Dental College and Hospital, SIMATS.
E-mail: dir.acad.sac@saveetha.com

Dr.M. Subha*, Associate Professor, Department of Oral Medicine & Radiology, Saveetha Dental College and Hospital, SIMATS. E-mail: doctorsubha@gmail.com

Dr.V.B. Preejitha, Tutor, Department of General Pathology, Saveetha Dental College and Hospitals, SIMATS.

Dr.S. Leslie Rani, Tutor, Department of General Pathology, Saveetha Dental College and Hospitals, SIMATS.

Dr.M.P. Brundha, Associate Professor, Department of Pathology, Saveetha Dental College and Hospitals, SIMATS. E-mail: mpbrundha7@gmail.com

Abstract--- Multiple Integrated learning algorithm (MILA), is a learning innovation which enables easy learning to the students. General Pathology being a complex subject but requires a lot of understanding to be a greater clinician. This subject needs understanding, memory and application which enables students in diagnosing the diseases and treating them with utmost care. The students get perplexed with the complexity in pathogenesis at cellular level. The understanding of the disease at molecular level is essential for prescribing drugs for the disease. This article focuses on a few chosen topics made easy with MILA. This enhanced the learning by the students.

Keywords--- MILA, General Pathology, Inflammation, Necrosis, RBC.

INTRODUCTION

Activity based learning is an evolution in the teaching learning process to overcome the limitations from conventional teaching or learning (Patil et al. 2016; “Website” n.d.). Clarity in theoretical concepts is essential for application in reality. However this cannot be achieved by conventional teaching (Rogers 2009) Transformation from conventional teaching to activity based learning has a positive influence on students. (Rogers 2009; Cummings and Sheeran 2019) By reinforcing concepts learned during lecture, visually teaching new concepts and providing an outlet where the students are free to interact more casually with the instructor and their peers enhances their concentration and confidence. (Kanchanamala and Muppidi 2016).

ABL is a reformed approach that enhances students’ active learning through various activities to develop cognitive, affective, and psychomotor skills equally. (Chaiyama 2018) Jonassen 2000 stated that learning is a highly complex process. Therefore, an effective learning process cannot be done with a single approach. ABL was developed as a learning approach that encourages and develops students’ active participation in learning by hands-on experiences in a multitude of learning environments inside and outside of campus. (Haslam, n.d.).

MILA in teaching is an innovative approach which reduces the lecture time to 20 minutes thereby engaging the students with lecture based activity for remaining 20 minutes. This helps in reducing the boredom lectures. This teaching methodology was highly appreciated by students as it helps to understand the subject easily and provides an easy way to remember the difficult topics. It is also beneficial to the teaching staff as they no need to continuously take lecture classes for 40 minutes.

This article is on how effectively an activity based learning is helpful in learning general pathology among the dental undergraduate students. All three case studies had utilised different types of learning and are discussed based on either the scores or students perception.

MILA in Teaching Concepts of Necrosis

Pathology is a vast syllabus and has numerous complicated concepts that make the students get confused to click out the important and correct concepts of various disorders. Students have difficulty in understanding the pathological concepts of cell injury and cell death especially 'Necrosis' like etiopathogenesis, morphological features including gross and microscopic features. In the undergraduate curriculum, understanding the morphological features of the lesion is a challenging aspect. In the study done by Kathan R et al mentioned that Morphological knowledge is very important for understanding pathology (Kanthan and Senger 2011). Though morphological features of a lesion need microscopic study, we used 'clay modeling' of the pathological features of necrosis for understanding the morphological features. We in our class used this 'clay modeling' as an activity in between the short session of lecture for 20 minutes. This activity-based learning method called the 'Multiple Interactive Learning Algorithm (MILA)' was introduced in 2014 ("Website" n.d.). In this system of learning, there will be a short lecture for 20 minutes followed by 20 minutes of interactive and non-interactive activities given to the students. In the time of the lecture, the facilitator will describe the concepts of the selected topic of the class schedule. After the lecture, an activity will be given about the concept discussed. In this monograph, we described the methods and results of the MILA system used in the pathology classroom for the second-year undergraduate students regarding 'Necrosis'.

METHODOLOGY

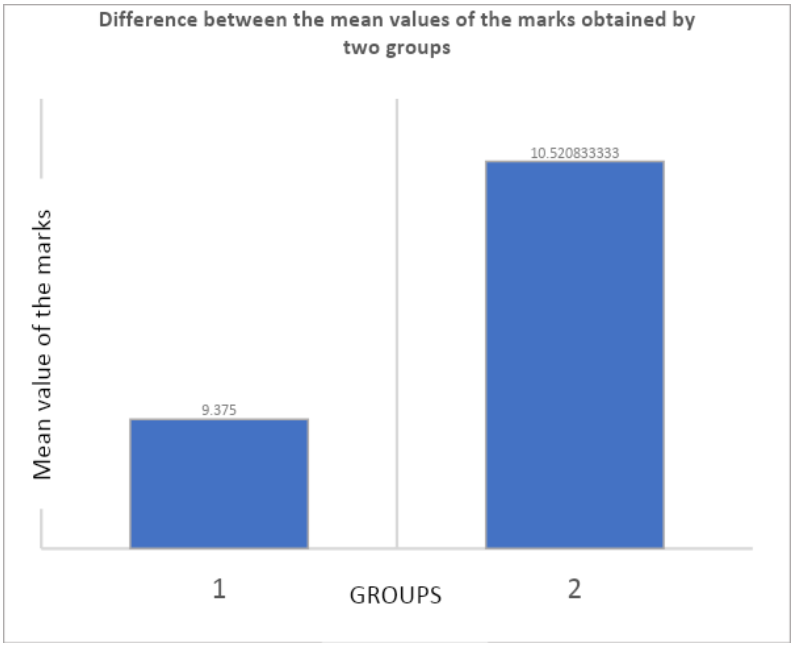
The study was conducted in the Lecture hall, Department of Pathology, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences. In our study, as per the Multiple Interactive Learning Algorithm (MILA), the entire second year dental undergraduate students were divided into small groups of around twenty-five to thirty students in each batch. With the sample population of twenty-five second-year undergraduate students, in MILA we utilized forty minutes out of the one hundred twenty minutes for the topic 'Necrosis'. Out of the forty minutes, the first twenty minutes were given for flipped class sessions and the next twenty minutes were given for the activity 'Clay modeling'. The protocol included in the Flipped class session was 1) Visualisation of a short keynote video for first three minutes, 2) Interactive discussion about the concepts shown in the video, 3) Discussion of the points for further understanding in order and the Clay modeling session, the students were segregated in five groups with three to five students in each group. The students were allowed to make a 2D model on microscopic features of the types of Necrosis for 20 minutes. Each group was given one type of necrosis. After the clay modeling activity, the students were allowed to discuss the salient features of the microscopy of the different types of necrosis. The level of understanding of the correct pathological concepts of the necrosis among the students was analyzed by their performance in the model theory examination which was evaluated by an external examiner in an unbiased manner. This group was considered group 2 and group 1 comprised 25 randomly selected students from the previous year batch of second-year students who were taught in the conventional lecture for forty-five minutes of the large group teaching method.

RESULTS

The results of the student performance and attentiveness were compared among the two groups.

Table 1: Conventional Method of Teaching Versus MILA System of Teaching.

Group	No. of students	Mean	Std dev	p- value	Statistical significance
Conventional method of teaching	25	9.300	2.107	0.028	Significant (<0.05)
MILA system of learning	25	10.500	1.646		



Graph 1: Comparison of the Two Means of the Marks Obtained by Two Groups

As table 1 showed the marks obtained by the students trained by Multiple interactive learning algorithms were at a higher level than the conventional method of the teaching method. The mean values of the two groups were shown in graph 1. The mean value of the marks of the group 1 is 9.3, and the group 2 is 10.5. The student t-test was performed with the results obtained. The p Value is 0.028 which is <0.05 and there is a statistically significant difference between the two groups. The student's attentiveness and interaction are also increased in the MILA learning method compared to the conventional teaching method. Modelling based activities create the ability of argumentation, visualization, and analogical reasoning among students (Millis and Cottell 1998; Anderson and Yates 1999). Millis et al in their study suggested that faculty should introduce cooperative learning in higher education which includes reciprocal or paired teaching activities, interactive lectures, and problem-based learning methodology to clarify the concepts of pathology among the students (Millis and Cottell 1998). In our study, we focused the same and found that the MILA system of learning pathology is helpful for the students.

MILA in Teaching RBC Disorders

MILA in teaching "RBC DISORDERS '' a difficult and confusing topic. Students have a difficulty in correlating the laboratory findings which is quite confusing in case of the RBC DISORDER. We utilised a method of case representation and pictorial representation type of pedagogy.RBC disorders is a vast and huge topic.

Various nutritional anemias, thalassemias, sickle anaemia come under this topic. For better understanding we made the students analyze the anaemias by giving the clinical case representation form. Clinical symptoms and some lab findings were included In the case history and students were asked to identify the type of RBC disorder. The classes were taken and the students were made to understand the concept of the topic and then with case

presentation and pictorial representation the various topics were covered so that they never got confused and had a clear cut idea on the topic.

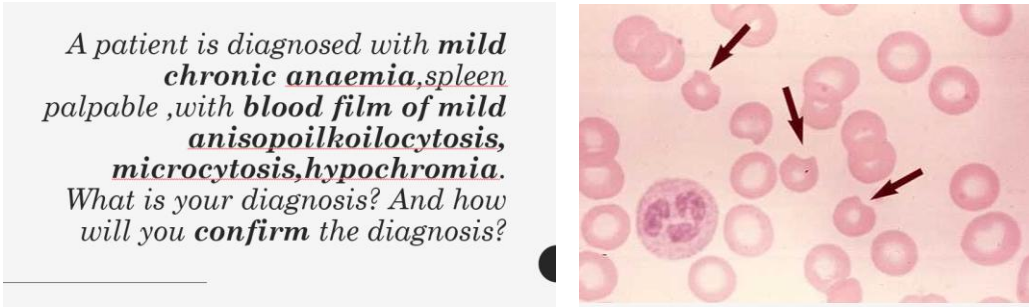
The microscopic findings and case histories were compiled to make them analysed and recollect and correlate the findings and diagnose what disorder it comes under. The classes were taken as usual. After the classes were taken, they were made to revise and brush the topics once again. Then the activity was given to the students by PowerPoint presentation.

Peer led team based learning was the activity we utilised for this study. They were divided into Group A and Group B. The students were given time to understand the question and the pictures to discuss with their peers and finally answer it.

Therefore this helps the students to apply what they have studied. This method has helped the students to analyse and learn and apply the concepts they have studied rather than blindly reading the topics. When they take care to analyse and apply it, it stays in their memory and helps them to recollect it whenever required. A test conducted in the following showed good results.

There has been a slight increase in understanding the concepts that have been taught. This shows that pictorial method and case history representation method has helped them to understand and grasp the concepts of this particular topic. The lab findings which were quite confusing for the students which later after the case representation and pictorial gaming was made simple for them.

This results in the following test showed that students have fully understood the concept. This type of activity also helps them to correlate the clinical symptoms and diagnose the disease rather than blindly reading the topics. This helps them to improve their analytical knowledge as well. Thus this shows that more than a monologue's class, involving the students and helping them correlate what they have learnt in class by giving activity helps them improve in their studies. Overall, we believe teaching students by this method is effective for teaching RBC disorders.



MILA in Teaching Chemical Mediators of Inflammation

We followed this MILA (Multiple Interactive Learning Algorithm) technique in General Pathology to teach the "Chemical Mediators of Inflammation". As there are many chemical mediators, it's quite difficult for the students to remember its source of production, its functions, types and examples.

There are various methods used in MILA which includes, PEER LED, POGIL, SCALEUP, CRITICAL THINKING, CLAY MOLDING, CONCEPT MAPPING, etc.

We utilised DIGITAL BASED ACTIVITY- MATCH THE MEMORY as one of the methods of pedagogy in a class between 8:30 am to 9:15 am. The objective of this learning game is to render the learning experience with more fun, to engage learners and to keep them motivated (Khenissi et al. 2014). Recent research on "brain training" renews

promise for improving memory and other cognitive skills (Deveau et al. 2014). Here, we focus on improving the speed of thinking and training the short term memory into long term memory through this digital based activity.

A flipped video was provided to the students, followed by discussion and a brief introduction was given about Digital based activity (Match the Memory). Match the memory is a fun game, where you need to match pairs of tiles. Game is completed once all the tiles are matched. Here, tiles to be paired can be denoted with picture- picture, text-text or picture-text. This helps in recalling and remembering the new terms, its definition, source, types, functions. As pictures are also included in this game it makes students identify the perfect match quickly. The time duration to complete the game and number of flips are considered for the scoring system. Students who take the minimum time and minimum number of flips to complete will top the leader board. A link was created and sent through whatsapp to all students.

Advantage of MATCH THE MEMORY includes improved concentration, train visual memory, increase short term memory, increase attention to detail, improve the ability to find similarities and differences in objects, help to classify objects that are grouped by similar traits, improve vocabulary.

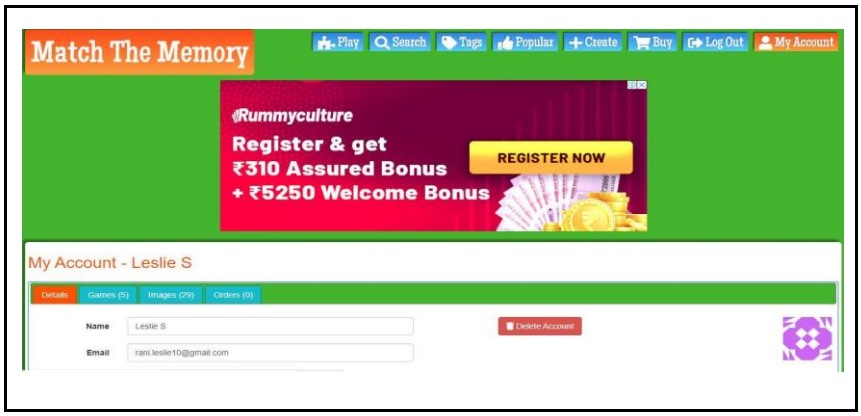
The major advantage of this game is to enhance the speed of thinking. Students can play anywhere and at any time and also many times. Instead of studying the entire text book for revision, students can play this game two or more times. This gives them better recollection of the terms along with pictures.

How was the Game Created?

There is a website named “matcthememory.com”. Creating a new game step by step is given in figure 1.First, an account must be opened in order to create a new game. Shows the details of the created account. It displays the number of games created and images uploaded. Secondly, create a new game (circled in the figure) by choosing the icon. The title of the new game is given as Chemical Mediators II. The game is made public. Layout of the card can be chosen. To encourage the winner pop up message can be created like Hurray.

The design of the back and front of the card are selected. Even the colour and the font of the text can be of our choice. There are various card types like Pic-Pic, Text-Text, Pic-Text as shown in the below figure. Each card is assigned some specific terms and pictures related to it. How is the game played? Figure 2 gives the order of the game. Pictures to be uploaded have to be dragged in the specified box as shown in the figure Different terms used in each card. In total 9 cards have been created with its corresponding match, it can either be a text or picture format.

Selected cards are shuffled. Link is shared to the students through gmail or whatsapp group. As the student plays the cards get revealed. On completion of the game results get displayed with the time taken and number of flips used to finish the game.



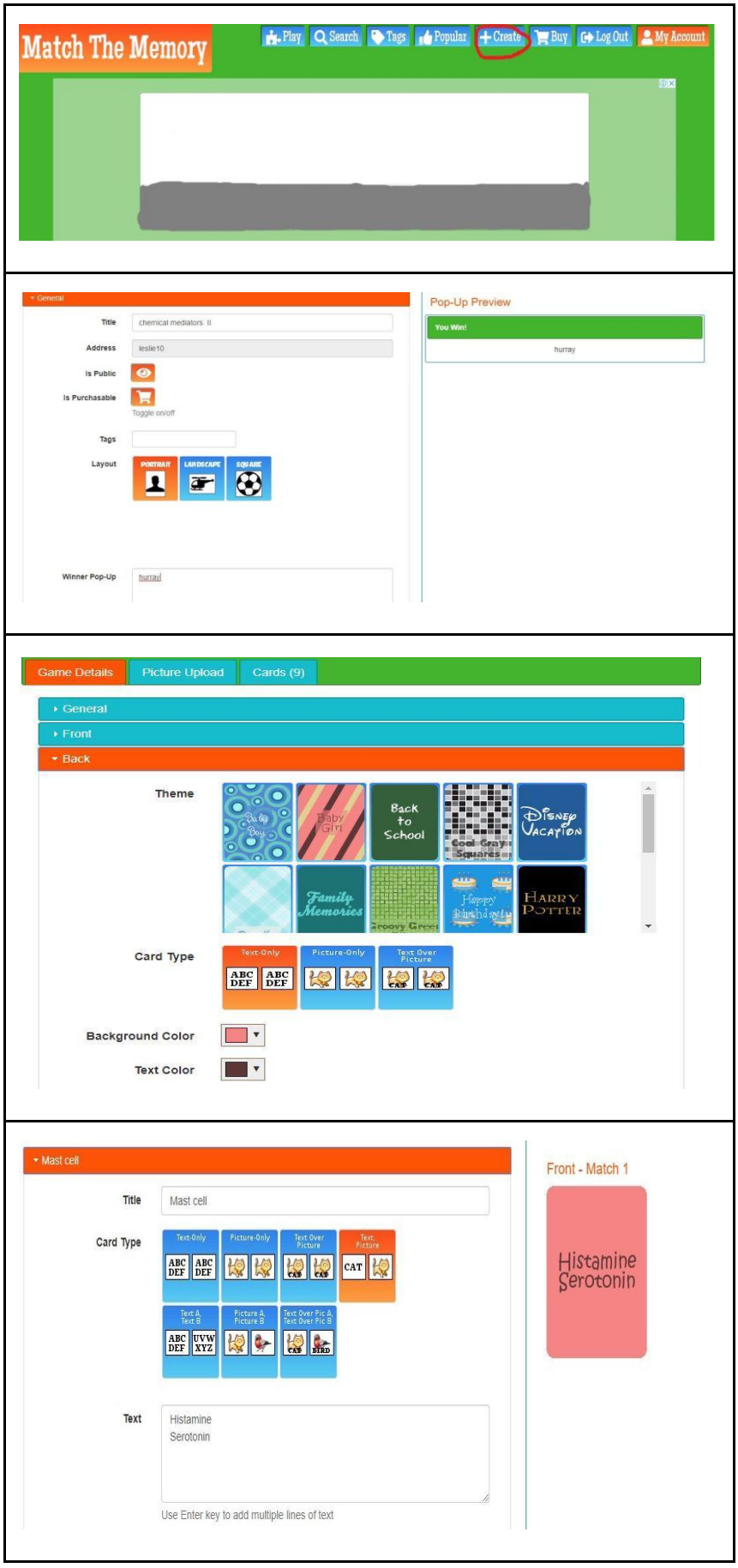


Figure 1: Creating a Game Step by Step

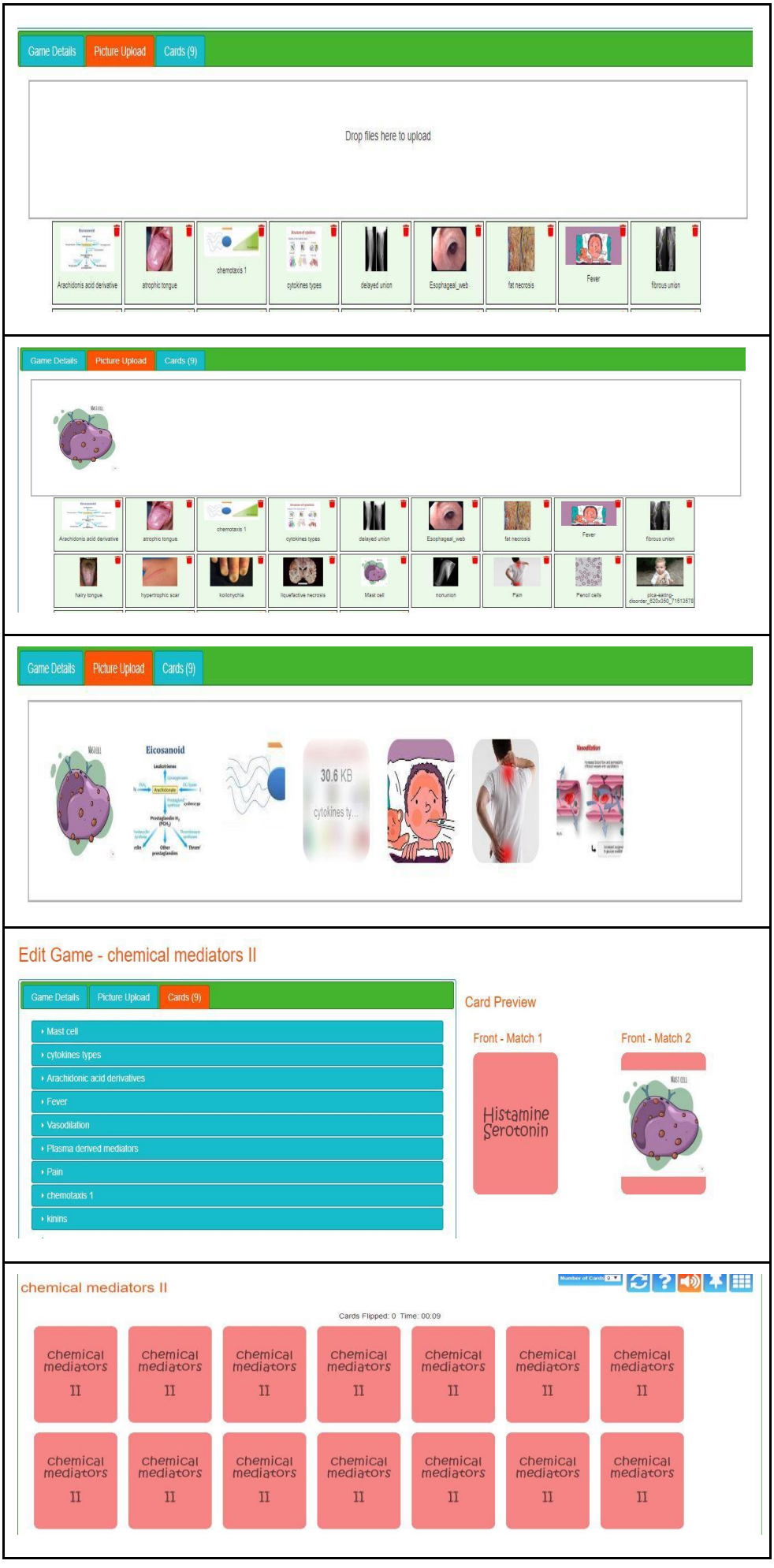

Game Details
Picture Upload
Cards (9)
Drop files here to upload
Arachidonis acid derivative
atrophic tongue
chemotaxis 1
cytokines types
delayed union
Esophageal_web
fat necrosis
Fever
fibrous union
Game Details
Picture Upload
Cards (9)
hairy tongue
hypertrophic scar
koilonychia
liquefactive necrosis
Mast cell
nonunion
Pain
Pencil cells
Game Details
Picture Upload
Cards (9)
Eicosanoid
30.6 KB
cytokines ty...
Edit Game - chemical mediators II
Game Details
Picture Upload
Cards (9)
Mast cell
cytokines types
Arachidonic acid derivatives
Fever
Vasodilation
Plasma derived mediators
Pain
chemotaxis 1
kinins
Card Preview
Front - Match 1
Histamine
Serotonin
Front - Match 2
chemical mediators II
Cards Flipped: 0 Time: 00:09
chemical mediators II

Figure 2: Playing the Game

Demonstration was given to the students on how to play the game. The link was sent to 13 current second year students and was asked to play. When compared to the last year passed out students, the current second year students were able to recall the different types of chemical mediators and its role in inflammation. It is also noticed that there has been a dramatic increase in the speed of thinking.

CONCLUSION

The MILA learning method is found to be having a dramatic increase in the performance of the students and understanding of the pathological concepts of the Necrosis. Overall, we believe that teaching students by this method is very effective for understanding and learning pathology concepts. We believe teaching students by this method is effective and improves the concentration level. Such dry topics can be memorised easily through these kinds of activities. Students were able to answer whenever the chemical mediators topic came for discussion.

BIBLIOGRAPHY

[1] Anderson, Angela, and Gregory C. R. Yates. 1999. “Clay Modelling and Social Modelling: Effects of Interactive Teaching on Young Children’s Creative Artmaking.” Educational Psychology. https://doi.org/10.1080/0144341990190406.

[2] Chaiyama, Nuanphan. 2018. “The Instructional Design Blended Learning Model by Using Active Learning Activities to Develop Learning Skills in 21st Century for Higher Students.” Proceedings of the 2nd International Conference on E-Society, E-Education and E-Technology - ICSET 2018. https://doi.org/10.1145/3268808.3268816.

[3] Cummings, Daniel J., and Nicola Sheeran. 2019. “Do Academic Motivation and Personality Influence Which Students Benefit the Most from Peer-Assisted Study Sessions?” Psychology Learning & Teaching. https://doi.org/10.1177/1475725719840502.

[4] Deveau, Jenni, Susanne M. Jaeggi, Victor Zordan, Calvin Phung, and Aaron R. Seitz. 2014. “How to Build Better Memory Training Games.” Frontiers in Systems Neuroscience 8: 243.

[5] Haslam, E. L. n.d. “A Learning Model That Develops Students’ Active Learning and Reflective Practices.” Proceedings Frontiers in Education 1997 27th Annual Conference. Teaching and Learning in an Era of Change. https://doi.org/10.1109/fie.1997.644822.

[6] Kanchanamala, P., and Satish Muppidi. 2016. “SIPAI: An Integrated Learning Model of Self Learning, Inquiry Based, Problem Solving, Activity Based, and Instructional Learning for Engineering Education.” 2016 IEEE 6th International Conference on Advanced Computing (IACC). https://doi.org/10.1109/iacc.2016.156.

[7] Kanthan, Rani, and Jenna-Lynn Senger. 2011. “The Impact of Specially Designed Digital Games-Based Learning in Undergraduate Pathology and Medical Education.” Archives of Pathology & Laboratory Medicine 135 (1): 135–42.

[8] Khenissi, Mohamed Ali, Fathi Essalmi, Mohamed Jemni, and Kinshuk. 2014. “A Learning Version of Memory Match Game.” 2014 IEEE 14th International Conference on Advanced Learning Technologies. https://doi.org/10.1109/icalt.2014.67.

[9] Millis, Barbara J., and Philip G. Cottell. 1998. Cooperative Learning for Higher Education Faculty. Greenwood.

[10] Patil, Ujwala, Suneeta V. Budihal, Saroja V. Siddamal, and Uma K. Mudenagudi. 2016. “Activity Based Teaching Learning: An Experience.” Journal of Engineering Education Transformations.

https://doi.org/10.16920/jeet/2016/v0i0/85433.

[11] Rogers, Daniel T. 2009. “The Working Alliance in Teaching and Learning: Theoretical Clarity and Research Implications.” International Journal for the Scholarship of Teaching and Learning. https://doi.org/10.20429/ijsotl.2009.030228.

[12] “Website.” n.d. Accessed August 14, 2020a. Patil, Ujwala, Suneeta V. Budihal, Saroja V. Siddamal, and Uma K. Mudenagudi. 2016. “Activity Based Teaching Learning: An Experience.” Journal of Engineering Education Transformations. https://doi.org/10.16920/jeet/2016/v0i0/85433.

[13] Deepak.N “MILA: A New Education System”, http://eventssaveetha.blogspot.com/2015/05/mila-new-education-ystem-by-dr-deepak.htmll. Lastly accessed date 27/1/2020.

MILA in Teaching Human Anatomy for Dental Students

Dr. Deepak Nallaswamy Veeraiyan, Director for Academics, SIMATS.

Professor, Department of Prosthodontics, Saveetha Dental College and Hospital, SIMATS.
E-mail: dir.acad@saveetha.com

Dr.M. Subha, Associate Professor, Department of Oral Medicine & Radiology, Saveetha Dental College and Hospital, SIMATS. E-mail: doctorsubha@gmail.com

K. Yuvaraj Babu, Assistant Professor, Department of Anatomy, Saveetha Dental College and Hospital, SIMATS. E-mail: yuvarajbabu@saveetha.com

Karthik Ganesh Mohanraj, Assistant Professor, Department of Anatomy, Saveetha Dental College and Hospital, SIMATS. E-mail: karthikm.sdc@saveetha.com

Dr. Lavanya Prathap, Assistant Professor, Department of Anatomy, Saveetha Dental College and Hospital, SIMATS. E-mail: lavanyap.sdc@saveetha.com

Ganesh Lakshmanan, Senior Lecturer, Department of Anatomy, Saveetha Dental College and Hospital, SIMATS. E-mail: ganeshl.sdc@saveetha.com

Dr. Dinesh Premavathy, Senior Lecturer, Department of Anatomy, Saveetha Dental College and Hospital, SIMATS. E-mail: dinesh801anatomy@gmail.com

S. Sangeetha, Lecturer, Department of Anatomy, Saveetha Dental College and Hospital, SIMATS.
E-mail: sangeethas.sdc@saveetha.com

Abstract--- MILA, Multiple interactive learning algorithms are an innovation in teaching and learning. Since conventional teaching methodology involves one way communication it prevents students from active participation. MILA is a methodology which involves active participation by the students in the form of activity and discussions. Activity based learning is an evolution in the teaching learning process to overcome the limitations from conventional teaching or learning [1]. Clarity in theoretical concepts is essential for application in reality. However this cannot be achieved by conventional teaching [2]. Transformation from conventional teaching to activity based learning has a positive influence on students [2,3]. By reinforcing concepts learned during lecture, visually teaching new concepts and providing an outlet where the students are free to interact more casually with the instructor and their peers enhances their concentration and confidence [4]. Activity-based learning prescribes an array of methods of pedagogical approaches to teaching. Its core practice lies on hands-on experiments and activities [5]. In our study we have tried numerous activities in teaching head and neck anatomy to dental undergraduate students. We have tried numerous individual and team activities in teaching anatomy. The activities include concept mapping, model making using chart, clay modelling, sketching, etc. A short flipped video followed by interaction with the facilitator and activity which enables students to have an active learning session. We found it to be a very effective learning methodology based on the students' performance and the feedback we received from the students.

Keywords--- Flipped Class, Teaching, Learning, Clay Modelling, Activity based Learning.

INTRODUCTION

Lecture sessions have been established to be one of the most inefficient methods of knowledge sharing for many decades [6]. The average student remembers less than 10% of what is taught in class and the overall standard of education is compromised by the use of large classrooms with impersonalised speeches [7]. Lecture sessions are also reported to be boring and inconsistent when similar topics are repeated between classes. Although adjuvants like presentations and slides promised to make lectures more effective, In reality they only led to increased boredom of faculty merely reading everlasting scripts with little to no passion [8]. By the early 2000's SMART classrooms were considered the holy grail of education [9]. The initial wave of positive review and the aura of technology propelled thousands of institutions across the globe to purchase high end smart board equipment. But over time they have also proved to be in-vain.

Over the past decade, other platforms tried to replace the smart board as the next big thing [9]. One major contender with tremendous promise was the iPad®/Tablet system coupled with polished software that promised to make course work and learning easier [7]. To an extent, these systems have shown some successful integration. The use of vital books and tablets notes have become common practice in most institutions and however the impact of this on the student learning and long term retention are questionable [10]. Tablets do provide easy access to a wide variety of sources and videos. Video based tutorials in youtube and in classrooms have become very popular and seem to impact the understanding of the learning of the individuals [11]. Nevertheless, the quality of content creation and lack of curation / reviews have made it very difficult to search for the right content. Many students have reported difficulty in effectively utilizing these resources with ease.

Learning management systems such as Blackboard®, Canvas® have been used extensively for content delivery, eventually they have become replaced by efficient services like Google Classroom®, Moodle® etc [12]. Classrooms have even gone virtual with Zoom®, Google Meet®, Cisco WebX® etc [13]. These methods have opened new paradigms for teachers to connect with students across long distances. It's evident from above mentioned facts that the majority of the focus in education primarily aimed to make teaching fancy, more technologically savvy etc. Unfortunately the focus on technology has not improved the spirit of education. Very little has been done to improve the quality of the teaching learning process with the available simple cognitive tools [14].

In this article, we have tried MILA, Multiple Interactive Learning Algorithm in teaching Head and Neck Anatomy for Undergraduate dental students. Seven difficult topics were chosen, handled by different faculty and reported as a case series. Each faculty had tried innovative ideas in making learning easier. The sessions were of 2 hours time which includes a flipped video session, interactive session, activity session and feedback or assessment session in any order of convenience.

MILA in Teaching Facial Nerve

Anatomy of the facial nerve is an important topic which has a significant role in day to day clinical practice. The facial nerve has a complex anatomical course and so, a thorough understanding of the course of the facial nerve is essential to localize the sites of its pathology with varying effects [1] [2] [3].

The facial nerve is the seventh cranial nerve (CN VII). It arises from the brain stem and extends posteriorly to the abducens nerve and anteriorly to the vestibulocochlear nerve. It courses through the facial canal in the temporal bone and exits through the stylomastoid foramen after which it divides into five terminal branches at the posterior edge of the parotid gland. The facial nerve provides motor innervation of facial muscles that are responsible for facial

expression, parasympathetic innervation of the glands of the oral cavity and the lacrimal gland, and sensory innervation of the anterior two-thirds of the tongue.

The facial nerve carries both motor and sensory fibers. Motor axons innervate the muscles of facial expression and the stapedius muscle. Parasympathetic fibers go to the ganglia that supply glands in the oral cavity and the lacrimal gland. The sensory component provides innervation to the external auditory meatus, the tympanic membrane, and the pinna of the ear. The facial nerve also carries a taste sensation from the anterior two-thirds of the tongue.

The difficulty to understand this topic for a first year dental student is many folds. The different nuclei of facial nerve present in the brain stem with different functional components initiates the complexity of the topic. To further compound the difficulty in understanding the anatomy lies the facial nerve's intratemporal course. The applied anatomy of the nerve involving the upper motor neuron lesion and lower motor neuron lesion and the differing clinical presentation based on strong anatomical correlation adds even more complexity and versatility for the topic.

To understand all the above mentioned concepts involved, students need more than just PowerPoint presentations or black board chalk and talk teaching methods as tools. We used Multiple Integrative Learning Algorithms to meet this daunting task. We approached this topic with concept mapping pedagogy and wire modelling of the nerve based on the concept mapping to make the topic familiarise and grasp the ideas and concepts behind the anatomy of the facial nerve. Following the flipped class on facial nerve anatomy involving video lecture and explaining the same to the small group learning students, using the Ipad, the students were asked to draw a concept map of the facial nerve (Figure 1). The students started to make concept maps from the nuclear levels and a flow chart of different components of facial nerve was drawn. Using the concept mapping, the students were then asked to do a colour wiring flow chart of anatomy of facial nerve using electronic circuit core wires which are very malleable and come in multi colours(Figure 2).

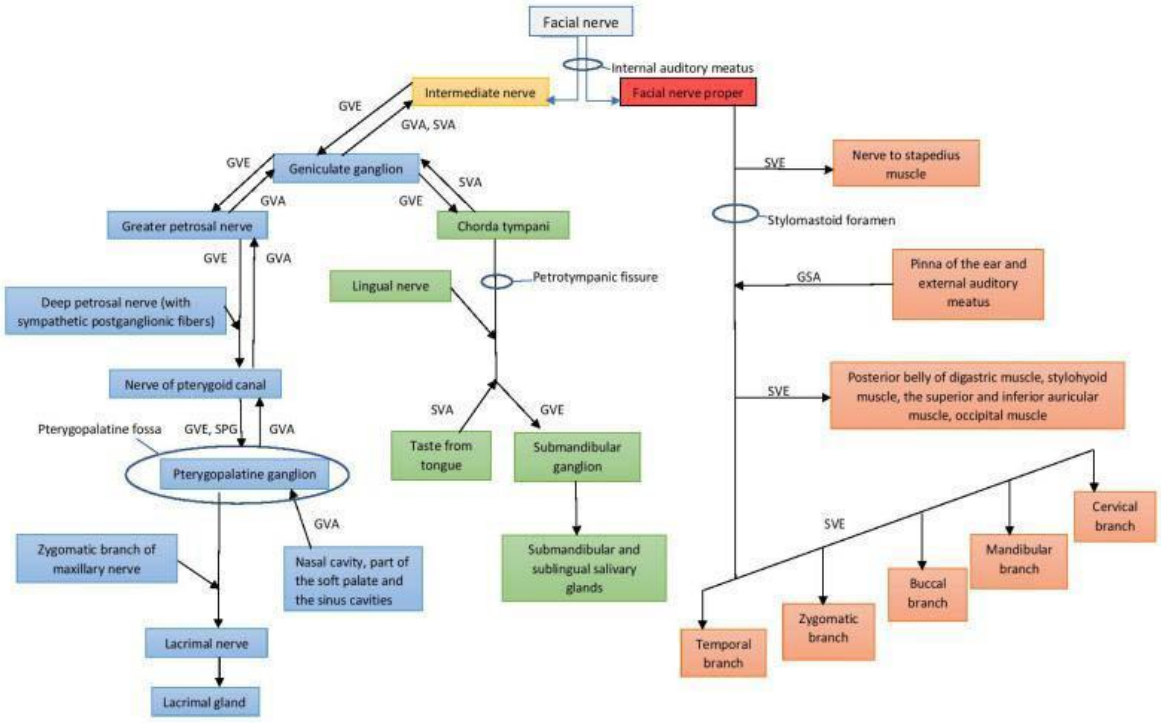


Figure 1: Concept Mapping of Facial Nerve

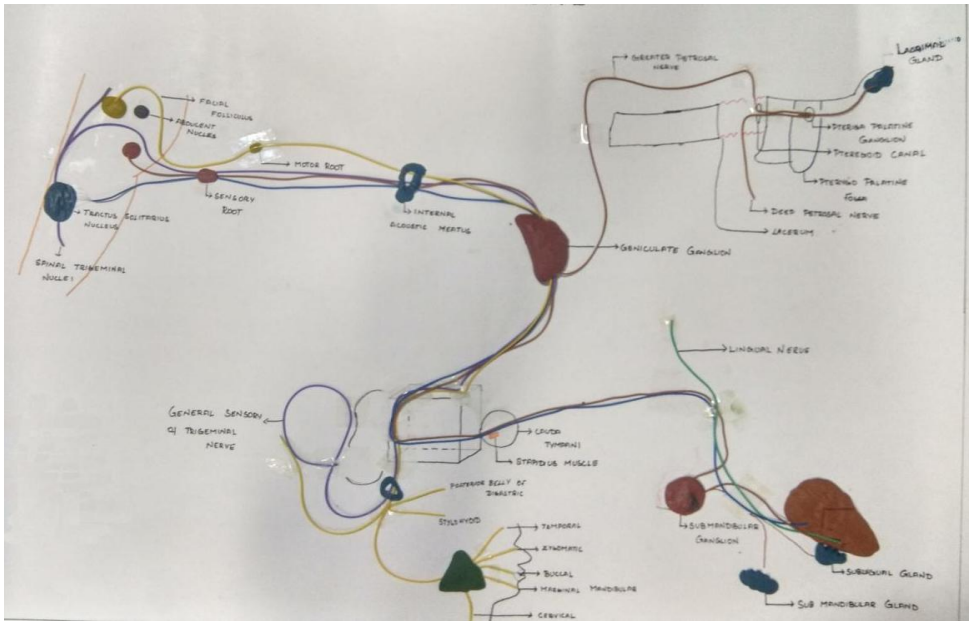


Figure 2: Coloured wire Chart of Facial Nerve

This activity greatly enhanced the core concept grasping involved in anatomy. Doing this as a play way method, the logics involved become different and intriguing for the students. Students reviewed that this activity greatly enhanced their understanding of anatomy of the facial nerve.

MILA in Teaching "Cavernous Sinus"

MILA in teaching "Cavernous Sinus" is a challenge. Students have difficulty in understanding its relations, tributaries and drainage channels /communications. This has been widely reported in various publications. Cavernous sinus is a large dural venous space situated in the middle cranial fossa on each side of the body of the sphenoid bone between the outer endosteal (internal periosteum) layer and inner meningeal layer of the dura mater of the brain. The relations and various aspects of cavernous sinus anatomy is difficult to understand [15]. Also, the understanding of the borders and walls that contain the cavernous sinus is extremely important in applied anatomical aspects, as this gives a proper orientation of various tumours in relation to the surrounding neurovascular structures [16]. The various channels in the cavernous sinus have numerous complex incoming and draining venous connections with the adjacent structures [17]. Thus this kind of complex anatomy of cavernous sinus is a topic to be studied and understood meticulously and also to be taught to students in a simple and easy way for better understanding.

We utilised the "Clay Modelling" method of pedagogy. Flipped Class in MILA is a learner-centered model. In the flipped classroom the lecture content of a topic is explained in the form of 8-10 minutes video followed by an active teaching which extends for about 20 minutes followed by the activity session commences.

The protocol for the clay modelling activity consists of dividing the students into several small groups containing maximum 4 or 5 students in each group. Each group was provided with a coloured chart and 1 box of clay containing various colours. With the help of the video and the explanation given the students first drew the outline of the Cavernous sinus, its relations on both the lateral walls, tributaries, and the draining channels. They used the clay and created a cavernous sinus3D form model over the picture drawn in the chart. Each structure was depicted in different colours. The tributaries and the communications were represented with coloured thin wires. The colour coding helps them differentiate each structure clearly. Interestingly, they used different strategies and innovative ideas to represent the caverns in the cavernous sinus. This clay art modelling is a fun filled activity which improves hand-eye

coordination skills, develops fine motor skills, improves creativity and above all encourages activity based learning among students. This type of activity makes all the members in a group get involved and engaged in this process. Once there is coordination between the hands and eye by brain, it intentionally makes even the slow learner of the group to get actively involved in sculpting the clay model of any complex topic. The final architecture image gets portrayed deeper in their mind and the incoming channels of the cavernous sinus follows a pattern of referenced memory with clues (colour, image shape, friend's name, etc.) to represent the tributaries.

There has been a dramatic increase in understanding the concepts like its relations, tributaries and communications upon preparing a clay model of cavernous sinus. The salient features in remembering these concepts are the various colour clues used in the model. This gives a reference oriented memory in acquiring the names of the structures. All these cues prepare the student efficiently to analyse, understand and retain the concept thoroughly. Also this topic is of utmost clinical importance as many cranial nerves and internal carotid arteries pass through this valve-less dural venous sinuses.

Overall, we believe teaching students by this method is effective for teaching "Cavernous Sinus". The graphical representation of student's perception on activity based learning in MILA is shown in the figure below (Figure 3). The images show the various clay models prepared by I. BDS students in their Anatomy class (Figure 4).

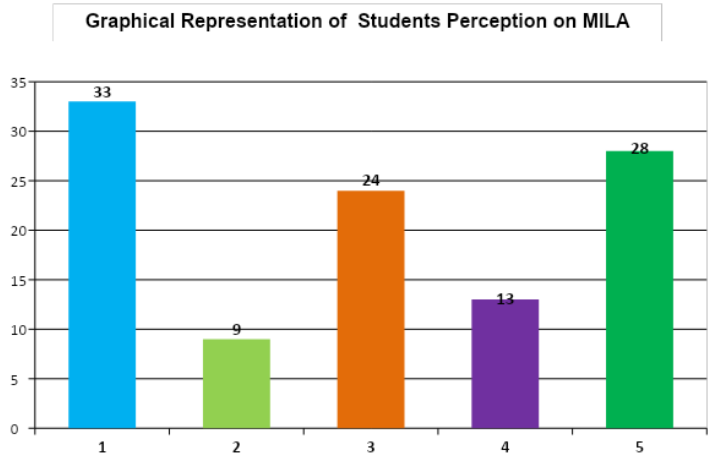


Figure 3: Bar Chart Showing Student's Perception on MILA (%)

Figure 4: Coloured Clay Modeling of Cavernous Sinus by 5 Groups of Students

MILA in Teaching Middle Ear

Middle ear is a very complicated concept. Students have difficulty in understanding the concepts of boundaries, its features and their communications. This has been widely reported in various publications [18] [19] [20].

We utilised small group learning with video presentation, group discussion and problem solving quiz method of pedagogy (Figure 5 and Figure 6).

The protocol included as follows orientation and video presentation for 20 minutes, learner facilitator clarification for 20 minutes. Group Activity for40minutes Individual and within group would work for 20 minutes and between groups for 20 minutes and each group will present for 10minutes.

Pre-learning of the given concepts using learning resources is encouraged before they appear for in-class interactive sessions. The learning materials like preloaded videos, I books, reference text books are provided to them. The topic of discussion is uploaded on the schoology platform well before the active session with the activity sheets for better preparation and time management.

There has been a dramatic increase in student's perception and understanding of the difficult concepts of the middle ear. The Multiple interacting learning algorithm allows the learner to engage actively throughout the session. As the learning system is interspersed every 20 minutes, the monotony in the learning process is cracked. The learners and the facilitators have an equal enthusiastic participation during the session. As we encourage group activities, in addition to learning the key concepts of the ear, they develop healthy interpersonal relationships and leadership qualities. In group presentations all the students are given equal opportunities to express themselves. It allows them to build self-confidence. The activities allow the learners to critically think and analyse the concepts to come out with answers. It helps to provoke their thinking, creative and application skills (Figure 7).

Overall, we believe teaching students by this method is effective for teaching anatomy of the middle ear cavity.

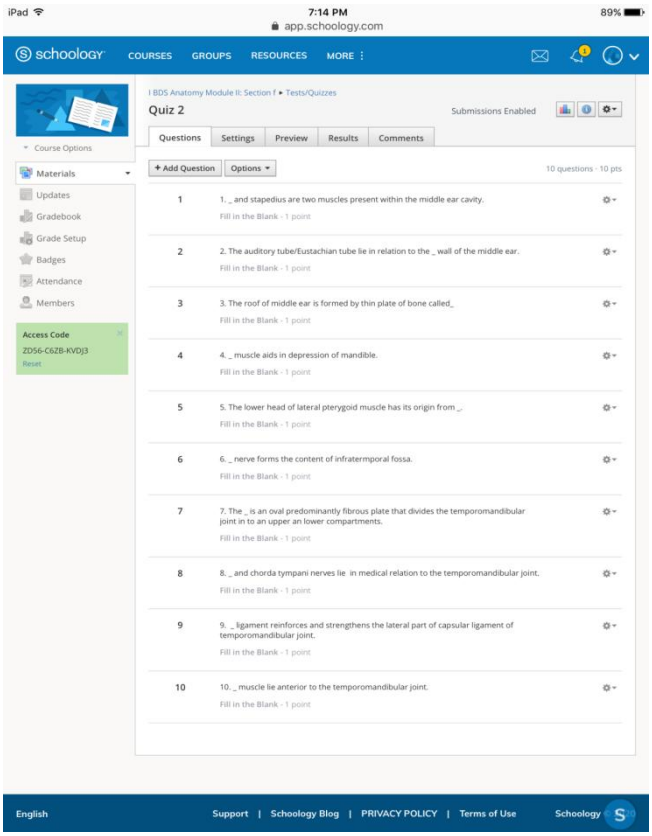


Figure 5: Take Home Quiz

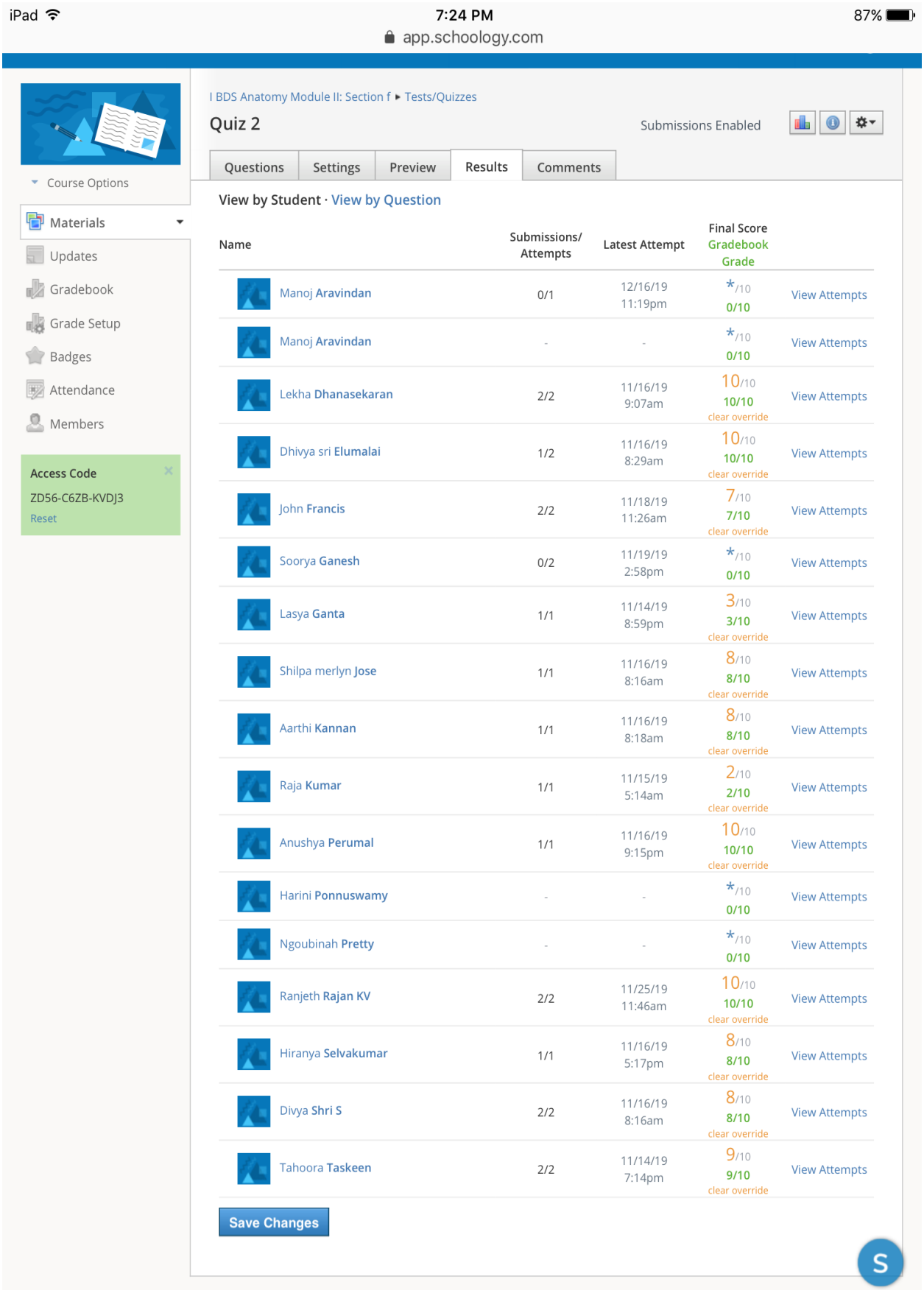


Figure 6: Result of Take Home Quiz

Feedback Form Report MILA teaching method: Topic- Middle ear for class held on 14/11/19

Questions	Strongly Agree %	Agree %	Not sure %	Disagree %	Strongly disagree %
Prior to session the topic was challenging to understand	44	31	25	-	-
Orientation/ Discussion was helpful	56	31	06	-	-
Video presentation stimulated fresh insight	25	56	19	-	-
Problem solving quiz enabled critical thinking	50	50	-	-	-
Group learning fostered exchange of knowledge and information	44	56	-	-	-
Received useful helpful feedback via quiz in schoology platform	56	44	-	-	-
Teaching methodology enabled relaxed learning environment	44	38	19	-	-
Gave me greater responsibility for myself and group	38	56	06	-	-
Post session knowledge about concept was clear and improved my performance	50	44	06	-	-
This method of learning should be encouraged/ continued	44	50	06	-	-

Figure 7: Student Feedback Report

MILA in Teaching Anatomy of Orbit

The anatomy of the orbit and the function of the six extraocular muscles of the eye is a challenging and frequently misunderstood concept amongst students [21]. The insertion and action of extra ocular muscle is a very complicated concept [22]. The actions of the individual extraocular muscles are usually explained to students in a lecture format by showing the relationship of each muscle to the axes of the eyeball and the walls of the bony orbit. The lateral and medial rectus muscles cross only the vertical axis, and consequently, cause only abduction and adduction, respectively. In contrast, the superior and inferior oblique and rectus muscles cross all three axes (vertical, horizontal, and anteroposterior) of the globe. Therefore, concentric contraction of each of these muscles results in three movements; abduction or adduction, elevation or depression, and intorsion or extortion. Hence it is a challenge to find more feasible ways of teaching extraocular muscle movements to ensure that students can efficiently comprehend the actions of extraocular muscles. This has been widely reported in various publications [1] [2] [3].

We utilised the model making method of MILA. The protocol included after the regular lecture followed by a video on action of extraocular muscle, the students are divided into small groups having 3 to 4 students. Each group was given a small ball to be used as an eyeball, a marker pen to draw the cornea, a few strips of chart paper to be used as the muscles and tape to attach the strips to the ball as muscle insertions.

The four recti muscles are first attached to the eyeball from standard distances of corneoscleral junction. Then the oblique muscles are attached behind the equator of the eyeball passing below or above the recti muscle. The inferior oblique is inserted close to the superior oblique a little below and posterior to it. This ensures the students understanding of the fibre direction and insertion of the extraocular muscles. The students then learn about the action of each muscle by pulling each strip and understanding how the various muscles on contracting exerts a pull on the eyeball producing the movements in various axes.

A thorough understanding of the action of each muscle is essential to clinically test the integrity of cranial nerves III, IV & VI (oculomotor, trochlear and abducens nerve) supplying these muscles. The knowledge and understanding

of the attachment and actions of these extra-ocular muscles is also useful when learning about conjugate movement of eyeballs and the clinical conditions like squint, diplopia and nystagmus related to paralysis of these muscles.

There has been a dramatic increase in understanding of the concept of how the fibres of the extraocular muscles pass in relation to each other and the orbital wall and gets inserted to the sclera of the eyeball. This knowledge was essential to learn about the actions produced by these muscles in different axes of eyeball (Figure 8). This model allows students to visualize the movements of the extraocular muscles by pulling the "muscles", this activity ultimately helps students to understand the mechanisms of muscle movements with regard to innervation and the rationale for cranial nerve tests. The other advantages of this eye model are that it is low cost and easy to construct.

Overall, we believe teaching students by this method is effective for teaching the action of extraocular muscles and its action.

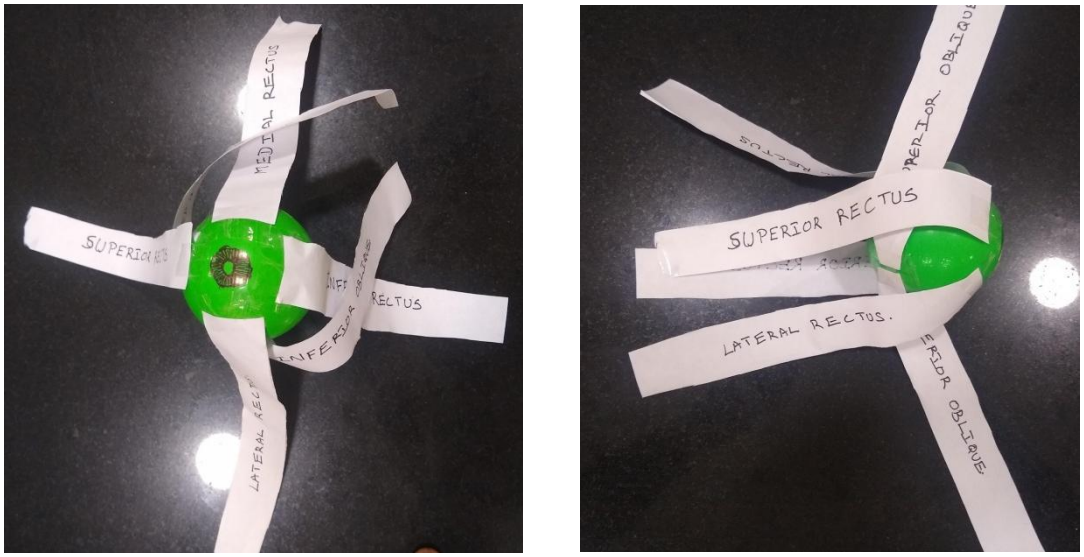


Figure 8: Eyeball Model Developed by Students

MILA in Teaching Muscles of Mastication

Muscles of mastication are the group of muscles that help in movement of the mandible as during chewing and speech. It's a complicated concept to study as these muscles control the opening and closing of the mouth and their equilibrium created within the mouth and it is also related with the movements of the mandible and Temporomandibular joint [23]. The students find it difficult to understand the role of masticatory muscles in relation to temporo mandibular joint dysfunction, inferior alveolar nerve block, and lower denture fitting, orthodontic treatment and in surgical approach of zygomatic complex fractures [24]. This has been widely reported in various publications [1] [2] [3].

We utilised a small group learning method of pedagogy in a class. The protocol included a flip video followed by activities which helps in using the lecture time in an effective and interesting way to the students. The two hours of long boring lecture time is divided into four effective sessions. The first session includes a flip video class about the topic with appropriate diagrams and proper explanation. The video was about 5-6 minutes with all anatomical details and coloured pictures. After the video there was open discussion about the topic which made the students interactive. Each student had their own perception about the topic and shared the views during interaction. Further clarifications and explanations were given to the students. This was followed by session two with a group activity about the topic.

Activity 1. The students were divided into small groups of about 5-6 students. The students were given colour clay dough and asked to fix the clay over the mandible to show the attachments. This method helped them to remember the subject in a better way.

Activity 2. A paper model of each muscle was made and represented over the skull and mandible to show the direction of fibers and exact location with origin and insertion. This helped to know the relations in the skull.

Activity 3. Students were asked to palpate the masticatory muscles of the fellow students. They were asked to do the movements of the mandible. Demonstration was given to position the mandible for TMJ Dislocations. A practical palpation and demonstration helped the students to understand the landmarks and made them confident. This was followed by a cadaver demonstration of masticatory muscles in a dissected specimen. It helped them to feel the texture of the muscle, bone and nerve. The immediate visual perception helped the students to recollect during the exam. The students were asked to take a photograph of the specimen in their ipad and asked to mark the anatomical landmarks and to identify the structures which they saw. This helps them to recollect during practical exams without any confusion.

There has been a dramatic change in the observing skills of the students. The students were more active and interested in the class. There has been a gradual increase in the understanding of the subject, correlating with diagrams and cadaver specimens. The practical palpation made them more confident about the landmarks and moulds them to handle the patients. There has been an increase in the marks of the students (Figure 9). The discussion session helped them to come out of their shell and shyness. It made me interact with all students and helped to understand everyone's point of view (Figure 10).

Overall, we believe teaching students by this method is effective, creative and fun based for teaching the Muscles of mastication along with clinical correlations. This method makes the student confident.

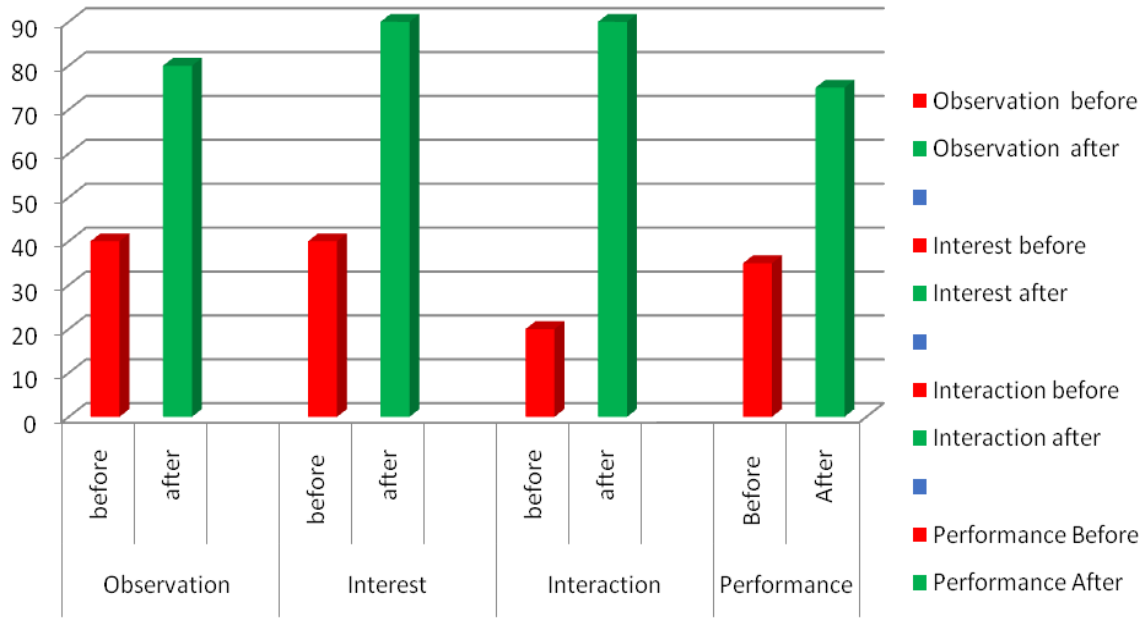


Figure 9: Student Performance before and after MILA

Figure 10: Clay Modelling Done by Students

MILA in Learning Lateral Wall of Nasal Cavity and Opening of Paranasal Air Sinus

The nose followed by nasal cavity is a midline structure that acts as a passage for air to enter and exit during respiration and is also involved in olfaction by containing olfactory receptors. It is partitioned into right and left halves by nasal septum, which is formed by cartilages and bones. It communicates with the external environment through external nostrils and posteriorly with nasopharynx through posterior nasal aperture. It contains a roof, floor, septum and lateral wall. The above mentioned boundaries are formed by bony and cartilaginous structures and lined by mucous membrane.

The bones related to the nasal cavity contain air spaces that help to lighten the weight of the skull, voice resonance, regulate the temperature of air when entered during respiration, etc. The air sinuses are frontal, maxillary, sphenoidal and ethmoidal are situated around the nasal cavity, hence it is called as paranasal air sinuses, the bones containing it are called as pneumatic bones. The nasal cavity is the place where the paranasal air sinus opened i.e. at the lateral wall of the nasal cavity.

The lateral wall of the nasal cavity is a complicated structure that contains various bones with opening of air sinus. It is made up of bones and cartilages such as nasal, maxilla, lacrimal and ethmoid, inferior nasal concha, perpendicular plate of palatine, medial pterygoid plate of sphenoid and alar cartilages [13]. The notable feature of it is the presence of bony shelves such as superior middle and inferior conchae lined by mucous membrane. Between the bony shelves, it contains spaces called meatus, thus the lateral wall contains superior, middle, inferior meatus and also the sphenoethmoidal recess, where paranasal air sinuses opens. Cappello et al., 2018 have reported that the arrangement of sinonasal structures in the head is intricate [15].

Clinically, sinusitis is a more familiar term that the involvement of paranasal air sinuses because they are more often infected. The unintentional damage of air sinuses during surgical approach may cause spread of infection to above mentioned cavities. For example, the approach of ethmoidal air sinus is highly complicated due to its close relation with cranial cavity. The reason for damage may be anatomical variation of air sinuses [14].

It is definitely a challenging topic for me to ease the sinonasal anatomical structures (lateral wall of nasal cavity and paranasal air sinus) for the students. The class of lateral wall of nasal cavity and paranasal air sinus was started by explaining general ideas about the topic like its location, arrangements and its clinical significance. Followed by the lecture class we played the video of the topic. But they felt it was very difficult to understand the skeletal framework of the lateral wall and its feature; opening of air sinuses at various locations of meatuses; blood supply and nerve supply. In case of blood and nerve supply; venous and lymphatic drainage the lateral wall is divided into various quadrants and segments. This is the main reason why students felt difficult to understand.

At the model making session, we planned to make a suitable model to make them understand easily. So we prepared a small booklet in the shape of a lateral wall of the nasal cavity which is there in the skull. Then we drew an arrangement of bones and cartilages in one chart piece followed by opening of the paranasal air sinuses, arterial and nerve supply, venous and lymphatic drainage and finally we made it into a small booklet. By placing that small booklet on the lateral wall in the skull they could easily oriented the bony and cartilaginous arrangements, areas of blood and nerve supply and lymphatic drainage (Figure 11).

At the end of the class, the response of students was good and they asked us to continue the same for all topics. The main advantage of this model is less expenses, easy making and quick recollection of the particular topics. This may be a good tool and easy way to understand the complex or complicated concepts in anatomy.

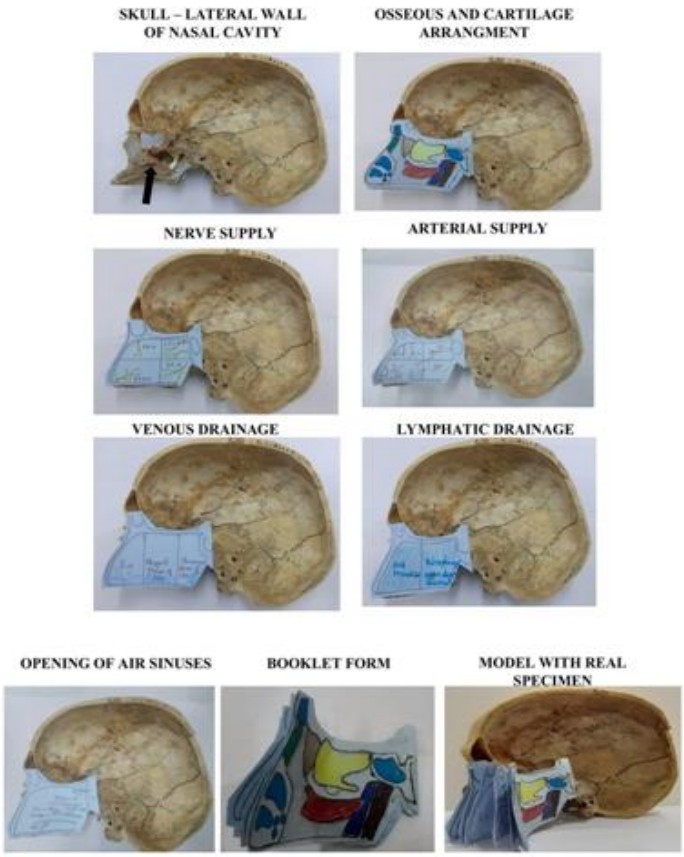


Figure 11: Booklets Placed on the Skull

MILA in Teaching Anatomy of Larynx

Larynx is the organ for the production of voice or phonation and it is also an air passage. It is made up of paired and unpaired cartilages connected by joints, ligaments and muscles. The unpaired cartilages are thyroid, cricoid and epiglottis. The paired cartilages are arytenoid, cuneiform and corniculate.

There are various intrinsic and extrinsic muscles which produce different movements of Larynx. They are cricothyroid, posterior cricoarytenoid, lateral cricoarytenoid, transverse arytenoid, oblique arytenoid, thyroarytenoid and vocalis. The movements are elevation and depression of the larynx, opening and closing of the inlet of the larynx. There are also muscles which act on vocal cord producing adduction and abduction, tension and relaxation.

The muscles and mucous membrane are supplied by internal, external and recurrent laryngeal nerves. All these are branches from the vagus nerve. The blood vessels are superior and inferior laryngeal arteries and veins. The cavity of the larynx is divided into vestibule, ventricle and infraglottic. It extends from the inlet of the larynx to the lower border of cricoid cartilage.

The anatomy of the larynx has been a very complicated concept. The students used to find it very difficult to have a clear image of it and this has been widely reported in various publications [16] [17].

To make it easier we used small group learning with the MILA application. In this video presentation, group discussion and an activity were given.

The two hours class was divided into four small sessions; Orientation and video demonstration for 20 minutes, Specimen demonstration and interaction for 20 minutes, Group discussion and group activity for 40 minutes and Presentation by the students- 40 minutes.

The students were given a brief discussion about the topic and then the video was played. The video presentation enhanced the understanding of the topic by the students than the regular board & chalk and the power point methods. The students had a three dimensional view.

The specimens were demonstrated and doubts were clarified as a separate session.

The students were divided into four groups and they were asked to do the chart paper models of larynx. After completion of models each group students were asked to present for ten minutes under the following headings (Figure 12).

Group I- Introduction, extent and cartilages.

Group II- Intrinsic & extrinsic muscles and their actions.

Group III- Structure, nerve supply and blood supply.

Group IV- Vocal cord and its movements.

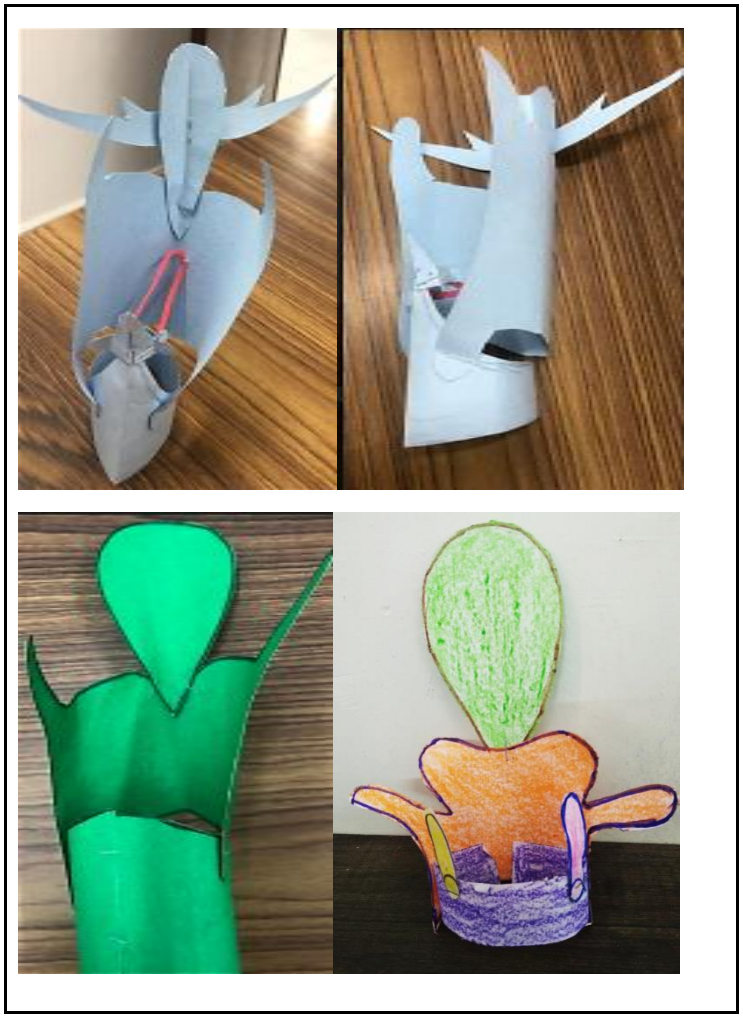


Figure 12: Chart Models of Larynx

At the end of the session, a quiz was conducted and the results showed the students had understood the concept in a better way than the previous teaching methodology. Since they understood the concept and made models of their own constructing cartilages, they were able to remember the shapes and articulation. This method is also a low cost one.

Overall we believe that this method improves the learning of the larynx in a much easier and better way.

CONCLUSION

The above case studies revealed that the students had a better understanding of the subject. In concern with anatomy, they were able to describe the location, appreciate the parts and communications, describe the boundaries and features of different walls, explain the structures passing through them, the content of each structure. They had better understanding about the functions and clinical implications of each structure also. MILA does not hone them academically alone but also their confidence, interactive capabilities, teamwork and innovative thoughts. Since, they enjoy learning the knowledge they gain during such sessions remain deep rooted in the young minds enabling them to be better practitioners in future.

BIBLIOGRAPHY

[1] Gupta, S., Mends, F., Hagiwara, M., Fatterpekar, G. and Roehm, P.C., 2013. Imaging the facial nerve: a contemporary review. Radiology research and practice, 2013.

[2] Ho, M.L., Juliano, A., Eisenberg, R.L. and Moonis, G., 2015. Anatomy and pathology of the facial nerve. American Journal of Roentgenology, 204(6), pp. W612-W619.

[3] Myckatyn, T.M. and Mackinnon, S.E., 2004, February. A review of facial nerve anatomy. In Seminars in plastic surgery (Vol. 18, No. 01, pp. 5-11).Copyright© 2004 by Thieme Medical Publishers, Inc., 333 Seventh Avenue, New York, NY 10001 US.

[4] Campero A, Campero AA, Martins C, Yasuda A, Rhoton AL. Surgical anatomy of the dural walls of the cavernous sinus. J Clin Neurosci., 2010; 17: 746–750.

[5] Chotai S, Liu Y, Qi S. Review of Surgical Anatomy of the Tumors Involving Cavernous Sinus. Asian J Neurosurg. 2018; 13(1): 1–8.

[6] Mitsuhashi Y, Hayasaki K, Kawakami T, Nagata T, Kaneshiro Y, Umaba R, Ohata K. Dural Venous System in the Cavernous Sinus: A Literature Review and Embryological, Functional, and Endovascular Clinical Considerations. Neurol Med Chir (Tokyo). 2016; 56(6): 326-339.

[7] Zhang, N., & He, X. (2010). Understanding the extraocular muscles and oculomotor, trochlear, and abducens nerves through a simulation in physical examination training: an innovative approach. The Journal of chiropractic education, 24(2), 153–158.

[8] Maini A, Welke L & Nagy G, (2015), Teaching the Extraocular Muscles of the Eye: Construction and Evaluation of a Low-Cost, High-Fidelity Ophthalmoscope for Medical Trainees, The FASEB Journal 29:1 supplement.

[9] Iwanaga, J., Refsland, J., Iovino, L., Holley, G., Laws, T., Oskouian, R.J. and Tubbs, R.S. (2017), A new teaching model for demonstrating the movement of the extraocular muscles. Clin. Anat., 30: 733 -735.

[10] Andrew Pepicelli, Michael Woods, and Christopher Briggs. The mandibular muscles and their importance in orthodontics: A contemporary review Orthod Dentofacial Orthop 2005; 128: 774-80) American Journal of Orthodontics and Dentofacial Orthopedics Volume 128, Number 6.

[11] Susan W. Herring Masticatory muscles and the skull: A Comparative Perspective Arch Oral Biol. 2007 Apr; 52(4): 296–299.

[12] J.H. Koolstra Dynamics of the Human Masticatory System.Crit Rev Oral Biol Med 13(4): 366-376 (2002).

[13] Catlin B, Lyons J, O'Rahilly M, Carpenter S. Basic Human Anatomy. The pharynx and larynx. Dartmouth Medical School. 2008.

[14] De Miranda CM, De Miranda Maranhão CP, Arraes FM, Padilha IG, De Farias LD, De AraujoJatobá MS. Anatomical variations of paranasal sinuses at multislice computed tomography: what to look for. Radiol Bras. 2011; 44: 256-262.

[15] Cappello, Zachary J., and Arthur B. Dublin. "Anatomy, head and neck, nose paranasal sinuses." StatPearls [Internet]. Stat Pearls Publishing, 2018.

[16] Allen E, Murcek BW. Anatomy, Head and Neck, Larynx Recurrent Laryngeal Nerve.

[17] De Bakker BS, De Bakker HM, Soerdjbalie-Maikoe V, Dikkers FG. Variants of the hyoid-larynx complex, with implications for forensic science and consequence for the diagnosis of eagle's syndrome. Scientific reports. 2019 Nov 4; 9(1): 1-0.

[18] Anschuetz L et al, Discovering middle ear anatomy by transcanal endoscopic ear surgery: A dissection manual, Journal of visualized Experiments, 2018 Jan 11; (131).

[19] Matthew J Mason et al, Structure and function of mammalian middle ear II: Inferring function from structure, J Anat. 2016 Feb; 228(2): 300-312.

[20] Daniele Marchioni, et al Endoscopic anatomy of middle ear, Indian journal of otolaryngol head and neck surg. 2011 Apr; 63(2): 101-113.

[21] Patil U, Budihal SV, Siddamal SV, Mudenagudi UK. Activity Based Teaching Learning: An Experience. Journal of Engineering Education Transformations 2016;0. https://doi.org/10.16920/jeet/2016/v0i0/85433.

[22] Rogers DT. The Working Alliance in Teaching and Learning: Theoretical Clarity and Research Implications. International Journal for the Scholarship of Teaching and Learning 2009; 3. https://doi.org/10.20429/ijsotl.2009.030228.

[23] Cummings DJ, Sheeran N. Do academic motivation and personality influence which students benefit the most from peer-assisted study sessions? Psychology Learning & Teaching 2019; 18: 244–58. https://doi.org/10.1177/1475725719840502.

[24] Kanchanamala P, Muppidi S. SIPAI: An Integrated Learning Model of Self Learning, Inquiry Based, Problem Solving, Activity Based, and Instructional Learning for Engineering Education. 2016 IEEE 6th International Conference on Advanced Computing (IACC) 2016. https://doi.org/10.1109/iacc.2016.156.

MILA in Teaching Biochemistry for Dental Students

Dr. Deepak Nallaswamy Veeraiyan, Professor, Department of Prosthodontics, Director of Academics, Saveetha Dental College & Hospital, SIMATS. E-mail: dir.acad@saveetha.com

Dr.M. Subha*, Associate Professor, Department of Oral Medicine & Radiology, Saveetha Dental College & Hospital, SIMATS. E-mail: doctorsubha@gmail.com

Dr.V. Vishnupriya, Professor, Department of Biochemistry, Saveetha Dental College & Hospital SIMATS. E-mail: vishnupriya_v9@yahoo.co.in

Dr.R. Gayathri, Assistant Professor, Department of Biochemistry, Saveetha Dental College & Hospital, SIMATS. E-mail: gayathri.jaisai@gmail.com

Abstract--- MILA, multiple integrated learning algorithms, is an innovation in learning methodology. This varies from conventional one way communication to interactive learning. The students participate in active learning in these sessions. Biochemistry is a complex subject with several enzymes which rhyme the same, it is difficult for the students to remember the terminologies and reciprocate the same. Also this becomes the hurdle in their clinical application. Hence, small group learning with numerous activities like role play, clay modelling, concept mapping, pogil, castle top were utilised to enhance their memory. In this study, we have chosen two topics which involve many cycles to memorise. This was made easy by providing a flipped class video ahead of class and the students were asked to work in groups during the class hour with the given activity. Their learning was assessed at the end of the session and it proves to be effective.

Keywords--- MILA, Biochemistry, Activity based Learning, Lipid, Carbohydrate.

INTRODUCTION

One of the greatest challenges that daunts every teacher while delivering an effective lecture is keeping the audience engaged. Of course, there are stellar orators who can keep the audes captivated for hours with ease. But not all teachers are great orators and when we discuss pedagogy we need to discuss its effectiveness not just efficacy [1]. The methods need to be effective irrespective of student compliance, faculty compliance, environment, time of day and other factors. Hence we need to discuss methods to counter these potential factors in order to make any pedagogic technique effective across the varied settings [1,2].

One of the most common traits observed across many powerful orators is their uncanny ability to narrate a story, this narrative style connects with the audies in an emotional manner. This is what keeps the brain engaged across long spans of time. The most common emotions in a human mind are fear, hate, love, empathy, enlightenment. It's obvious from the above list, that enlightenment is the only path an orator can use to make an audience excited about new ideas and information. For enlightenment to occur in the classroom, a faculty needs to be seen as a role model in the eyes of a student [3,4]. Not all faculty are able to captivate their students to look at them as a role model. We need a method of pedagogy that all faculty would be able to produce successful outcomes in a fast and efficient manner [5]. Another benefit of interactive learning is that faculty are not the only content providers in the class, here the faculty and students together work as a cohesive group to share and teach each other [6]. Even if a particular faculty member is not able to exude the charisma of a powerful orator, the group dynamics itself will be captivating enough for students to be attentive for long periods of time.

When multiple interactive activities are scheduled one after another there is a chance for this also to reach a certain level of boredom. Therefore we need scientific knowledge on the particular sequence activities that should be followed to produce the most effective optimal teaching learning performance [7]. Generally there are many established systematic reviews that agree on the consensus that the students' attentiveness in lectures / instructions sessions last only around 18 minutes. Therefore there is custom to break up the classes into 15 minute intervals with breaks and activities intertwined to reset boredom and maintain attentiveness over the hour [8,9]. Simple measures like moving, standing up, discussing with a partner or team for a couple of minutes have shown great potential in maintaining attentiveness. Nevertheless, one should also be aware of the potential for activities to become very distracting. Such disruptive procedures actually increase the time required by the students to regain focus in class [9]. We have previously observed that in experimental settings, certain activities are more suitable to teach certain subjects. Although this concept is logical and expected, the sequence of activity and its impact on learning has not been well understood. This thesis delves into hundreds of such techniques tried over multiple programs. Towards the end, we hope to hypothesize a recommended protocol to train students in the most effective way with minimal effort.

The concepts of flipped classes and Castle top training have become incredibly popular in certain fields of education [10]. Essentially a flipped class reduced the didactic session further to home made short videos, followed by extended discussions / groups assignments in class [11]. Essentially flipping homework and classwork. In our experience although we do believe flipped classes are very effective, the faculty come out with feelings of dissatisfaction [12]. Maybe it is the innate need of the faculty to receive gratification in the form of nodding heads (by students) or the preconceived notion that they failed to execute their job if they do not perform an hour long lecture. Eitherway, unless the faculty are satisfied, they are unlikely to hop on board. Castle top learning just adds a layer of out of class lateral thinking activating to the already robust in class curriculum traditionally followed across the globe [13]. In our experience, students tend to report that the path of inquiry provides wisdom however such wisdom was seldom evaluated or calibrated to evaluate the success of the system. Therefore, we are more inclined to use traditional lectures supplemented with in class activities to improve optimal outcomes in student attentiveness, faculty satisfaction and speed of content courage [14]. These three pillars can set a stable foundation for any system in learning.

Our MILA system of Interactive learning was developed with these policies in mind. In this article we have tried MILA (Multiple Interactive Learning Algorithm) where biochemistry is taught with numerous activities. Here we have two case studies in which the effectiveness of activity based learning was assessed among the first year students in learning biochemistry.

MILA in Teaching Lipid Metabolism

Biochemistry is a science that deals with chemical processes within living organisms. Biochemists focus mainly on the function, role and structure of biomolecules. Concepts of Biochemistry are potentially important for Medical and Dental students. Many students study Biochemistry in an aim to pass the examination [15]. Especially the concepts involving metabolism like Lipid metabolism seems to be difficult for the students to understand and moreover even if they understand, they tend to forget on a long run. Lipid metabolism involves pathways such as lipid biosynthesis, Cholesterol and sterol biosynthesis and degradation, Beta oxidation, ketosis etc. Especially when it comes to shuttling pathways such as shuttling of acetyl CoA and fatty acids inside and outside the mitochondrial matrix is conceptually tough to understand and also difficult for the teacher to explain. Teaching a difficult concept in an easy manner and to make the students understand is the task for every teacher. Here the teaching methodology with MILA proves to be a boon for the student as well as teachers. MILA is an activity based learning system consisting of lectures interspaced

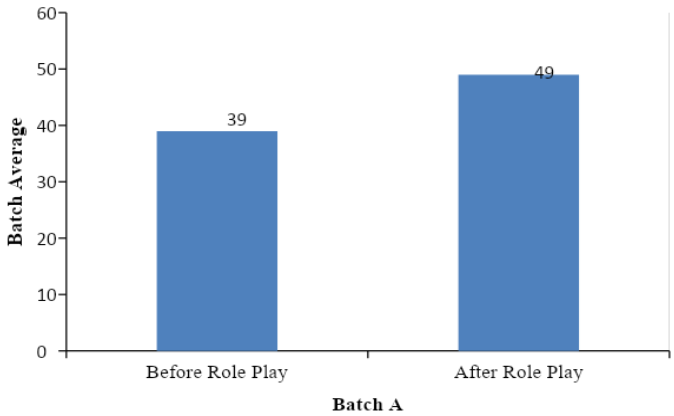
with activities. Activities such as jigsaw, POGIL(Process Oriented Guided Inquiry Learning), mind mapping, game based learning, critical pedagogy, peer-led team based learning, role play and scale up not only keep the students interested in the topic but also help them break down and easily understand challenging topics and reproduce the concepts easily. This system also helps the teachers to evaluate and assess the understanding of individual students regarding a particular topic.

In Lipid metabolism, usually students find it difficult to understand the "Shuttling of Acetyl CoA and NADPH from the mitochondrial matrix to cytosol for Fatty acid biosynthesis"[15,16]. The difficulty that the students felt in this topic is to understand the mechanism of shuttling of various components involved in lipid biosynthesis. Understanding the nature of the mitochondrial membrane and the permeability of these components across the membrane.

To explain the concept "Role play'a concept of MILA was utilized in teaching between 2018-19.

The students were initially explained with an overview of the concept. Then placards indicating the key words such as "Acetyl CoA, Pyruvate, NADPH, citrate, mitochondrial matrix, mitochondrial membrane, malate etc are prepared in colourful ways by the students. After the preparation of the placards. Each student holding a placard stood in the allotted place. A big mitochondrial inner membrane was created by a set of students in a hand in hand fashion. Initially the student with Acetyl Co placard standing inside the matrix will try to pass through the membrane. Students who are standing as membrane will resist the entry and try to push the acetyl CoA back into the matrix. Once the Acetyl CoA gets converted to malate, it easily passes through the membrane. The conversion of one compound to another and its permeability across the membrane were enacted by the students enthusiastically.

The same concept when taught in a conventional way, students found it difficult to understand and remember for a long run. To make the understanding easier MILA was introduced. Thus after the Role play, a concept of MILA, students were found to understand the concept and remember it for a long time. Activities such as Role play not only helps in understanding but also increases creative skills and boosts a friendly atmosphere for the students. That is how learning was made in a healthy and enjoyable way. When asked to write a sudden test on the concept, students were confident and wrote well. (Graph 1)). It is not only understanding, remembering what they learn is also important. MILA proves to be the best teaching learning concept.



Graph 1: Comparison of Marks before and after Activity based Learning

MILA in Teaching Carbohydrates

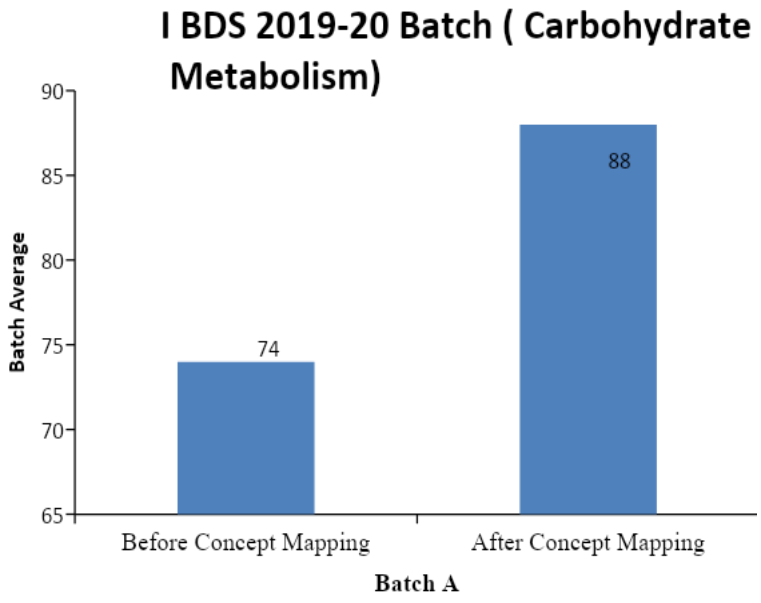
Biochemistry is an interesting subject and it deals with biomolecules required for existence. Biochemistry is a tougher subject for both teacher and student [15]. It involves detailed structure, anabolic pathways, catabolic

pathways, disorders and regulation of biomolecules. Teaching these concepts in an easy and interesting way and making the students retain longer is a challenging task for a teacher. This has been made possible by the introduction of Multiple Interactive Learning Algorithm (MILA). MILA is an activity based learning system where the teaching and learning process is interspersed with activities. Activities such as Jigsaw, POGIL (Process Oriented Guided Inquiry Learning), Concept mapping, game based learning, critical pedagogy, peer-led team based learning, role play and scale up not only keep the students interested in the topic but also understands the concepts well.

Carbohydrates – Chemistry and Metabolism is a very complicated concept. It involves major pathways like oxidation of glucose, glycogen metabolism, Hexose monophosphate shunt, metabolism of sugars. Students have difficulty in understanding these pathways. This has been widely reported in various publications [17]. To simplify Carbohydrate metabolism and make the students understand the concepts better, we utilised Concept Mapping method of pedagogy in a class between 2019 – 2020 for Batch A students. The students were given an overview about the Classification of carbohydrates, its properties, disaccharides, polysaccharides, metabolism of sugars, oxidation of glucose to carbon dioxide and water, glycogen metabolism, hexose monophosphate shunt, metabolic disorders.

The students downloaded a simple mind app on their iPad. They familiarized the app with their family tree. Students with the help of the facilitator initiated the carbohydrate chemistry and metabolism in a stepwise manner. The concept map was highly branched which included the entire chapter in the concept tree. The concept mapping helped the students to break down and easily understand challenging topics and reproduce the concepts easily. This system also helps the teachers to evaluate and assess the understanding of individual students regarding a particular chapter.

The students found it difficult to understand Carbohydrate chemistry and metabolism when taught in a conventional way prior. But on applying the MILA – Concept Mapping method, there was a dramatic increase in the results when they were asked to write a test on the topic (Graph 2). The students were well versed with the topic and it helped to retain the subject for a very long duration. It is very useful to the students and a very powerful study strategy. Concept mapping interlinks concepts in a detailed manner. It helps to clarify and structure the ideas. Biochemistry was made easy with MILA and this was evident with the results.



Graph 2: Comparison of Marks before and after Concept Mapping Method of Learning

CONCLUSION

With the above case studies, it is evident that activity based learning improves students performance. Having in mind the duration of attention if a class is planned ahead with lectures, audio visual components and activities the students will have an everlasting memory. The above two case studies had made it clear with an average difference of about 10 marks and 14 marks increase in MILA teaching methodology compared to conventional lecture based classes. From a teacher's perspective, the students seem to be more attentive in class compared to conventional lecture classes. Also, students develop a social wellbeing. Their confidence, communication and creativity grows enormously which is also essential for being successful professionals.

BIBLIOGRAPHY

[1] Strong M, Gargani J, Hacifazlioğlu Ö. Do We Know a Successful Teacher When We See One? Experiments in the Identification of Effective Teachers. Journal of Teacher Education 2011; 62: 367–382. https://doi.org/10.1177/0022487110390221.

[2] Starkweather-Lund AR. Training teachers to give effective commands: effects on student compliance, academic engagement, and academic responding n.d. https://doi.org/10.31274/rtd-180813-8781.

[3] Townsend T, Bates R. Handbook of Teacher Education: Globalization, Standards and Professionalism in Times of Change. Springer Science & Business Media; 2006.

[4] Townsend T, Bates R. Handbook of Teacher Education: Globalization, Standards and Professionalism in Times of Change. Springer Science & Business Media; 2006.

[5] Fabrice H. Learning Our Lesson Review of Quality Teaching in Higher Education: Review of Quality Teaching in Higher Education. OECD Publishing; 2010.

[6] Howard JR. Discussion in the College Classroom: Getting Your Students Engaged and Participating in Person and Online. John Wiley & Sons; 2015.

[7] Self B, Widmann J. Demo or Hands-on? A Crossover Study on the Most Effective Implementation Strategy for Inquir--Based Learning Activities. 2017 ASEE Annual Conference & Exposition Proceedings n.d. https://doi.org/10.18260/1-2--28101.

[8] Durães DA. Attentiveness and Engagement in Learning Activities n.d. https://doi.org/10.20868/upm.thesis.53795.

[9] Hover KM, Muhlhauser M. Classquake: Measuring Students' Attentiveness in the Classroom. 2015 IEEE International Symposium on Multimedia (ISM) 2015. https://doi.org/10.1109/ism.2015.24.

[10] Tecedor M, Perez A. Perspectives on flipped L2 classes: implications for learner training. Computer Assisted Language Learning 2019: 1–22. https://doi.org/10.1080/09588221.2019.1626439.

[11] Balan P, Clark M, Restall G. Preparing students for Flipped or Team-Based Learning methods. Education Training 2015; 57: 639–657. https://doi.org/10.1108/et-07-2014-0088.

[12] Frímannsdóttir I. DO FLIPPED LEARNING CLASSES COMPARE WITH TRADITIONAL CLASSES? INTED2016 Proceedings 2016. https://doi.org/10.21125/inted.2016.0758.

[13] Leese M. Out of class-out of mind? The use of a virtual learning environment to encourage student engagement in out of class activities. British Journal of Educational Technology 2009; 40: 70–77. https://doi.org/10.1111/j.1467-8535.2008.00822.x.

[14] Chen D, Faichney J. Flipping a Programing Class to Improve Student Performance and Student Satisfaction. International Journal of Adult Vocational Education and Technology 2019; 10: 27–39. https://doi.org/10.4018/ijavet.2019010103.

[15] Wood EJ. Biochemistry is a difficult subject for both student and teacher. Biochemical Education 1990; 18: 170–172. https://doi.org/10.1016/0307-4412(90)90123-90126.

[16] Vanderlelie JJ, Alexander HG. Learning-oriented assessment increases performance and written skills in a second year metabolic biochemistry course. Biochemistry and Molecular Biology Education 2016; 44: 412–420. https://doi.org/10.1002/bmb.20962.

[17] Chen H, Ni J-H. Teaching arrangements of carbohydrate metabolism in biochemistry curriculum in peking university health science center. Biochemistry and Molecular Biology Education 2013; 41: 139–44. https://doi.org/10.1002/bmb.20695.

MILA in Teaching Physiology for Dental Students

Dr. Deepak Nallaswamy Veeraiyan, Director for Academics, SIMATS.

Professor, Department of Prosthodontics, Saveetha Dental College and Hospital, SIMATS.
E-mail: dir.acad.sac@saveetha.com

Dr.M. Subha*, Associate Professor, Department of Oral Medicine & Radiology, Saveetha Dental College and Hospital, SIMATS. E-mail: doctorsubha@gmail.com

R. Gayathri Devi, Assistant Professor, Department of Physiology, Saveetha Dental College and Hospital, SIMATS. E-mail: gayatri.physio88@gmail.com

A. Jothi Priya, Assistant Professor, Department of Physiology, Saveetha Dental College and Hospital, SIMATS. E-mail: a.jothipriya88@gmail.com

S. Preetha, Senior Lecturer, Department of Physiology, Saveetha Dental College and Hospital, SIMATS.
E-mail: drpreeth.homeo@gmail.com

Abstract--- MILA, Multiple interactive learning algorithm is a learning innovation based on activity based learning. Traditional teaching methodology doesn't seem to inspire the current generation as their concentration span has considerably reduced. Also they have loads of information to learn and remember. It is easier for the students to understand the complex topics when learnt through activities. A minced into portions that can be significantly remembered and applied in routine practice make the graduates successful practitioners. MILA in teaching physiology has made the subject much easier, understandable with a long term memory. In this article difficult topics from physiology were chosen and the students were taught by MILA. They were assessed for their learning and the results showed significant differences in the understanding of the students.

Keywords--- MILa, Learning, Physiology, Neurophysiology, Respiratory System.

INTRODUCTION

Lecture sessions have been established to be one of the most inefficient methods of knowledge sharing for many decades (National Research Council et al. 2002). The average student remembers less than 10% of what is taught in class and the overall standard of education is compromised by the use of large classrooms with impersonalised speeches. (Attard and Holmes 2019) Lecture sessions are also reported to be boring and inconsistent when similar topics are repeated between classes. Although adjuvants like presentations and slides promised to make lectures more effective. By the early 2000's SMART classrooms were considered the holy grail of education. (Gray 2015) The major contender with tremendous promise was the iPad®/Tablet system coupled with polished software that promised to make course work and learning easier. (Attard and Holmes 2019) To an extent, these systems have shown some successful integration.

The use of vital books and tablets notes have become common practice in most institutions and however the impact of this on the student learning and long term retention are questionable. (Fry, Ketteridge, and Marshall 2003) Video based tutorials in youtube and in classrooms have become very popular and seem to impact the understanding of the learning of the individuals. (Chtouki et al. 2012) Classrooms have even gone virtual with Zoom®, Google Meet®, CiscoWebX® etc. (Teneqexhi and Kuneshka 2019) These methods have opened new paradigms for teachers

to connect with students across long distances. It's evident from above mentioned facts that the majority of the focus in education primarily aimed to make teaching fancy, more technologically savvy etc.

Pedagogic styles like SCALE UP have called for the need to covert lectures into activity based discussions to avoid boredom and improve learning efficacy. (Syarafina, Jailani, and Winarni 2018)(Syarafina, Jailani, and Winarni 2018; Oliveira, Teixeira, and Neto 2020) Activity based learning has also shown the promise of making the process of learning more inspiring yet, maintaining the speed of content delivery. Therefore activity based learning reduces the work required from the faculty, improves the student interaction and also helps complete the syllabus in time. This is one of the prime reasons for the extraordinary success of this method. (Concepción, Holtzman, and Ranieri 2009) (Concepción, Holtzman, and Ranieri 2009; Ozyer and Wilson 2016).

Dental education is fairly robust especially in comparison with medical education in that the learning is less didactic, with a lot of hands on learning. However, a significant group of teachers continue to pursue education research in dentistry. (Majidi et al. 2015) (Cunningham 1987) These publications have been primarily focussed on simulations labs, hands on training protocols and their effectiveness in achieving better dental training. There is very little research that exclusively focuses on the teaching learning process. Furthermore the impact of interactive learning is experimented by few groups however, not much groundbreaking research has been published with regard to interactive learning. Therefore to quench this everlasting thirst to find methods to improve student learning with ease, this thesis aims to analyze the impact of our new interactive learning protocol known as the Multiple Interactive Learning Algorithm (MILA) in various aspects of dental education.

MILA in Teaching Neurophysiology

Neurophysiology is a very complicated concept in Physiology. Students have difficulty in understanding the concepts of various neural pathways of the brain. This has been widely reported in various publications.

Students find it difficult to get into their heads what goes on in their heads: how billions of nerve cells, working in parallel on individual tasks in separate areas of the brain with no coordinating supervision, are nevertheless able to assemble sensual input into coherent perceptions of the world, create decisions and come up with new ideas. How can our intuition fail so fundamentally when it comes to studying the organ to which it owes its existence—that is, when it comes to understanding how the brain works? We imagine that there is a central entity at work in our heads, which we equate with our conscious self and that has all the wonderful abilities that distinguish us as humans (Singer 2007). This intuition imposes itself so persuasively—even overwhelmingly—that it is not surprising that, throughout our cultural history, scientists and philosophers have speculated as to where in the brain this all-powerful and all-controlling entity might be (Fries, Nikolić, and Singer 2007).

Commonly used teaching methods may include class participation, demonstration, recitation, memorization, or combinations of these. We practice a unique method of teaching called "Multiple Interactive Learning Algorithm" (MILA) which includes Pogil, Peer led team based learning, Jigsaw, critical pedagogy, clay molding, journal discussion etc. We teach through keynote video based teaching and we give notes in Ibook, wherein we upload salient points with relevant pictures and videos. So that the students can understand the concepts in a much better way, it is also helpful in preparing for university exams and other competitive exams. It gives a space for the students to participate in the lectures and learn with interest. It is more of an activity based teaching than a monotonous lecture that made the change in the students perspective of the subject and show better performance in the studies and as well as research.

The protocol included from the MILA for understanding the concepts of Neural pathways in the Central Nervous System is “GAME BASED LEARNING”.

Game based Learning

Incorporating technology into your teaching is a great way to actively engage your students, especially as digital media surrounds young people in the 21st century. Interactive whiteboards or mobile devices can be used to display images and videos, which helps students visualize new academic concepts. Learning can become more interactive when technology is used, as students can physically engage during lessons as well as instantly research their ideas, which develops autonomy. Mobile devices, such as iPads and/or tablets, can be used in the classroom for students to record results, take photos/videos (Beale et al. 2007).

I utilised a method of game based learning activity, one such example is woollen thread model, for understanding the concepts of neural pathways in the brain. For this method of teaching, we will be having a small group learning which consists of four to five students in a group. So totally a whole class of 25 to 30 students will be splitting into small groups of 4 members in each group. For this activity, I Will be playing a 4 mins flipped class video to every group on the particularly difficult topic on neural pathways in the brain which will be followed by a 20 mins MILA activity. Initially by playing the video, we try to bring the difficult concepts to life with visual and try to impart that visual knowledge into practical learning experiences. By attaining the visual knowledge, the students tend to impart that knowledge in their practical activity. After visualisation, the students have to do it practically, for this purpose, the students from each group have been provided with different colourwoollen threads and a thermocol. Then the students have to trace the neural pathway by using colour threads. This makes the students to easily understand each and every process which is taking place in those difficult pathways. This activity encourages the students of mixed abilities to work together by promoting small group or whole class activities.

Through verbally expressing their ideas and responding to other students will help to develop their self-confidence, as well as to enhance their communication and critical thinking skills which are vital throughout their life.

There has been a dramatic change after these small group activities. The students felt very comfortable and fun based learning in understanding the difficult topics.

Students Feedback

Effective feedback helps individuals to understand what they did well and what they could do better. Once they know what is good and what isn't, they are able to adapt their behaviour and work to improve it. Thus, feedback is a key tool for improving both individual and team performance.

The students have felt this activity based teaching methodology is very helpful in understanding the difficult topics in a better way. Moreover, this woollen thread activity is such a wonderful and fun filled activity for the students in such a way that they can easily trace the difficult neural pathways in a simple and better way.

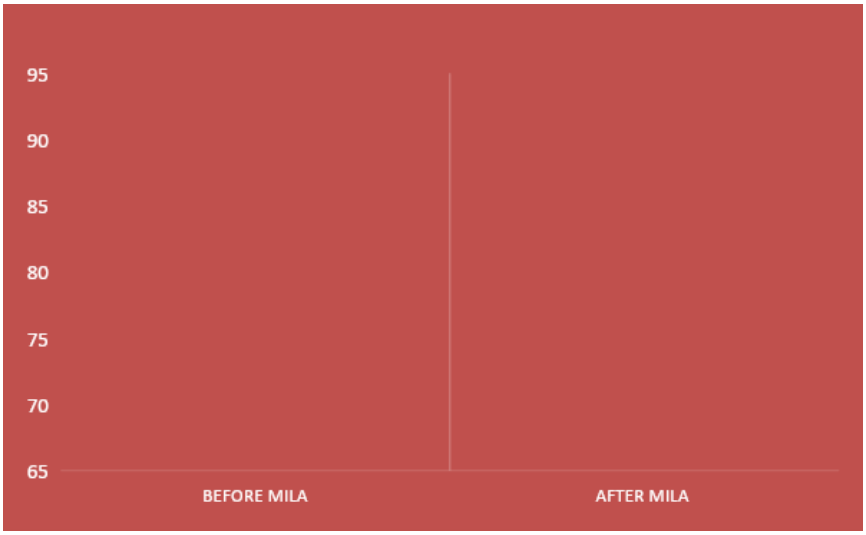


Figure 1: Students Performance Before and After MILA

MILA in Teaching Respiratory System

MILA in teaching Respiratory physiology is a very complicated concept. Students have difficulty in understanding the regulation of respiration because it has complex multiple connections with other disciplines. Factors like ability to reason causally, think about dynamic systems and understanding the physiological mechanisms, and analyse the different levels of organization simultaneously, understanding and remembering the figures, tables and graphs, practice and usage of abbreviations and symbols are the difficulties from a student's perspectives. This has been widely reported in various publications. (Modell 1997)(West 2008) (West 2008; Sturges and Mauner 2013).

The protocol included preliminary flipped class teaching followed by activity based learning, interactive sessions like fill the blocks and keywords. In the activity based learning, students were divided into teams. For each team, clay, chart and sketches were given to make the respiratory centers model without labelling. The function of each of the respiratory centers were discussed earlier. Then each team was shooted with questions related to a respiratory center and were asked to label the corresponding respiratory center. The evaluation was based on the following criteria.

1. Labelling the correct area
2. Creative and neat presentation
3. Timing of completion of the activity
4. Detailed representation
5. Clarity in justification of the answer

By doing so, students attained clear understanding of the functions of the respiratory centers and enhanced group work and creative skills. This activity aimed to help students to organize their knowledge base into functional models of the respiratory system.

The next activity given was the ‘Fill the blocks’ in which the flowcharts of factors affecting respiratory centers were projected with blanks. The students filled the blanks in the flowchart. This helped them to recall the steps in physiological mechanisms involved that affect the respiratory regulation. One example is the sequence of events in Hering Breuer reflex (Figure 2). Students were able to clearly explain the flowchart that they have answered. The students were able to improve their verbal communication as they express their mental models in their own set of words. This learner centered method of teaching transformed classrooms into an active learning environment.

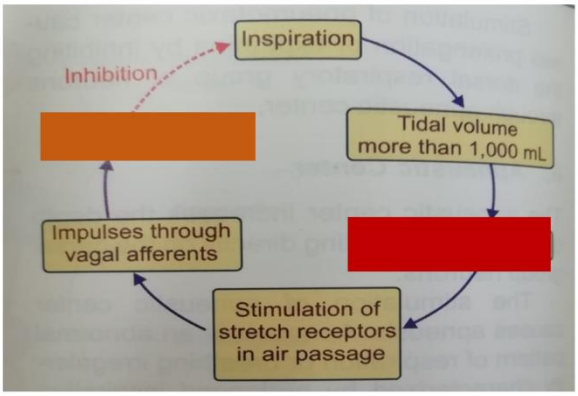


Figure 2: Sequence of Events in Hering Breuer Reflex

The final activity was 'Keyword' in which important terminologies and abbreviations were projected. The students answered in order. One of the difficult parts of respiratory physiology is an extensive table of abbreviations, symbols and terminologies which are new to the fresh readers and feel tough to associate in contexts. The 'Keyword' activity helped students to register all the important terms and abbreviations and they were able to associate to the context.

There has been a dramatic change in the students' perspective of understanding the concept and absorbing permanent knowledge that one can appreciate the integrated nature of physiological mechanisms and co-ordinate with different disciplines.

MILA in Teaching Regulation of Respiration

Physiology is considered bedrock of all undergraduate medical students of different disciplines (Rabiya Rehan, 2016). It is highly challenging for the students to understand the various mechanisms involved in the subjects which require substantial cognitive effort from the students (Michael J, 2011). One of the most complicated topics in physiology is respiratory physiology which involves mechanics, volumes, capacities and regulation and respiratory disorders. A study by Kay Louis Colthorpe also reported that 79.2% of the students cited respiratory physiology to be the difficult concept to understand in physiology (Kay Louise Colthorpe, 2016). There are many reasons for difficulties faced by the students in understanding the concept. One such difficulty addressed by the students is that this system requires strong foundation in physics, chemistry and mathematics to understand the mechanics involved in respiration (Rovick AA, 1999). Those students who do not have a strong foundation in these basic subjects are subjected to face understanding difficulties. Student's understanding of the concepts, not only depends on the nature of the concept, but also on the teachers who take efforts in imparting the subjects in a very easier, uncomplicated way.

Incorporating active learning activities in teaching physiology is found to be beneficial and are now well documented and reported by cognitive science (Michael 2006). In our college, Multiple Interactive Learning Algorithm (MILA) System of teaching is being followed which is an activity based learning system comprising 2 hours of lectures which are divided into 6 segments. Each segment comprises 20 minutes of teaching followed by 20 minutes of activity. This system of teaching keeps students active and involved. This helps students understand the concepts in an easier way. This helps students in active interaction in the class. Experiential learning theory supports the use of this activity type, since it involves multiple learning environments (thinking, feeling, behaving (doing), and perceiving) (Kolb, and Kolb 2005).

To understand the concept of regulation of respiration, the students were given a brief lecture for a period of 20 minutes and this was followed by the activity called Role play. Role-play is enacting activity when you either put yourself into somebody else's shoes. In role play activities, the students enact the role of each element involved in the concept. In regulation of respiration, the students are given the role of different receptors, different centres, nucleus in the centres, neurons, effectors. They enact their roles by movement and explaining their role and their act in every step of the regulation of respiration. The 17 students were assessed by giving one mark questions before and after the activity of role play. For which, 25 one mark questions were framed in the topic and given to the students before the activity and after the activity of role play. Pass percentage of 17 students were calculated before and after the activity. The performances of all 17 students before and after the activity were assessed by their marks before and after the activity. From the study, it was found that 9 students only passed by evaluation before the activity whereas 16 students passed by evaluation after the activity. (Figure 3) Thus the activity facilitates the participation of each and every student and the students enjoy learning by the activity based learning. They also develop love towards the subject and show enthusiasm in the class to enact their roles. Their interest is being kindled by this way of role play activity based learning.

The obtained feedback from the students also shows that their interest for the concept is increased and the subject can be remembered for long term. They felt that long term memory of the concept is being initiated by this way of learning experience. Overall even the least performer in the class is also motivated to be involved in the class. By this way, all the students in the class are made to engage and the concept is reinforced to the students by activity based learning.

The students are thus kept active throughout the lecture hours. The performance after the activity based learning has drastically improved with greater significance. Thus there is a vast variation in the performance before and after the activity based learning.

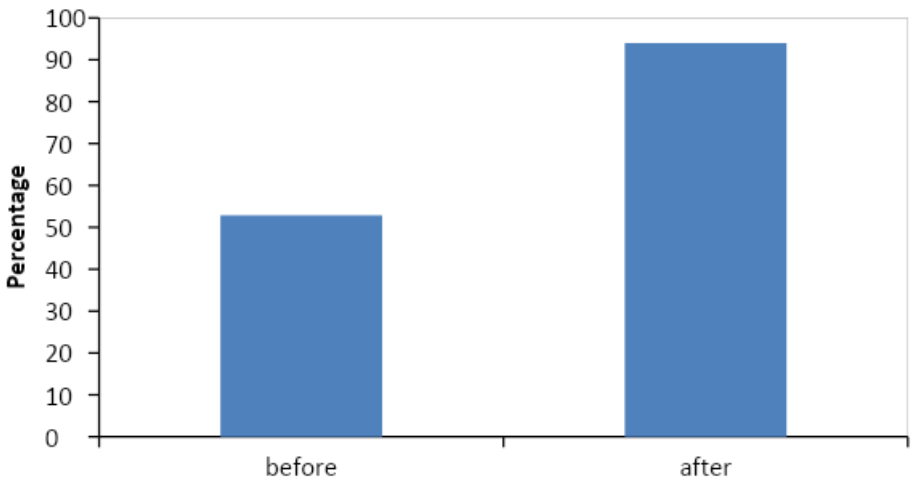


Figure 3: Students Academic Performance Before and After Activity Based Learning

MILA in Teaching Structural Organisation of Protein

Mila (Multiple interactive learning algorithm) is an activity-based learning technique. The traditional method of teaching is not that useful to make the students understand all the difficult concepts in the subject. And it is also difficult to make all the students get involved in the class. Hence we followed the activity based teaching method which involved many activities like pogil, jigsaw, clay modelling, concept mapping, peer led team based learning,

journal discussion etc. Different activities will be adopted for different topics to make the students involved in the class and also to make them understand the concept in a better way. MILA, thus helped to improve the student's perception towards the subject. This also helped the students to memorise all the things and to reproduce them during their examination. Thus there was a tremendous improvement in the academic performance of the students by following the MILA method of teaching and learning. This has been widely reported in various publications (Surapaneni and Tekian 2013). The study by Krishna et al, explained about the use of concept mapping in learning biochemistry. The study was conducted in Saveetha medical college among the undergraduate medical students. In their study they divided the students into two groups – one group receiving the traditional teaching and another group attending the innovative programme. The Student performance was measured using three written tests. The study revealed that the concept-mapping program resulted in higher academic performance compared to the traditional course. They especially valued the use of concept mapping as learning tools to foster the relevance of biochemistry to clinical practice, and to enhance their reasoning and learning skills, as well as their proper and deeper understanding for biochemistry.

The Structural organisation of protein is a very complicated concept. Students have difficulty in understanding the differences between primary, secondary, tertiary and quaternary structures, and the bonds involved in different structural organisation. Hence making the students understand the concept of protein structure is difficult by conventional methods of teaching. We utilised the clay modelling method of pedagogy. The protocol included the clay modelling of the primary, secondary, tertiary and quaternary structures of protein. They studied structural organisation from ibook and books. Then the whole batch (comprising 17 students) was divided into two groups. Chart papers, clay, sketch pens and other stationeries were provided to the students. Both the groups were assigned to do the clay modelling (Figure 4). Both the groups discussed among themselves about how to do the modelling. Then using different colours of clay they modelled the different structural organisation of proteins. All the students were actively participating in the clay modelling. While they are doing the activity, they are able to understand the differences in the different levels of structural organisation of proteins. And both groups did the clay modelling in different ways which revealed their differences in perception and innovation. The whole activity was fun filled and very interactive also. At the end of the activity both the groups were asked to describe the topic. Both groups explained the topic very well, which revealed that they understood the concept better than before. Thus this activity helped a lot to make the students understand the concept of protein structure.

A peer led team based activity was given to understand and explain about the bonds that stabilize the protein structure. The whole batch is divided into 6 groups. Each group.

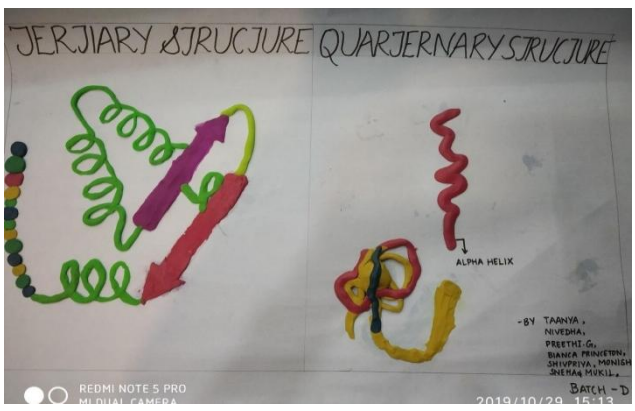


Figure 4: Group of Students who Performed the Activity and the Work Done

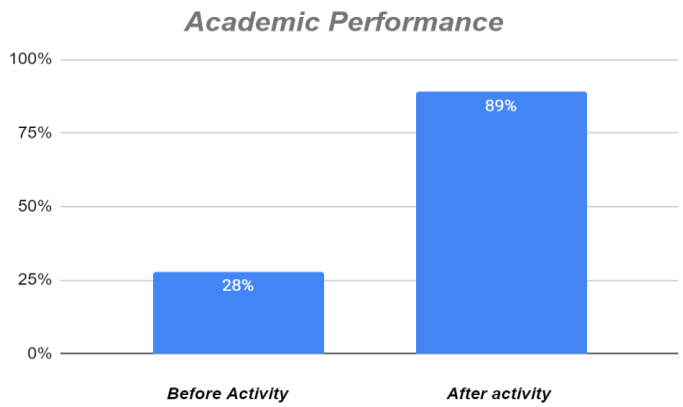


Figure 5: Students Academic Performance Before and After Activity based Learning

is assigned to describe different types of bonds like peptide bond, hydrogen bond, hydrophobic interaction, van der waals force, electrostatic bond and disulphide bond and its role in protein structure. One person from each group will lead the group and help others to understand and study the topic. Each group explained the topic well. At the end of the activity a dramatic increase can be observed in understanding the topic, which was actually difficult to understand by conventional learning and teaching.

The lectures on the classification of carbohydrates, lipids and amino acids, which are more confusing and difficult to understand by the students. Hence for these topics we adopted the concept mapping method. Here each of the students are asked to do concept maps on each of these topics by using mind map application. With the help of ibook and the faculty they can develop a concept map which makes them realise the topic more easily and to memorise it without any confusion and difficulty. With this concept map alone they can explain the whole classification easily. (Figure 5)

MILA in Teaching Renal Physiology

Renal Physiology is a very complicated concept. Physiology is considered to be challenging for students due to its conceptual nature. In Physiology, there are diverse ranges of difficult topics that have been identified which include Excitable tissue, Renal physiology, Gastrointestinal System, Respiratory System, Cardiovascular System and Nervous system (Colthorpe et al. 2018)(Cheng 2015). Kidney has been inextricably linked to Homeostasis of the body and thereby allowing the physiological freedom to move into varying environments and also take various diets and fluids. Kidney is interlinked with many other systems in order to maintain homeostasis. While studying this concept, students have difficulty in understanding. The factors may include nature of discipline, lack of physiological concepts, lack of effort to develop a deep understanding of the topic.

Multiple Interactive Learning Algorithm (MILA) is an activity based learning method of teaching. The main Motto of this methodology is to make concepts clear, understandable and also keep every brain active throughout the class.

In renal physiology, students are facing difficulty in understanding the concept of urine formation. As a physiology teacher, I decided to choose appropriate learning strategies to understand the concept in an easy manner and thereby improve student's academic performances. With the aid of MILA teaching, I planned to teach urine formation in a simple manner. First 20 minutes, I have given brief introduction about the nephron parts and its importance, followed by Activity part I. Ionic reabsorption and secretion mechanism of each part of nephron were explained to students with the help of diagram in flipped videos, followed by Activity part II.

Every 20 minutes class is divided with activity related to that topic. In MILA, there are many activities available like POGIL, JIGSAW, Critical pedagogy; Game based learning, Role play and so on. I utilised Game based learning - Clay modelling method of pedagogy in this class. Students were divided into 3 sub groups. Each group had been allotted different parts of nephron. Group 1 received Proximal Convoluted Tubule, Group 2 received Loop of Henle, and Group 3 received distal convoluted tubule and collecting duct. Before starting the activity, students were instructed properly. Activity Part I: First, they have to draw nephrons in the chart and then each part of the nephron is differentiated with a different clay colour. Activity Part II: Each ion colour was chosen and then placed in the respective part of the nephron. By using arrow marks, ions reabsorption and secretion were marked. If the ions are reabsorbed, the arrow should be facing towards the tubule and for the secretion arrow coming outward from the tubule. If the ions are reabsorbed by active mechanism, it is represented in double arrow or by passive mechanism can be represented in single arrow. Time allotted for this activity is 15 minutes. After 15 minutes, they have to explain the concept with their prepared model.

By doing clay models, students have the opportunity to develop creativity. It improvises the fine motor skills by activating the neurological process between the hand and brain. After this model preparation, students have to discuss with their friends. So this helps them to develop the self confidence level.

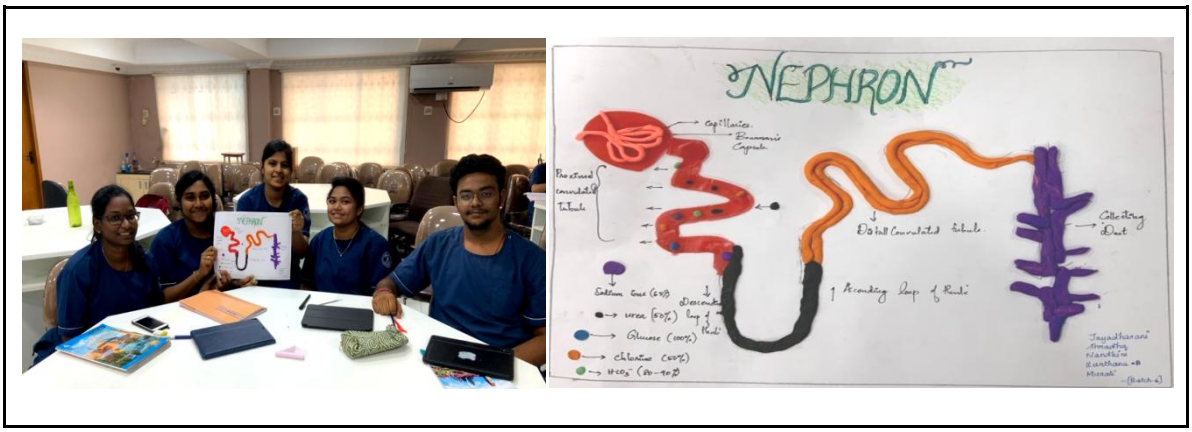


Figure 6: Students Performing Activity

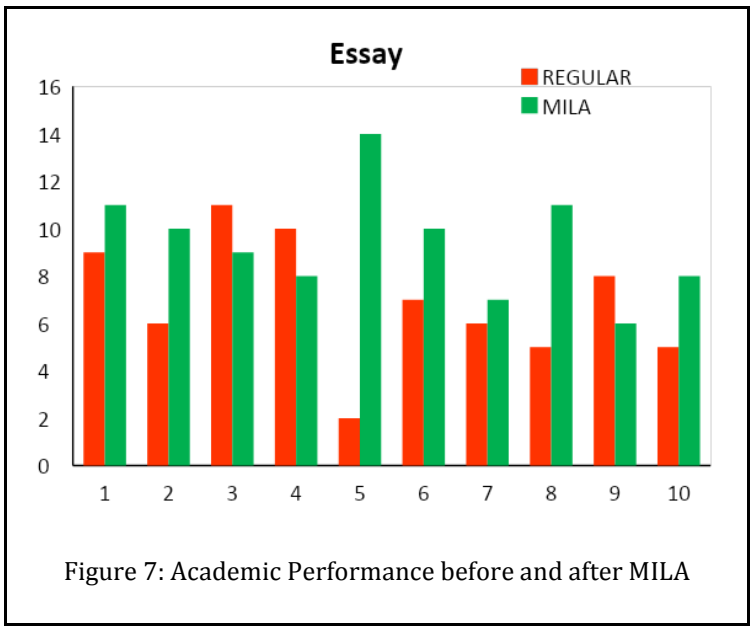


Figure 7: Academic Performance before and after MILA

Student Feedback: Before introducing game based learning, they felt it was difficult to visualize the reabsorption and secretion of ions in the tubule. Due to the complexity of diagrams in books, it is also complicated to understand

them. After this activity, they gained a better idea on the concept. At the end of this session, students were confident about the mechanism of urine formation.

After the introduction of MILA teaching to students, they are active throughout the class. Students are very much interested in participating in the activities. Students have improved their learning strategies and helped them to overcome learning hindrances. Students retrieve new information to clarify any gaps or misunderstanding which aids them into deeper conceptual understanding.

When comparing the performance of the students between regular and MILA teaching. Randomly 20 students' academic marks were selected before and after the MILA method of teaching. Each group consists of 10 students. Urine formation and its mechanism is an essay. After MILA teaching, students secured 14 marks out of 15. There has been a dramatic change noticed in their academic performance after MILA teaching. Students had the ability to recall the concepts and were able to present in their paper without any confusion. This method of teaching aids both high and poor achievers. Good students tend to seek new information from external sources to extend their existing knowledge. Poor achievers also significantly showed the improvement in academic as well as self confidence level.

CONCLUSION

Multiple interactive learning algorithm, ia an activity based learning methodology. The above mentioned topics are complex. Understanding their structure and function with their clinical application is a challenge. Students need to remember these basics for lifetime as it has lots of clinical implications. MILA proved to improve their understanding and clinical application better at the initial stages of their career. Hence its proved yet another time that activity based learning is effective in higher education and MILA is the next level of innovation to transform learning into a joy.

BIBLIOGRAPHY

[1] Attard C, Kathryn H. Technology Use in Mathematics Classrooms: What Do School Leaders, Teachers, and Students Say?. Technology-Enabled Mathematics Education 2019. https://doi.org/10.4324/9781351189392-7.

[2] Beale IL, Pamela MK, Veronica MMB, Nicole G, Steve WC. Improvement in Cancer-Related Knowledge Following Use of a Psychoeducational Video Game for Adolescents and Young Adults with Cancer. Journal of Adolescent Health 2007; 41(3): 263-270. https://doi.org/10.1016/j.jadohealth.2007.04.006.

[3] Chtouki Y, Harroud H, Khalidi M, Bennani S. The impact of YouTube videos on the student's learning. In international conference on information technology based higher education and training (ITHET) 2012: 1-4. https://doi.org/10.1109/ithet.2012.6246045.

[4] Concepción D, Holtzman M, Ranieri P. Sustaining Student and Faculty Success: A Model for Student Learning and Faculty Development. International Journal for the Scholarship of Teaching & Learning 2009; 3(1). https://doi.org/10.20429/ijsotl.2009.030129.

[5] Cunningham MA. Didactic community dentistry curricula in US dental schools. Journal of dental education 1987; 51(5): 233-237. https://doi.org/10.1002/j.0022-0337.1987.51.5.tb02103.x.

[6] Fries P, Nikolić D, Singer W. The gamma cycle. Trends in neurosciences 2007; 30(7): 309-316. https://doi.org/10.1016/j.tins.2007.05.005.

[7] Fry H, Ketteridge S, Marshall S. A Handbook for Teaching and Learning in Higher Education: Enhancing Academic Practice. Routledge 2003.

[8] Gray C. Improving Academic Outcome: The Search for the Holy Grail. International Journal of Early Years

Education 2015; 23(2): 135-137. https://doi.org/10.1080/09669760.2015.1045210.

[9] Seyed Majidi M, Judi R. Evaluation Attitudes of Clinical Medicine and Basic Sciences Teachers about Peer-Assisted Learning in Babol University of Medical Science. Dental Material Research Center, School of Dentistry, Babol University of Medical Sciences, Babol, Iran 2015; 7(1): 13-18. https://doi.org/10.18869/acadpub.rme.7.1.13.

[10] Modell HI. How can we help students learn respiratory physiology?. Advances in Physiology Education 1997; 273(6): 68-74. https://doi.org/10.1152/advances.1997.273.6.68.

[11] National Research Council, Division of Behavioral and Social Sciences and Education, Center for Education, and Committee on Programs for Advanced Study of Mathematics and Science in American High Schools. 2002. Learning and Understanding: Improving Advanced Study of Mathematics and Science in U.S. High Schools. National Academies Press.

[12] Oliveira A, Mario T, Carlos N. Recommendation of Educational Content to Improve Student Performance: An Approach Based on Learning Styles. Proceedings of the 12th International Conference on Computer Supported Education 2020, 2: 359-365. https://doi.org/10.5220/0009436303590365.

[13] Ozyer A, Wilson BG. Inquiry and innovation in the classroom: Using 20% time, Genius Hour, and PBL to drive student success. Interdisciplinary Journal of Problem-Based Learning 2016; 10(1). https://doi.org/10.7771/1541-5015.1631.

[14] Singer W. Understanding the brain: How can our intuition fail so fundamentally when it comes to studying the organ to which it owes its existence?. EMBO reports 2007; 8(S1): S16-S19. https://doi.org/10.1038/sj.embor.7400994.

[15] Sturges D, Trent M. Allied Health Students' Perceptions of Class Difficulty: The Case of Undergraduate Human Anatomy and Physiology Classes. Internet Journal of Allied Health Sciences and Practice 2013; 11(4): 1-10.

[16] Surapaneni K, Ara T. Concept Mapping Enhances Learning of Biochemistry. Medical Education Online 2013; 18(1). https://doi.org/10.3402/meo.v18i0.20157.

[17] Syarafina DN, Jailani, Winarni R. The application of problem based learning to improve students' self-efficacy. In AIP Conference Proceedings, AIP Publishing LLC 2018; 1: 020024. https://doi.org/10.1063/1.5054428.

[18] Teneqexhi R, Loreta K. Making Virtual Classrooms of Google Platform More Real Using Transparent Interactive Screen-Board (tiSb-Albania). Proceedings of the International Conference on E-Learning 2019; 333-336. https://doi.org/10.33965/el2019_201909r049.

[19] West JB. Challenges in Teaching the Mechanics of Breathing to Medical and Graduate Students. Advances in Physiology Education 2008; 32(3): 177–84.

MILA in Teaching Prosthodontics

Dr. Deepak Nallaswamy Veeraiyan, Professor, Department of Prosthodontics, Saveetha Dental College and Hospital, Saveetha University, SIMATS.

Dr. Subha*, Reader, Department of Oral Medicine and Radiology, Saveetha Dental College and Hospital, Saveetha University, SIMATS.

Dr. Dhanraj M Ganapathy, Professor, Department of Prosthodontics, Saveetha Dental College and Hospital, Saveetha University, SIMATS.

Dr. Ashok, Professor, Department of Prosthodontics, Saveetha Dental College and Hospital, Saveetha University, SIMATS.

Dr. Suresh, Professor, Department of Prosthodontics, Saveetha Dental College and Hospital, Saveetha University, SIMATS.

Dr. Vinay Sivasamy, Reader, Department of Prosthodontics, Saveetha Dental College and Hospital, Saveetha University, SIMATS.

Dr. Mariam Anand Bennis, Senior Lecturer, Department of Prosthodontics, Saveetha Dental College and Hospital, Saveetha University, SIMATS.

Dr. Visalakshi, Senior Lecturer, Department of Prosthodontics, Saveetha Dental College and Hospital, Saveetha University, SIMATS.

Dr. Rakshagan, Senior Lecturer, Department of Prosthodontics, Saveetha Dental College and Hospital, Saveetha University, SIMATS.

Dr. Keerthi Sasanka, Senior Lecturer, Department of Prosthodontics, Saveetha Dental College and Hospital, Saveetha University, SIMATS.

Dr.D. Revathi, Senior Lecturer, Department of Prosthodontics, Saveetha Dental College and Hospital, Saveetha University, SIMATS.

Dr. Kiran Kumar, Senior Lecturer, Department of Prosthodontics, Saveetha Dental College and Hospital, Saveetha University, SIMATS.

Dr. Subhashree, Senior Lecturer, Department of Prosthodontics, Saveetha Dental College and Hospital, Saveetha University, SIMATS.

Abstract--- Traditional dental undergraduate education engages students in laboratory and classroom settings during the first two years of their preclinical training, with the clinical subjects being introduced in the third and final year, followed by one year of rotatory internship. Prosthodontics is an extensive subject, with learning beginning right from the time the undergraduate student joins the course till the completion of undergraduation. An effort to probe into the difficulties faced by the students in learning prosthodontics has been made and identified areas of difficulties have been selected so that suitable remedial measures could be recommended and if feasible tested with Multiple interactive learning algorithm as a combined effort from the Faculty of Prosthodontics, Saveetha dental

college. MILA makes a real difference when compared to the traditional method of chalk and talk lectures that sounds not very interesting with lectures scheduled during the afternoon sessions when the students felt drowsy. The article shares the outcomes of teaching prosthodontics with Multiple interactive learning algorithm in Preclinical prosthodontics-Denture teeth arrangement, RPD design, Impressions in complete denture treatment, Tooth preparation, Die systems, Failures in FPD, Basic implantology, practice management among slow learners, suturing techniques in implantology among UG and PG students. The results of prosthodontic learning outcome using MILA based on students performance after each teaching model with MILA is displayed in this article. The outcomes have been satisfactory. MILA in teaching Prosthodontics has revolutionized the way teaching can be constructed to move forward the younger generation to new thinking.

Keywords--- Multiple Interactive Learning Algorithm, Prosthodontics, Complete Denture, Implantology, POGIL, CAT.

INTRODUCTION

The Prosthodontics clinical course aims to teach students not only the importance of replacing oral structures but to stress preservation and optimization of the supporting structures through a combined effort with the other dental specialties. Students are exposed to the philosophies and principles of prosthodontics treatment with fixed, removable, implant, and maxillofacial prosthodontics. Teaching as well as learning prosthodontics constitute a major concern among both learners and teachers. MILA is educational process which involves multiple method of learning which can be customized to individual students based on their aptitude and acumen. Multiple interactive learning tools used in prosthodontics include CAT, POGIL, pedagogy lectures, flipped class, problem based learning, video based learning, evidence based learning, critical appraisal, competition based learning, simulation training along with clinical training. It was hypothesised that A high learning outcome was achieved with multiple interactive learning algorithm which enhanced the students in their area of interest in prosthodontics. Accordingly multiple interactive learning tools were applied in teaching prosthodontics among the1st 2nd and 4th year students of undergraduate curriculum and year 1,2,3 students of postgraduate curriculum. The objective of this research was to analyse, display and share the results of prosthodontic course learning outcome using MILA and students performance after each teaching model with MILA.

MILA in Teaching Pre-Clinical Prosthodontics- Removable Prosthodontics

Introducing the 1st year students to Pre-Clinical prosthodontics laboratory Exercises & Concepts. Being a novice it is very difficult for 1st year graduate students to understand and learn the Pre-Clinical works, to visualise the outcome of their lab works they do and to correlate the theoretical lectures & Practical demonstrations with clinical perspective.[1]

Any demonstrations using videos & small group discussions will augment the faster learning process by the students. This method of teaching is required as the students are working in the laboratory, doing the lab works which are intended for the purpose of the patient, it will be difficult for the student to know the clinical use and correlate with the works they do in the lab in the absence of the patient. It is also important to improve the manual dexterity for the students at the same time.[2]

To overcome these difficulties faced by the students to understand the concepts and improve the work efficiency a protocol was introduced for Small Group learning by segregating 100 students into 6 small batches, each batch comprising about 16 – 17 students. In 1st year the students are required to do laboratory steps for Complete Denture, Removable Partial Denture and Cap-Splint. The complete Denture Exercise includes the fabrication of the Occlusal Rims & Mounting of the Casts in the Articulator. To understand the purpose of the Occlusal Rims & Articulator a

series of video based demonstrations were used to make them understand the procedures involved both clinically and in the laboratory. Also the students were made to observe their seniors in the clinics how they do the Jaw Relations which make them understand the clinical procedures involved. Then a video based demonstration of the jaw and its movements were shown followed by focused group discussions about 3 -4 students in a group where the subjective simulation by themselves were was done & correlating these jaw movements in the semi – adjustable articulator which made a better understanding and visualisation of the procedures they do in the Pre-Clinical laboratory.

Video based Demonstrations -> Clinical Exposure -> Subjective Simulation -> Increased performance & Dexterity

It is very important to explore the students' difficulty in understanding the concepts, for this purpose feedback could be a good resource to know the difficulties faced by the students. The students were asked to provide feedback on the protocol and few more inclusions were made in the feedback form to know the perception of students towards the work environment and the teaching methods, where a majority of responses were positively given. (fig 1,2,3,4,5,6,7). This method of teaching is very effective in Pre-Clinical laboratory as it enhances the students focus in learning the objectives & improved performance of each student in completion of the pre-clinical exercises.

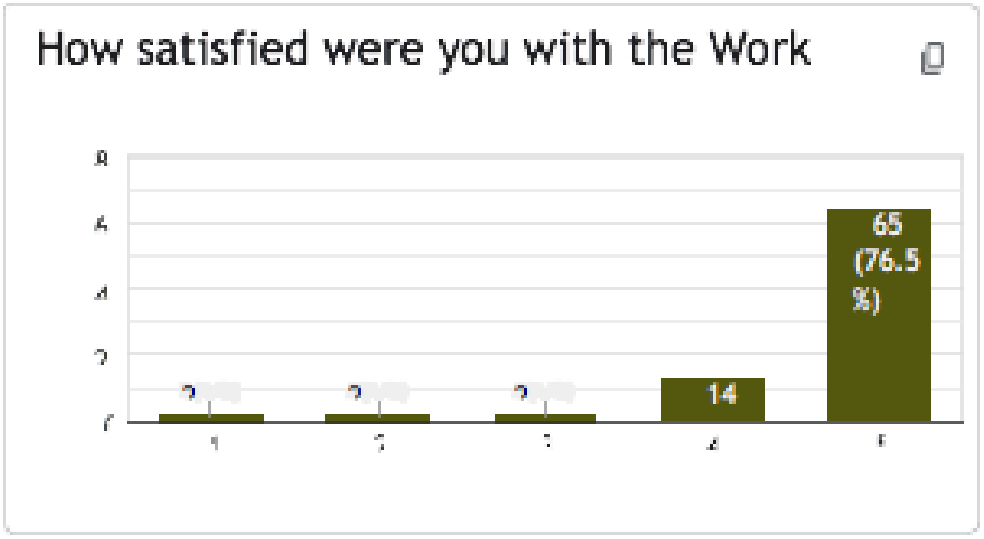


Fig. 1: Bar Chart Showing Response Scores of Participants in the X Axis and Number of Participants in Y Axis

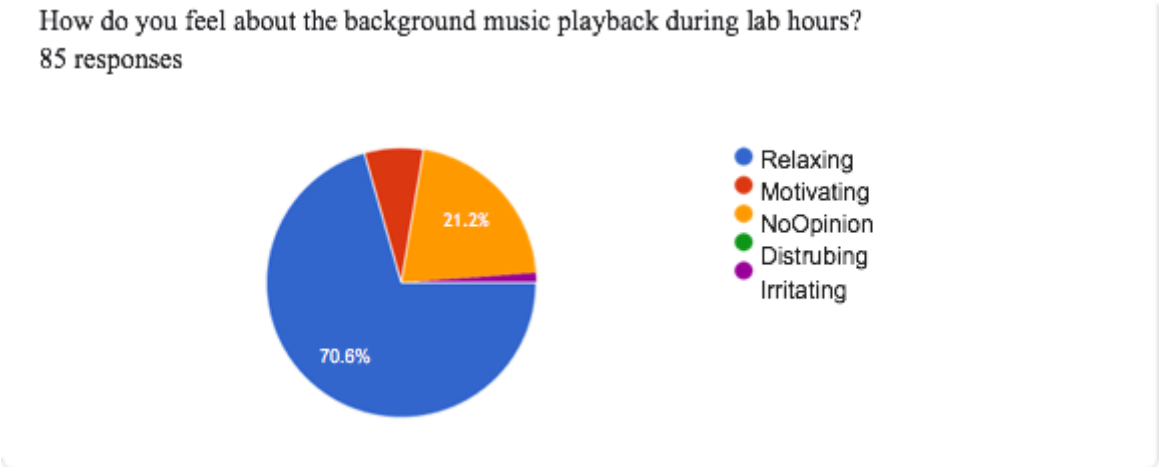


Fig. 2: Pie Chart Displaying the Responses of Students

85 responses

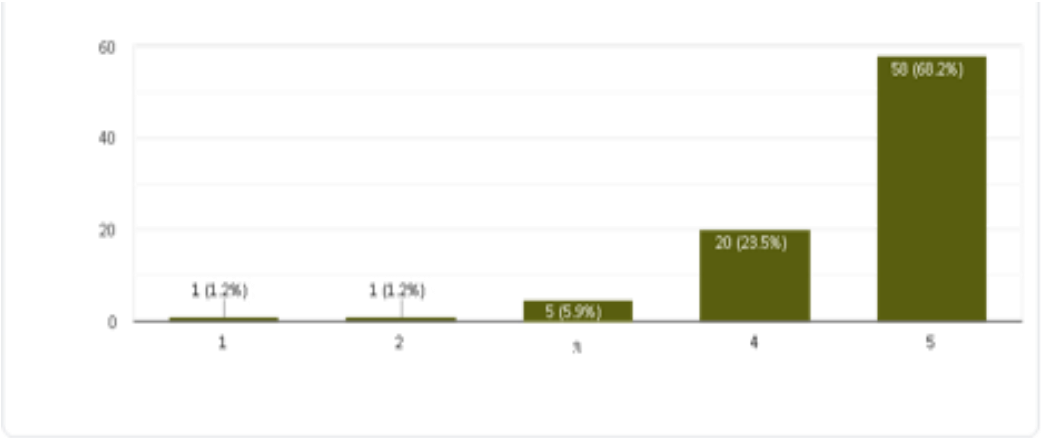


Fig. 3: Responses to the Question: How Relevant do you think the Method of Teaching Helps you to Complete Your Work?

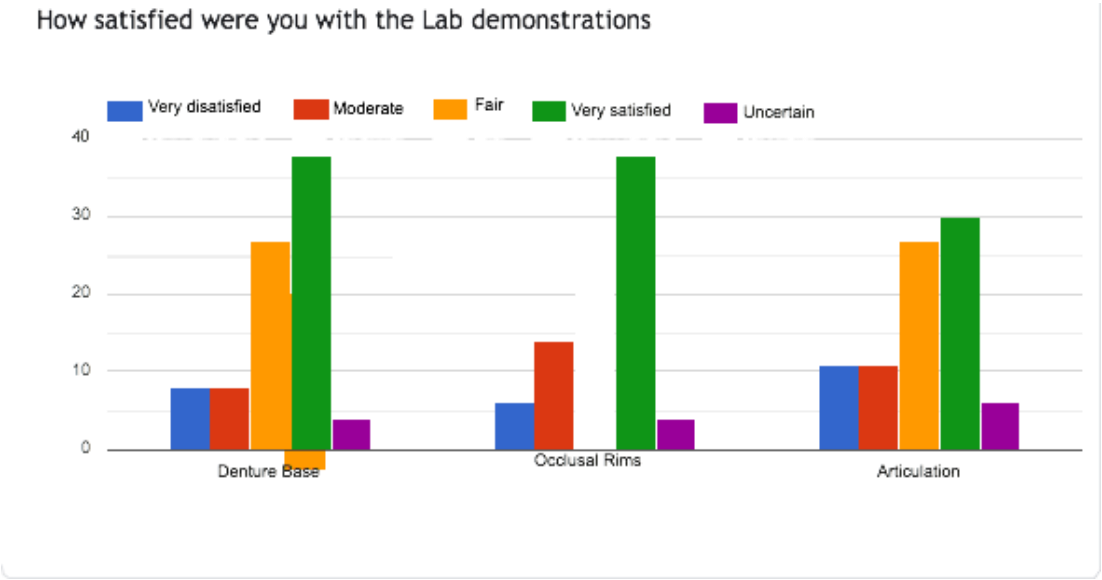


Fig. 4: Students Feedback on Denture Base, Occlusal Rims, Articulation Demonstrations

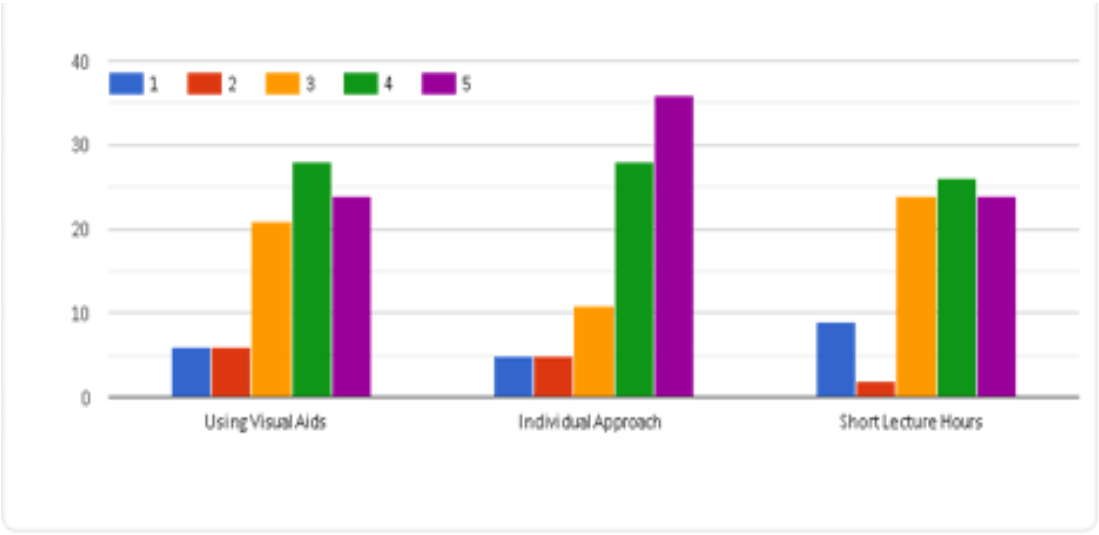


Fig. 5: Student Feedback on Most Relevant Sessions

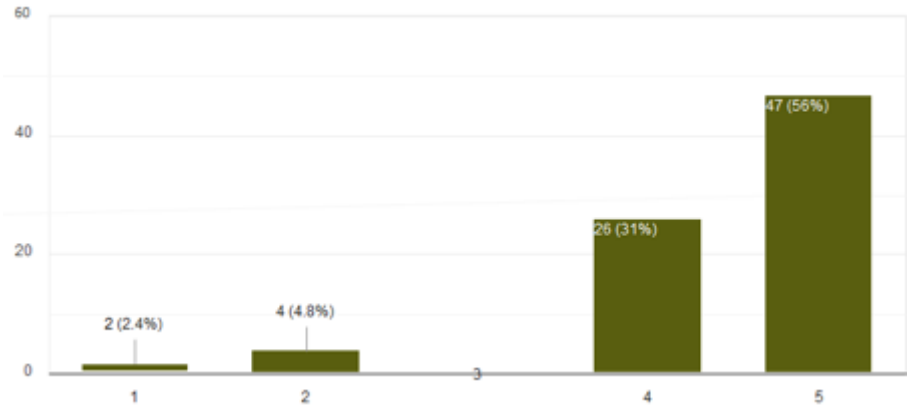


Fig. 6: Student Feedback on Level of Understanding the Use and Purpose of Articulator after Theory Session.

MILA in Teaching Preclinical Prosthodontics - Denture Teeth Arrangement

Preclinical Denture Teeth Arrangement is a very complicated concept. Students have difficulty in understanding practical concepts such as Arch form, Symmetry, Plane, Occlusal Contact relations, Occlusal Scheme and Aesthetic appearance in addition to identification of tooth form and anatomy.

Difficulty in teeth arrangement exercises have been widely reported in multitudes of publications across the entire dental education fraternity and is considered a source of consternation for predoctoral students and faculty alike. [1], [3].

We utilised a combination of "Video based Learning, Small Group Learning, Flipped Class and Structured Drills" method of pedagogy in a class between 9.00 AM to 12.00 Noon.

The Protocol included segregation of a total number of 42 students into batches of 13 students each (Small Group Learning). Each batch was subjected to a conventional teeth setting exercise in order to determine their aptitude and dexterity in teeth arrangement. The teeth arrangement principles and methods were taught to the students earlier during the 1st year of their program. A revision class was conducted prior to the teeth arrangement exercise. The exercises were graded upon completion. The students were then provided a custom designed video (Video based Learning) depicting the ideal appearance of teeth arrangement and were instructed to view the video on the eve of their scheduled exercise (Flipped Class). They were also encouraged to pause and watch individual frames of the video during the exercise. Upon completion, the exercises were graded once again. The evaluation was broken down into Arch form, Symmetry, Plane, Contact relation & Aesthetics and was individually scored. The students were informed of the structured scoring pattern prior to both exercises (Structured Drills).

The results indicate a significant difference between the scores obtained in the pre- and post-video based sessions. The post-video session scores were found to be significantly higher compared to the pre- video scores. The students were asked to provide feedback on the new protocol to which a uniform positive response favouring the video based session was obtained. There was at least one student per batch who requested monitoring even with the video playback during the arrangement. Even with such incidents, all students reported lesser frustration levels due to the visual aid from the video and heightened satisfaction upon completion of their practical exercise.

The 2 Supervising faculty have also observed a reduced need for physical monitoring as well as a lesser number of errors per teeth setting made by each student.

We would like to conclude stating the protocol proposed above has the potential to drastically enhance teeth arrangement skills among predoctoral dental students as observed by the results obtained during real time

implementation. We would also like to point out that the session was carried out on a small group of students; Even with that limitation, the wide difference in results indicate a positive effect of this protocol irrespective of the individual skill of the student.

Overall, we believe teaching students by this method is highly effective for teaching Preclinical Teeth Arrangement and advocate the implementation of this technique to other preclinical disciplines and in other institutions as well.

MILA in Teaching Impression in Complete Denture

Posterior palatal seal in complete denture impression seems to be a simple topic. But understanding the posterior palatal seal is a little difficult to understand. Understanding the anterior vibrating line and the posterior vibrating line in the posterior palatal seal area is quite confusing.

This has been widely reported in various publications.[4] [5].

We utilised Group discussion method of pedagogy in a class between 8am to 10am. The protocol included dividing the students into three groups and each group identified the anterior vibrating line, posterior vibrating line, hamular notch in the cast and they acted like the advantages of recording posterior palatal seal, the effects of overextended and under extended denture margins. The next activity the students did was identification of the anterior and posterior vibrating line and marked using the haematoxylin pencil. Impression done cast poured and verified with the replication drawn in the mouth.

The students after group discussion and visual search among themselves made them understand the concept better and confident enough in doing their impressions in complete denture patients that had the recordings of anterior and posterior vibrating lines. This technique not only understands the students recording the theory of posterior palatal seal but also guides the students to record the posterior palatal seal in the completely edentulous patients in the clinics that aids in better retention with good posterior seal. Patients are also satisfied with the dentures made by the undergraduates with good posterior seal area. Post insertion complaints are very less after students understand the concept. Overall we believe that the group discussion and the visual examination with self-finding teaching methods are very effective both theoretically and clinically useful for both students as well as patients.

MILA in Teaching Removable Partial Dentures

Removable Partial denture topic as a whole is a difficult concept for the undergraduates to understand. Prosthodontics subject as a whole revolves around incorporating mechanical rigid components into biological hard and soft tissues, when it comes to Removable prosthesis especially this partial denture creates a lot of challenge in why it's being done in this particular way.

Students have difficulty in understanding the components used, biomechanical principles, impression recording techniques and final prosthesis construction. These specific tic difficulties have been reported in literature and associated prosthetic construction failures.

We incorporated POGIL and playful show tell do method of pedagogy between the regular oral theory sessions. These concepts were intertwined between theory classes which focuses on how to break down the bigger concepts and relate to everyday activities. In the playful show, students were given simple scales, rubbers and other stationeries to make a childhood game of seesaw. In this playful activity effort, fulcrum, load concepts were demonstrated with different lever principles and how these were correlating to the removable Partial denture

components. This playful show tell do activity made students understand the biomechanics in a bigger picture and how different prosthetic components helps in stabilisation.

In process oriented guided interactive learning (POGIL) students will be given key words related to the theory topics covered and they have to do literature search on those keywords. The literature search will be done electronically in pubmed, scopus search engines and relevant documents will be retrieved and each student reads those manuscripts. Each student then will summarise in the shortest possible way about the article they read and how it is relaxant to the theory class covered. When students interact about the new learnings from the literature students tend to grasp the subject better and clarify doubts about the subject then and there. This method was employed in teaching the topic- impression procedure for removable Partial dentures and Students could actually differentiate different techniques once the class was over.

These activity based learning has made big differences in student learning outcomes. The pass percentage in the particular subject-prosthodontics has gone up to 99 %, during clinical exams too the students ability to answer confidently was appreciated by external examiners. When a case based discussion was given to the students they were able to hit the bullseye of getting a treatment plan with various Removable prosthesis designs.

To conclude MILA in teaching has revolutionized the way teaching can be constructed and move forward the younger generation to new thinking.

MILA in Teaching Removable Partial Denture Design

The theory of Partial Denture Design is quite a complicated concept and difficult to understand for undergraduates students in prosthodontics. Students have difficulty in understanding the section of diagnosis, classification, R.P.D design, fabrication and treatment plan. These have been reported in various publications [6][7] [8].

We utilized the method of POGIL (Process oriented guided interactive learning), Small Group Case Based Discussion, Video based learning and Flipped class in theory classes.

The protocol included splitting the students into various small groups. (POGIL) Interrelated topics we gave as discussion topics for separate groups. Each student of the group will be well versed in the topic. Students were motivated to collect information on this topic from various sources including their journals, textbook and the web. The groups are then reshuffled so that the new group has one member of each group. They were shared and discussed amongst their new group members of information and the content absorbed and learned. This was conducted as a session of 20 minutes lecture followed by the activity for the period of 20 minutes, which will be related to the 20 minutes lecture to improve the thinking and increase the retention skills. (Small Group Case Based Discussion) The class was divided into small groups, each group consisted of six students. Cases were selected from the patient's records and distributed among each student group. They were discussing the treatment planning and then providing one solution for the case. Video based learning (Flipped class) we were provided the pre-recorded video of the class representing the appearance of R.P.D design and concepts. They were instructed to view the video and help in easy understanding the concept as well as open more paths for discussion.

Multiple teaching methods were beneficial for the students. There has been a dramatic increase in understanding the concepts in relation to removable partial denture design in Prosthodontics. As well as, the students were able to identify the classification, draw the design and label the component parts of Removable partial denture. Students were able to understand the concepts right away. Students were able to rationalize the diagnosis and treatment plan. They updated the recent concept and also understood the existing debates.

To conclude that, I believe teaching this type of Multiple Interacting Learning Algorithm methods as a main approach to teachers to ameliorate the learning outcome for the undergraduate students and the possibility for immediate reach any type of student learning's preference.

MILA in Teaching Principles of Tooth Preparation

MILA in teaching Principles of tooth preparation is a relatively challenging and complicated.

Practice involving both art and science. The influence of preparation design on the quality of tooth preparation in dental education is well known. Understanding the concepts is necessary to design and execute the plan. This has been cited by several authors.

Students have difficulty in understanding concepts and applying it in clinical practice. Initially we had a Conventional classroom teaching lecture for an hour on principles of tooth preparation after which students had to design and prepare teeth for a three unit fixed prosthesis. They were graded on completion based on treatment plan, design and execution of principles of tooth preparation.

We then used a combination of flipped class method (digital interactive learning) and small group learning of pedagogy in a class between 9 and 11 am. The protocol included preparation of a flipped class with concept mapping. Students were instructed to view and understand the contents prior to the scheduled class. After the scheduled class, students were divided into five groups based on headings in concept mapping. The five topics under this concept mapping were discussed with diagrams by students Within and between groups. After the scheduled group discussion, students were asked to design and prepare teeth for a three unit fixed prostheses. They were graded accordingly.

When the scores were compared there was a dramatic improvement in the quality of tooth preparation, after the flipped class teaching method. Students were able to apply the theoretical concepts to practice with ease and confidence. The time taken was less, preparations had a path of insertion, bevels for structural durability, features for retention and resistance with good margins.

Overall we do believe that training and motivating students in this method is very effective for teaching principles of tooth preparation in clinical scenarios in fixed prosthodontics. It enhanced their knowledge, skill, dexterity and confidence relatively easily.

MILA in Teaching Die Systems

MILA in teaching: Various die systems used in Metal ceramic and All ceramic technology, compositions and their method of fabrication.

It seems to be an easy topic but the most confusing and easily evaporating topic from memory. Post Graduate Students have difficulty in understanding each concept without having knowledge of demonstration on each technique of fabrication.

The Protocol Included

We utilised and started with the basic book reading session from standard books meant for these topics and discussed in a classroom. I followed this approach since I observed little or no practice from students in reading these textbooks. Book reading has got direct and indirect advantages such as for writing fill in the blanks for the exam and improving their depth of knowledge...etc I Encouraged students to get actively involved in book reading sessions on recommended text books (fig 8,9) on these subjects/topics.

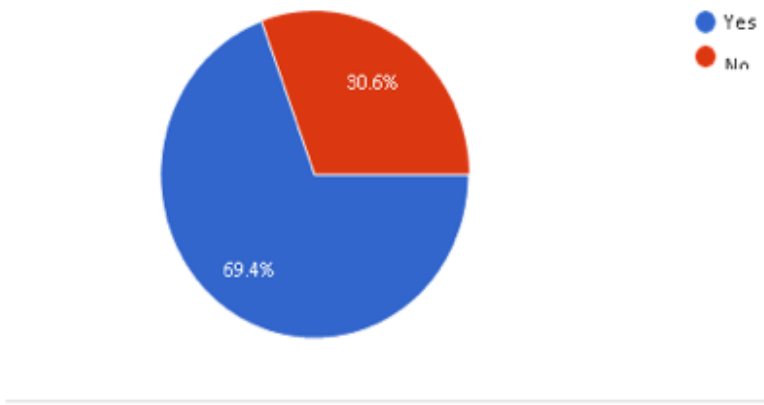


Fig. 7: Feedback on Adequacy of Working Hours for Work Completion

Fig. 8: Book Reading Session Followed by Individual Presentations

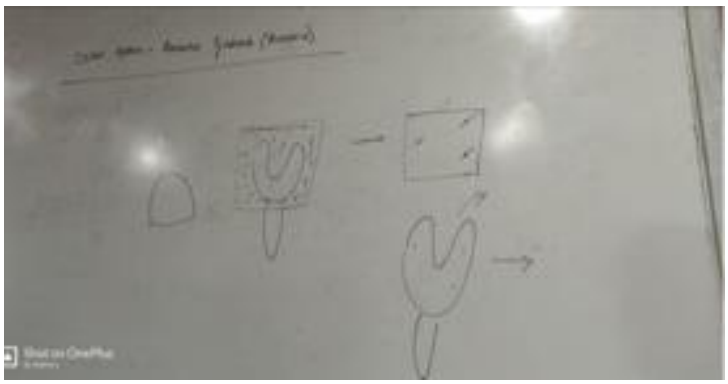


Fig. 9: Individual Presentations

This once again was followed by individual presentation by students on assigned topics by class room teaching pedagogy method. (fig 10) in a class. At the end of the pedagogy Class each of them were asked about questions related to,

1. Importance of doing precise die cutting
2. Normal contacts and contours
3. Consequences of improper Die cutting
4. Consequences of improperly contoured Crowns and periodontal problems

Coming on to the methods of fabrication they were asked to watch flipped Class with youtube videos (Video based learning) since they are not in touch with conventional method of fabrication...(they Follow digital CAD CAM method for fabricating all ceramic crowns and bridges) Followed by 5 minutes question session regarding.

1. The success and failure in all ceramic restoration
2. Importance of proper fabrication method
3. Composition of each material
4. Bonding mechanism involved
5. Ceramic veneering techniques

This was such a satisfying method of teaching among all methods I believe as far as the post graduates are concerned. I conducted a quiz program with a timer, whoever answers first within the expected time period they are announced as the winner and they will get a reward. This encourages them to give excellent responses and attention in a classroom. While giving marks I analysed them in 5 categories such as,

1. Those who are able to understand theory much and explain in a much better way
2. Those who are interestingly involved in explaining difficult part to others
3. Those who have knowledge of searching in good indexed journal (pogil search)
4. Those who are covering all important points from multiple text books and other sources available (Google)

After this practice they are able to understand the mistakes which have been made by laboratory fabrication and are able to instruct them to do corrections if needed.

I have spoken to the tessellation centre saveetha dental college regarding the demonstration based learning for the above mentioned same topic for their final and finer understanding. Initially when I took class by Conventional method they didn't have much interest in listening and from the postgraduate point of view everyone will have understanding capacity but they lack listening capacity and interest towards learning and there were also no improvement in scoring marks in the weekly test. So to motivate them I have started a new methodology of teaching which includes starting from,

1. Book reading in standard recommended text books (helpful in writing fill in the blanks)
2. Flipped class and you tube videos (video based learning)
3. Writing concept mapping at the end of book reading
4. Classroom pedagogy (main method along with Pogil search)
5. Demonstration based learning (saveetha tessellation centre)
6. Quiz Program with timer

Students are happy now as it eliminated the fear and improved their confidence level, vocabulary, knowledge and memory power.. etc..

There has been a dramatic increase in their performance after the implementation of this method, which improved their interest towards listening to the classes, and there has been a dramatic increase in their presence to college. (Absent percentage drastically reduced).

Overall, i believe teaching Post Graduate students by this method is effective for teaching Various Die systems used in metal ceramic and All ceramic restorations and their method of fabrication.

MILA in Teaching Failures in FPD

It is always a quiet challenging job for the students to understand the complex clinical or practical situations in the theory books, so we have adopted the MILA system to make the students in interactive in every aspects of learning

and understanding the concept by various approaches like video, group discussion and friendly approach through easing the students to approach faculty easily. Clinically applied teaching helps the students the most ways. Above all, a good teacher role is not only teaching the subject but also teaching life and philosophy which directly or indirectly helps in connecting or handling clinical skills more skilfully.

The Protocol Included

We utilised and started with the short 15min theory session with the slide share from standard books meant for these topics and discussed in a classroom. Followed this approach since I observed little or no practice from students in listening to the class. Textbook gazing was advised for the students, this has got direct and indirect advantage such as for writing fill in the blanks for the exam and improving their depth of knowledge...etc I Encouraged students to get actively involved in book reading gazing session on recommended text books (1)(2) on these subjects/topics.

At the end of Class and discussion each of them were asked about questions related to,

1. Cementation failure
2. Mechanical failure
3. Biological failure

Coming on to the methods of Diagnosis they were asked to watch flipped Class with youtube videos (Video based learning) (various failures in FPD) Followed by 5 minutes question session regarding,

1. The success and failure in all ceramic restoration
2. Importance of proper fabrication method
3. Bonding mechanism involved.
4. Ceramic veneering techniques

Following any of the old patients is recalled in the clinics side by the seminar itself and directly the FPD failures are addressed and appointment patients with FPD failures were treated by one of the students assisting by myself. This makes the student feel more confident in handling the patients with their sound theory background by direct clinical application.

This was such a satisfying method of teaching among all methods I believe as far as the post graduates or undergraduates concerned. They need a teacher whom they can trust on along with many different orientations of teaching methods that are not monotonous for them. This encourages them to give excellent response and attention in a class.

Finally I gave a self assessment short exam with them to students.

While giving marks I analysed them in 5 categories such as,

1. Those who are able to understand theory much and explain in a much better way
2. Those who are interestingly involved in explaining difficult part to others
3. Those who have knowledge of searching in good indexed journal (pogil search)
4. Those who are covering all important points from multiple text books and other sources available (Google)

After this practice they are able to understand the mistakes by themselves and feel more confident and motivated on managing the clinical cases using their theory applied knowledge.

I have myself started assisting the students in saveetha dental college regarding the demonstration based learning for the above mentioned same topic for their final and finer understanding. Initially when I took class by Conventional method they didn't have much interest in listening, they lack listening capacity and interest towards

learning and there were also no improvement in scoring marks in the weekly test. So to motivate them I have started a new methodology of teaching which includes starting from,

1. Book gazing in standard recommended text books (helpful in writing fill in the blanks)
2. Flipped class and you tube videos (video based learning)
3. Writing concept mapping at the end of book gazing
4. Classroom pedagogy (main method along with Pogil search)
5. Demonstration based learning (Clinical cases)
6. Spending time with the students leisurely
7. Attend conferences and other academic activities with them

Students are happy now as it eliminated the fear and improved their confidence level, vocabulary, knowledge and above all to approach the faculty anytime.. etc

There has been a dramatic increase in their performance after the implementation of this method, which improved their interest towards listening to the classes, and there has been a dramatic increase in their presence to college. (Absent percentage drastically reduced).

MILA in Teaching Basic Implantology

Learning the Basic implantology for undergraduate students is quite challenging. Students have difficulty in understanding the subject at undergraduate level, and placement of implants in undergraduate level.

We utilised video based learning as a method in class between the modules, which happened for one week. The protocol included classes shown through video which were played twice, followed by activity.

There has been a drama c increase from the conventional lecture classes when compared. Overall, we believe teaching students by this method is effective in learning basic implantology.

Topic: Video based training for Final year Implantology Module No. Of Students: 75 (2018)

90 (2019) 30 (2020) Materials and Method

Source: Video which was made on that particular topic were played twice

Activity: Different activity after each video class

Duration: 5 days of comprehensive learning module

Topics: History of implantology, design, diagnosis and treatment planning, osseointegration, grafting procedures, placement, treatment options, success and survival.

Students Review

1. Visualising and learning the practical
2. Activities were more practical

Summary Video based teaching was conducted for the final year implant module every year. Students seem to be more attentive than regular board classes. The knowledge transfer was much better when compared to conventional. The students were able to visualise the concepts of implantology through this and understood the topic better. When in doubt the videos were stopped in-between and further explanation was provided. The activities given at the end of the session were more practical and the students were able to relate the classes well. The E- Learning was more effective, engaging and the training approach for placing implants was much easier.

MILA in Teaching Implantology

The use of dental implants for treating complete or partial edentulism is a widely accepted treatment option as a result of its high success rate, it is imperative that the undergraduate dental students receive sufficient training about implant treatment modalities so that they can give knowledge to the patients about implant therapy and its advantages. Since the patient is seen and treated by the undergraduate students first and then referred to the postgraduate departments for further advanced treatments, it is essential for an undergraduate student to learn all the modalities of treatment for a missing tooth and treat the patients within their limitations. In this regard teaching Implantology for undergraduate students is important as Implant based treatments have become usual within dental practices and Dental colleges are responsible for providing students training in theory and in practical skills. Our college is the first college in the country to introduce Implantology as a subject in the main curriculum for the undergraduate students from 2011 and at that point it was important for us to simplify the contents to undergraduate level so that the students can learn the topics with more confidence and MILA Teaching methodology was so handy in making the students learn implantology at ease. MILA is a teaching methodology where short lectures are interspersed with different activities that will facilitate a simpler, easier and fun filled learning experience for the students. In comparison with conventional lectures where it is very difficult to retain student's attention, the MILA concept keeps the student active throughout the lecture time and since the students are divided into small groups for activities, the facilitator can give individual attention to the students.

Protocol Followed

1. Flipped Class: The entire topics to be taught is done into short videos of not more than 3 mins and this material is introduced to the students before attending the class and the classroom time is used to discuss the topic with peers and teachers in depth thereby making learning more active in comparison to conventional teaching where the learning is considered to be passive. The following topics were made into Flipped class videos.
    1. Introduction to Implants - History, Evolution and Types of implants
    2. Implant design
    3. Diagnosis and treatment planning
    4. Osseointegration
    5. Implant surgical and Prosthetic components
    6. Protocol and Guidelines for placing and loading implants
    7. Impression making
    8. Fabrication of Simple and Complex implant prosthesis
    9. Implant Occlusion
    10. Bone Augmentation
    11. Implant complications and Failures
    12. Maintenance Protocol
1. Group Activities: Each flipped class session is followed by a group activity pertaining to that topic. Each group will have a faculty as facilitator who will guide the group for the activity. Activities like ZIGSAW, PLTL, CLAY MODELLING, MIND MAPPING were used.
    1. Introduction to Implants: The activity used for this topic is JIGSAW In this activity member from each group is picked and an expert group is formed and the main topic Introduction to implant was divided into sub-topics like History and Evolution, Types, Demography and Need for Implants, Current status of

Implant treatment in India, Market share of 5 big implant companies in India. The expert group will discuss and learn the sub topics and return to the home group, in the Home group each member will teach the peers what they learnt in the expert group.

2. Implant Design: The activity used for this topic is clay modelling, each group is asked to design implants of their own and the group leader will explain the design in detail and substantiate that with evidence. This activity will kindle the creativity in the students and the students enjoy doing this activity.
3. Diagnosis and Treatment planning: The activity used for this topic is Mind mapping which is a graphical way to represent ideas and concepts. It is a visual thinking tool that helps structuring information, the topic is divided into subtopics like Indications and contraindications, steps in CBCT planning, surgical guides, Recent advances and each group will make a mind map and share it with the other groups. This activity helps them to remember the topic very well.
4. Osseointegration: The activity used for this topic is Peer led team Learning (PLTL) in this activity students help themselves in understanding and learning concepts in the presence of a facilitator topics like Theories of osseointegration, Bone remodelling around implants, Methods to test osseointegration and failure of osseointegration are discussed.
5. Implant surgical and Prosthetic components: Activity used Mind Mapping.

MILA in Teaching Controversy in Immediate Implant Placement and Restoration

Critical appraisal of a topic is a compilation of existing evidence from systematic review to analyze and form a new informed opinion. Immediate implant is a very complicated concept. Students have difficulty in understanding protocols, consensus, complications, and outcomes. This has been widely reported in various publications [9][10].

We utilised CBL (Competition based learning) method of pedagogy in a class between 1pm to 3pm. Debate was utilized as a competition based learning (CBL) tool. The protocol included comparison of pre and post debate fill in the blanks test marks for 18 students from the same subject field on the particular topic- immediate implant in order to determine their aptitude and knowledge in the controversy of immediate implant. For the debate, the 18 students were segregated into two groups by random sampling. There were three rounds for the debate (CBL).

1. Firstly, they were establishing their points based on evidence.
2. Face to face round where they were fighting verbally with submission of evidence (published paper),
3. Thirdly, each of them were discussing their own understanding from the topic.

Then next day again test were conducted from the same topic in order to understand the outcome of the activity based learning i.e. CBL.

There has been a dramatic increase in learning skill, capacity of remembering the evidence, clear knowledge of the subject, understanding different ways of critical analysis.

This activity secession reinforced students' old concepts and gave way to newer ideas and also improved their knowledge to analyse high levels of evidence to improve clinical practice. Students were updated on current literature and improved their confidence in all clinical procedures they do. It helped them to defend themselves. This novel CBL activity triggered students' minds to apply intellectual ideas.

Overall, we believe teaching students by this method (CBL) is effective for teaching controversy in any field of dentistry based on literature and this is a fun, motivating, enlightening, innovating, brainstorming activity based learning.

MILA in Teaching Suturing Techniques in Implant Dentistry

Students have difficulty in understanding the suturing concepts that they study in books without practice. Difficulty in suturing exercises has been widely reported in multiple publications.[11][12][13] [14][15].

We utilised a combination of Small group interactive learning followed by Simulation method of pedagogy in a class between 1.30pm to 3.00pm. The protocol included small group learning of suture materials, knots and needles followed by demonstration of suturing techniques on a Duoderm CGF Extra minces model, orange rind.

The use of teaching models permits the students to handle the surgical instruments in a limited field under a semi-realistic circumstance and also helps in developing psychomotor skills.

A fresh orange is cut into two segments from top to bottom. The pulp of the fruit is carefully removed thereby separating it from the rind (fig 11,12)A thin layer of putty vinyl polysiloxane impression material is smeared on to the inner surface of the orange skin peel and the pulp space is filled with either plaster of paris. Subsequently, when the dental stone sets, the suture model is ready for use(fig 13) which can be sutured similar to tissue along the incision.(fig 14).[16].

Different suturing techniques were demonstrated to students and the same was simulated by the mentors on Duoderm models (fig: 15,16,17), orange rind following which the students were made to practise the same on models during class.

Fig. 10: Presentations after the Book Gazing, Book Reading Module

Fig. 11: A fresh Orange is Cut Into Two Segments from Top to Bottom

Fig. 12: The Pulp of the Fruit is Carefully Removed Thereby Separating it from the Rind

Fig. 13: The Suture Model is Ready for Use with Suturing Armamentarium

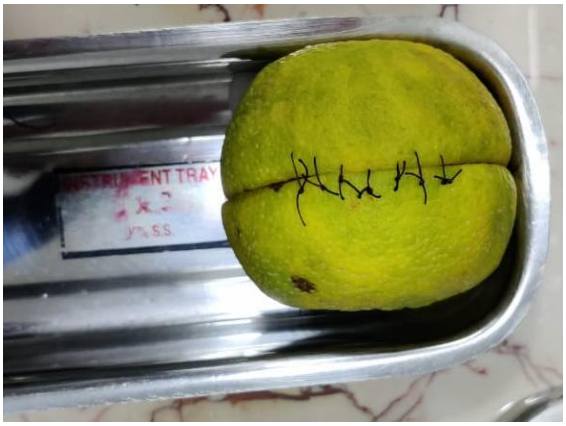


Fig. 14: Simulated Dental Suturing to Position

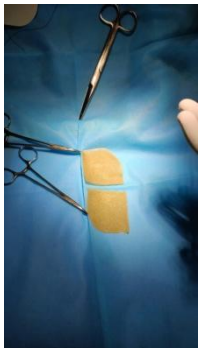


Fig. 15: Duoderm Models Ready for Suturing

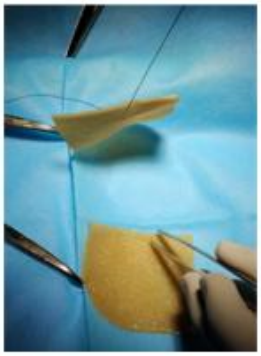


Fig. 16: Demonstration of Suturing on Duoderm by Mentors

There has been a dramatic increase in the attention of students when compared to regular class. Students better understood concepts of suturing of skin and mucosa.

The primary objective of dental suturing to position and secure surgical flaps were well understood by students. Optimal soft tissue healing for aesthetics depends on the clinician's knowledge of and skill at executing proper suturing for optimal wound closure. [17]

Optimal choice of suture thread material, needle and knots not only eliminate the difficulties encountered during surgical closure but also decrease the potential for postoperative infections. [18]

Overall, we believe teaching students by this method is effective for teaching "Suturing techniques in implant dentistry'' by enhancing psychomotor skills and tactile sensation among students practicing suturing techniques.

MILA in Teaching Practice Management

Undergraduate dental education is extremely unique as it involves not only academic knowledge, but also encompasses in it a knack to acquire clinical and interpersonal skills. For a dental student, the third year marks a very important year in their journey of becoming a dental surgeon. Entry into third year can be termed translational as the dental student first enters clinical practice and starts performing procedures on patients. This can be quite challenging and overwhelming for a budding dentist. Concepts such as patient conflict management, infection control and adherence to treatment protocols are difficult concepts. This has been widely reported in various publications. For example in the study published by Polychronopoulou et al 2009, it was observed that dental students from across the world unanimously agreed that their first clinical year was the most difficult year in the undergraduate period. A similar study published by Divaris K et al in 2008 also identified the overwhelming pressure of handling patients for the first time as the greatest stressor in their five years of undergraduate education.

We understood the need for a programme that basically helped students ease into clinical practice. We utilised Video based learning, Small Group Learning Problem based learning and Role play as a method of pedagogy in a weeklong intensive hands-on workshop that was held from 08:00 AM to 03:00PM. (fig 18)

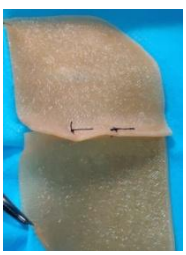


Fig. 17: Simulated Sutures on Duoderm Models

Fig. 18: Figure Demonstrating Small Group Learning Actively Mentored by Mentors

The Protocol included segregation of a total number of 80 students into 10 groups with 8 students each (Small Group Learning). Each group was then mentored by a faculty who would mentor them through different clinical concepts and hands on exercises.(fig 19) After a 20 minute didactic session, the faculty would then assign an activity for the whole group to participate in.(fig 20) The activity could be finding the solution to a problem (Problem Based Learning)(fig 21,22). The activity would then be assessed by the mentor faculty present in the group, who would also provide real time feedback on the outcome of the various activities performed by the student. Dr. MM House said that it was imperative for a clinician to meet the mind of the patient before meeting the mouth of the patient. To help students get a better understanding of this concept, we utilised Role play to enact different psychological patient profiles and ways to handle them. The videos (Video based learning) of different clinical procedures were played to students after which they were asked to perform (under supervision) the same in preclinical models. The procedures were assessed by the mentors and active real time feedback was shared with the students.

Fig. 19: Picture of a Mentor Demonstrating Procedures to Students

Fig. 20: Figure Displaying the Gingivectomy Activity Model for Activity between Didactic Sessions

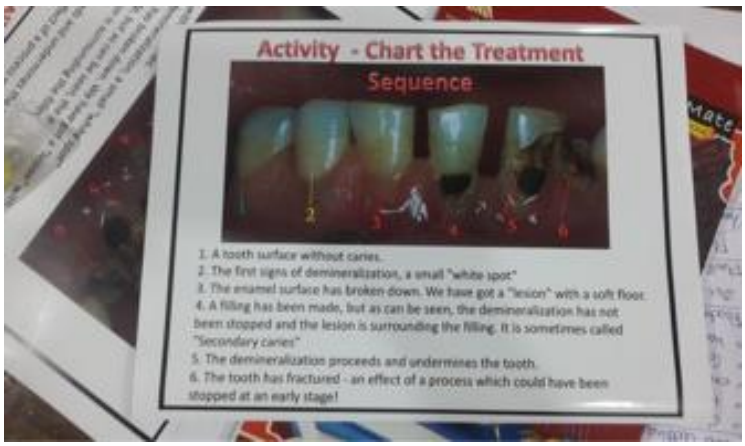


Fig. 21: Figure Displaying the Activity Cards Used in Module

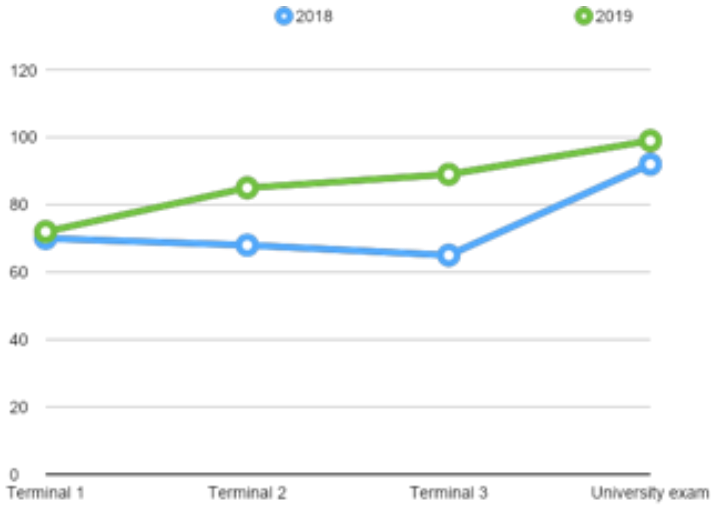


Fig. 22: Figure Displaying the Students Performance in Exams in Percentage

The students were then asked to provide feedback on the programme to which a uniform positive response was seen. The year end clinical performance was then assessed with the total number of procedures counted as the main variable. The average procedure count increased by 85% and improved the overall confidence level of the students. We also conducted a survey among students to check their perception towards the need for a practice management course in their undergraduate curriculum. The survey results showed that 97.7% of the student population agreed that the practice management programme should be inculcated in their curriculum.

Overall, we believe teaching students by this method is highly effective for teaching practice management to undergraduates and advocate the implementation of this technique in other institutions as well.

MILA in Teaching Educational Tool in Slow Learners

Students with below average cognitive abilities whom we cannot term as disabled are called slow learners. They struggle to cope with the traditional academic demands of the regular classroom. Actually slow learners are normal students but the problem is that they are simply not interested in studying under a traditionally accepted system of education. Slow learners should not be confused with students in need of special education or reluctant learners who are non-cooperative. A student may fail to excel in some classes or in some subjects but it does not imply that he or she is a slow learner. The teachers and guardians may resort to some of the teaching aids available to special education students that may enhance interest of slow learners and help them get involved in the learning process.

Students learn at different rates, and, according to some published research, students learn only when they are ready. Other research gives importance to intrinsic rewards, differentiated curriculum, and motivation by personalizing lessons. However, the bottom line for most educators is that some students are slow to learn, but do not have a learning deficiency. Perhaps the greatest challenge to an educator is a child who is a slow learner. These students do not fall into the category of special education, they do well outside the classroom, and show no evidence of having a medical problem. They simply do not do well in school or a particular subject. Slow Learners may have problems not only with math and reading but also with coordination such as penmanship, sports, or dressing. Often they are quiet and shy, and they have trouble making friends. They may have poor self confidence. They often have a short attention span. All of these problems cause them to have a poor self esteem.

In general, slow learning students may exhibit some or all of these characteristics, depending on their age and degree of problems acquiring knowledge at school. First, slow learners are recurrently immature in their relations with others and do poorly in school. Secondly, they cannot do multifaceted or complex problems and work very slowly. They lose track of time and cannot convey what they have learned from one task to another well. They do not easily master skills that are academic in nature, such as the times tables or spelling rules. Perhaps the most exasperating trait is their inability to have long-term goals. They live in the present, and so have considerable problems with time management perhaps due to a short attention span and poor concentration skills. One thing which we should remember is that, just because a child not doing well in one class does not make that student a slow learner. Also, slow learners vary from reluctant learners. A slow learner to begin with wants to learn, but has a problem with the process. A reluctant or hesitant learner is not motivated and can also be passive aggressive, creating more problems for teachers and parents through non-cooperation.

Reluctant learners seldom have learning disabilities. We experienced a huge setback while teaching final year additional batch students in prosthodontics in 2019. For the first time, after two decades of teaching, we experienced a devastating University examination result in which all the eleven students who appeared for the exams failed. We were in a state of shock and we were not able to comprehend the results. After careful contemplation and deliberation we decided to teach the students with modified education tool, MILA.MILA is educational process which involves multiple method of learning of which can be customized to individual students based on their aptitude and acumen. In this situation, we employed methods like Game based learning, Video tutorial learning, Debate based learning, Peer led team based learning and Process Oriented Guided Inquiry Learning. The students were also involved in Quiz based learning which enabled them to perform much better in the fill in the blanks questions. The training of the students with MILA was very satisfactory to us and the confidence levels of the students improved greatly and their understanding of the subject also immensely improved. Much to our delight all the students who appeared next time for the University examination cleared the exams in flying colors. The external examiners also expressed great happiness and testified the success of the technique of MILA.

CONCLUSION

MILA was easy to be applied in prosthodontic training successfully. Based on the analysis of the student's performance in classroom they seem to enjoy with their peers in the due course of interactive learning. Based on analysis of the student's results there seemed a significant enhancement in final assessments comparative to their baseline assessments. There seems to be an increased desire for learning by applying MILA eliminating monotonous hours of classroom learning. Based on exam performance there has been a considerable difference in the performances of students. We encourage and highly recommend implementation of MILA in teaching prosthodontics in dentistry.

BIBLIOGRAPHY

[1] Shigli K, Jyotsna S, Rajesh G, Wadgave U, Sankeshwari B, Nayak SS, et al. Challenges in Learning Preclinical Prosthodontics: A Survey of Perceptions of Dental Undergraduates and Teaching Faculty at an Indian Dental School. J Clin Diagn Res 2017; 11: ZC01–5.

[2] Faraone KL, Garrett PH, Romberg E. A blended learning approach to teaching pre-clinical complete denture prosthodontics. Eur J Dent Educ 2013; 17:e22–7.

[3] Rayyan M, Elagra M, Alfataftah N, Alammar A. Acceptability of instructional videos. The Clinical Teacher 2017; 14: 268–272. https://doi.org/10.1111/tct.12543.

[4] Hardy IR, Kapur KK. Posterior border seal—Its rationale and importance. The Journal of Prosthetic Dentistry 1958; 8: 386–397. https://doi.org/10.1016/0022-3913(58)90064-7.

[5] Calomeni AA, Feldmann EE, Kuebker WA. Posterior palatal seal location and preparation on the maxillary complete denture cast. The Journal of Prosthetic Dentistry 1983; 49: 628–630. https://doi.org/10.1016/0022-3913(83)90385-2.

[6] Sethi N. Removable Partial Dentures. Review of All Dental Subjects (ROADS) 2015: 501–501. https://doi.org/10.5005/jp/books/12580_13.

[7] Bilhan H. Preparation of the Mouth for Removable Partial Dentures. Removable Partial Dentures 2016: 53–61. https://doi.org/10.1007/978-3-319-20556-4_6.

[8] Oyague RC de, de Oyague RC, Lynch C. Variations in teaching of removable partial dentures in Spanish dental schools. Medicina Oral Patología Oral Y Cirugia Bucal 2011: e1005–13. https://doi.org/10.4317/medoral.17368.

[9] Lodge JM, Kennedy G, Lockyer L, Arguel A, Pachman M. Understanding Difficulties and Resulting Confusion in Learning: An Integrative Review. Frontiers in Education 2018;3. https://doi.org/10.3389/feduc.2018.00049.

[10] Woolfolk AE, Brooks DM. Nonverbal Communication in Teaching. Review of Research in Education 1983;10:103. https://doi.org/10.2307/1167137.

[11] Kroeplin BS, Strub JR. Implant dentistry curriculum in undergraduate education: part 1-a literature review. Int J Prosthodont 2011; 24: 221–34.

[12] Koole S, De Bruyn H. Contemporary undergraduate implant dentistry education: a systematic review. Eur J Dent Educ 2014; 18 Suppl 1: 11–23.

[13] Sanz M, Saphira L. Competencies in implant therapy for the dental graduate. Appropriate educational methods. European Journal of Dental Education 2009;13:36–43. https://doi.org/10.1111/j.1600-0579.2008.00544.x.

[14] Silverstein LH, Kurtzman GM, Shatz PC. Suturing for Optimal Soft-Tissue Management. Journal of Oral Implantology 2009; 35: 82–90. https://doi.org/10.1563/1548-1336-35.2.82.

[15] Silverstein LH, Kurtzman GM, Kurtzman D. Suturing for optimal soft tissue management. Gen Dent 2007; 55: 95–100.

[16] Kumaresan R, Karthikeyan P. An Inexpensive Suturing Training Model. Journal of Maxillofacial and Oral Surgery 2014; 13: 609–611. https://doi.org/10.1007/s12663-013-0546-z.

[17] Palacci P, Nowzari H. Soft Tissue Enhancement Around Dental Implants. Periodontology 2000 2008; 47: 113–32. Https://Doi.Org/10.1111/j.1600-0757.2008.00256.x.

[18] Burkhardt R, Lang NP. Influence of suturing on wound healing. Periodontology 2000 2015; 68: 270–81. https://doi.org/10.1111/prd.12078.

Multiple Interactive Learning Algorithm (MILA) in Teaching Oral Medicine and Radiology

Dr. Deepak Nallaswamy Veeraiyan, Professor, Department of Prosthodontics, Saveetha Dental College & Hospital, SIMATS. E-mail: dir.acad@saveetha.com

Dr.M. Subha*, Associate Professor, Department of Oral Medicine & Radiology, Saveetha Dental College & Hospital, SIMATS. E-mail: doctorsubha@gmail.com

Dr. Vivek Narayan, Senior Lecturer, Department of Oral Medicine & Radiology, Saveetha Dental College & Hospital, SIMATS. E-mail: vivek_narayan85@icloud.com

Dr.T.N. Umamaheswari, Professor, Department of Oral Medicine & Radiology, Saveetha Dental College & Hospital, SIMATS. E-mail: umasamsi@gmail.com

Dr. Jayanth Kumar, Reader, Department of Oral Medicine & Radiology, Saveetha Dental College & Hospital, SIMATS. E-mail: doctorjayanth@gmail.com

Dr. Sreedevi, Reader, Department of Oral Medicine & Radiology, Saveetha Dental College & Hospital, SIMATS. E-mail: sanjamrut@gmail.com

Abstract--- Traditional lectures are the most common teaching method employed by many dental institutions. It is the method where the teacher stands in front of the students and delivers a speech about a particular topic to make the students understand the topic. This method of teaching is very popular among teachers and is still being used by many. Unfortunately, this traditional teaching method has significant drawbacks often resulting in a poor understanding of the concepts taught to the students. This has led to the advent of the Multiple Interactive Learning Algorithm which is abbreviated as MILA. MILA teaching involves fragmentation of the entire duration of the class into multiple small sessions. Here, the word facilitator is preferred over the lecturer, as the teacher facilitates the students in learning a particular concept rather than lecturing it. MILA uses many innovative techniques that are interactive to make the learning process more efficient. MILA has improved the understanding and retaining of a concept in memory and has also made the students engage actively in the learning process. MILA is employed in teaching various topics in Oral Medicine and Radiology such as TMJ disorders, IOPA, radiation physics, etc. The paper aims to discuss the new and innovative teaching method MILA in Oral Medicine and Radiology.

Keywords--- Teaching, Traditional Lecture, Oral Medicine, Oral Radiology.

INTRODUCTION

Learning is an experience and experience gives wisdom. Teachers in our society have an immense responsibility towards the students as they play a crucial role in a student's life. They impart knowledge to the students and prepare them to face challenges in their lives. Imparting knowledge to the students is a unique, sensitive and a challenging task. The standard of a teacher is determined by how much the student is able to understand their teaching [1]. For a very long time traditional lecturing is the most popular and one of the widely used methods to transfer knowledge from the teacher to the student. In this method, the teacher is present in front of the students and delivers a speech about a particular topic. Certain teachers are exceptionally great at teaching and for them traditional lecturing is still an effective way to teach. Similarly certain students who are exceptionally brilliant can easily understand a topic

irrespective of the quality of the teacher. Unfortunately the majority of the teachers and students do not belong to this exceptional category. Most teachers often experience difficulty in making a student understand a concept through traditional lecturing and as a result of that the student is unable to appreciate and perceive the concept. The students often find the traditional lecture to be boring as many of them do not actively participate in the lecture. Over a period, this traditional lecturing has undergone certain changes like addition of certain supportive aids which would enhance the teaching. These include overhead projectors, use of audio visual aids like slide presentation (powerpoint, keynote etc) etc. In one of the studies it was found that powerpoint presentation was beneficial for teaching but the material in the presentation plays a vital role [2]. Another study revealed that with powerpoint presentation, the teaching was enhanced although the final grades of the students did not improve [3]. This means an enhanced presentation tool such as powerpoint was unable to bring about improvement in the final grades of the students. This could be probably attributed to the traditional lecturing method and this calls for a change in the learning method itself.

The drawbacks of the traditional lecturing method has led to the advent of a new and a creative learning method called 'Multiple Interactive Learning Algorithm abbreviated as MILA'. This method avoids lecturing and actively engages the students in activities which enhances their learning of a concept/topic. The students are provided with a short video describing the topic which the students have to see a day before attending the class. This prepares the student about the topic and this has been shown to be effective in a study done in 2016 [4].

In MILA the total duration of the class would be 120 minutes and the term teacher/lecturer is replaced with the term facilitator. It has been found that the human brain can concentrate on a particular topic for only 20 minutes [5]. Hence, the total duration of the class is divided into 6 micro sessions lasting for 20 minutes each. Once the class starts, the topic for the day is divided into 3 parts of a brief overview followed by 3 parts of activities after every overview [figure 1]. In the brief overview the facilitator simply explains a part of the topic in a nutshell which will be followed by an activity about the topic. Here the idea is to facilitate the students in learning by making them find out more about a topic and not actually lecturing about the topic. An activity can be anything that actively engages the student to explore further into the topic which was explained previously.

20 mins (brief explanation)	20 mins (activity)	20 mins (brief explanation)	20 mins (activity)	20 mins (brief explanation)	20 mins (activity)
Introduction Types of intraoral radiographs IOPA Bisecting angle technique Paralleling technique	Scale up occlusal radiographs & bitewing radiographs	Extraoral radiography Basic landmarks Types of extraoral radiographs & indications Panoramic radiography	Problem solving 2 cases are presented to 2 groups of students for which they have to prescribe an appropriate radiograph	Faulty radiographs errors due to faulty exposure & processing errors in digital radiography	Game based learning Jumbled words are given the students have to find out the word & arrive at a final answer

Figure 1: The Table is an Example Showing the Basic Framework of the MILA System of Teaching and Learning

Few examples of such activities include Process Oriented Guided Inquiry Learning (POGIL), Student-Centered Active Learning Environment with Upside-down Pedagogies (SCALE-UP), Game based learning, peer led learning, concept mapping, problem based learning etc. the facilitator also can come up with his/her own innovative activity which will actively engage students. The activity session enhances self directed learning. This makes the students interactive, work as a team to find a solution, and also teach their peers. This boosts the confidence of the students and improves the emotional and social intelligence of the students. Emotional intelligence is the ability of being concerned with effectively understanding oneself as well as others, maintaining good relationships with people and

adapting to and coping with the immediate surroundings to be more successful in dealing with environmental demands [6]. Social intelligence is something which is essential for a person to acclimatise with the peers, maintain relationships, help others and interpret social information, leading to accurate social inferences [7].

Researchers state a person with higher emotional and social intelligence are more successful than the one with higher intelligence quotient alone [8]. MILA provides an environment where the intelligent, emotional and social quotient are horned. Students who shy away and those who have low self confidence had transformed into good speakers and teachers at the end of the year. Thus the students had a personality development too along with their academic development.

TMJ Disorders (TMD)

TMJ disorders are an interesting topic yet difficult to understand. Diagnosis of TMD is challenging and difficult as it is multifactorial and there are many orofacial pain conditions which can be misdiagnosed as TMD pain [9]. This makes proper understanding of the topic paramount. Differentiating orofacial pain as odontogenic and non-odontogenic is the initial step and later finding out whether TMJ was the source for non-odontogenic cause is the following step in diagnosis of TMD [10]. Clinicians' knowledge of appropriate choice of treatment of TMD is the next challenge to be faced. Majority of TMD can be managed with conservative management such as pharmacotherapy, behavioural management, Transcutaneous Electrical Nerve Stimulation [TENS], physiotherapy. Surgical intervention such as gap arthroplasty, condylectomy, meniscectomy with implant reconstruction are advised in severe cases with major structural changes in TMJ [11]. The plan included flipped class in the beginning which was a video presentation to explain the concepts of TMD in a simplified manner with emphasis on the important sections such as etiopathogenesis, clinical presentations, diagnostic criteria, differential diagnosis, radiodiagnosis of TMJ Imaging and medical and surgical management of TMD.

Fundamental knowledge of normal anatomical structures and physiology of TMJ are important for differentiating the pathology from normal. This can be achieved with POGIL activity, in which each student was instructed to involve in mono acting of a particular anatomical structure of TMJ. The various bony components such as condyle, glenoid fossa, articular eminence and soft tissue components such as articular disk, muscles of mastication, ligament, tendon, synovial fluid and neurovascular structures, each of which will be distributed among the students and each student will perform mono acting on the structure explaining from the fundamental aspects to complete management of the pathologies related to that anatomical structure. This activity enables the students to be involved in learning the specific structure in depth and by listening to other students' mono acting. Complete knowledge of the complex anatomical structures of TMJ and basic functioning is possible only when students are made interactive during the lecture class. The case based learning was made effective using Jigsaw puzzle activity in which three groups of different clinical and imaging features pertaining to three main disorders of TMD based on RDC criteria [12] was displayed to students. The students have to pick out three disorders such as myofascial pain dysfunction syndrome [MPDS], anterior disk displacement with reduction and osteoarthritis from the three group of clinico-radiographic features arranged in a puzzle.

The activity of Concept mapping [figure 2] was given to the students at the end of the class which serves as a visual aid for revising the entire contents of TMD. There has been a significant increase in the students' performance [figure 3] which was assessed by various measures such as case based discussion, in which various TMD documentation cases with complete case history, investigations including Computed Tomography (CT), Cone Beam Computed Tomography (CBCT) and Magnetic Resonance Imaging (MRI) were displayed and the students' ability to diagnose, interpreting the radiographic image, arriving at a final diagnosis and formulation of the appropriate

treatment plan was assessed. The students' understanding skills and communication skills in presentation of the concepts were assessed based on debate topics such as CT versus MRI imaging of TMD, medical versus surgical management of TMD disorders. Overall, we believe teaching students by the MILA method was effective in TMJ disorders and aids students to achieve knowledge and excellence in the topic.

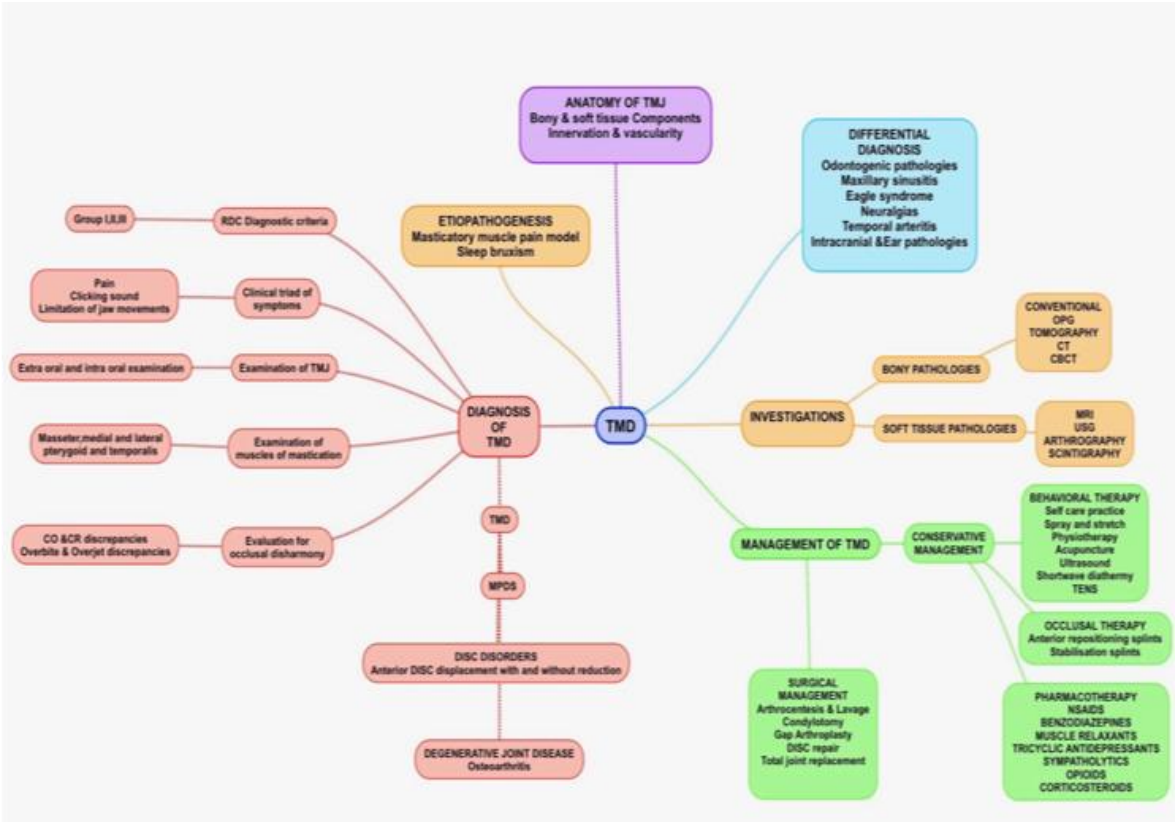


Figure 2: Picture Shows the Activity of Concept Mapping of TMJ Disorders

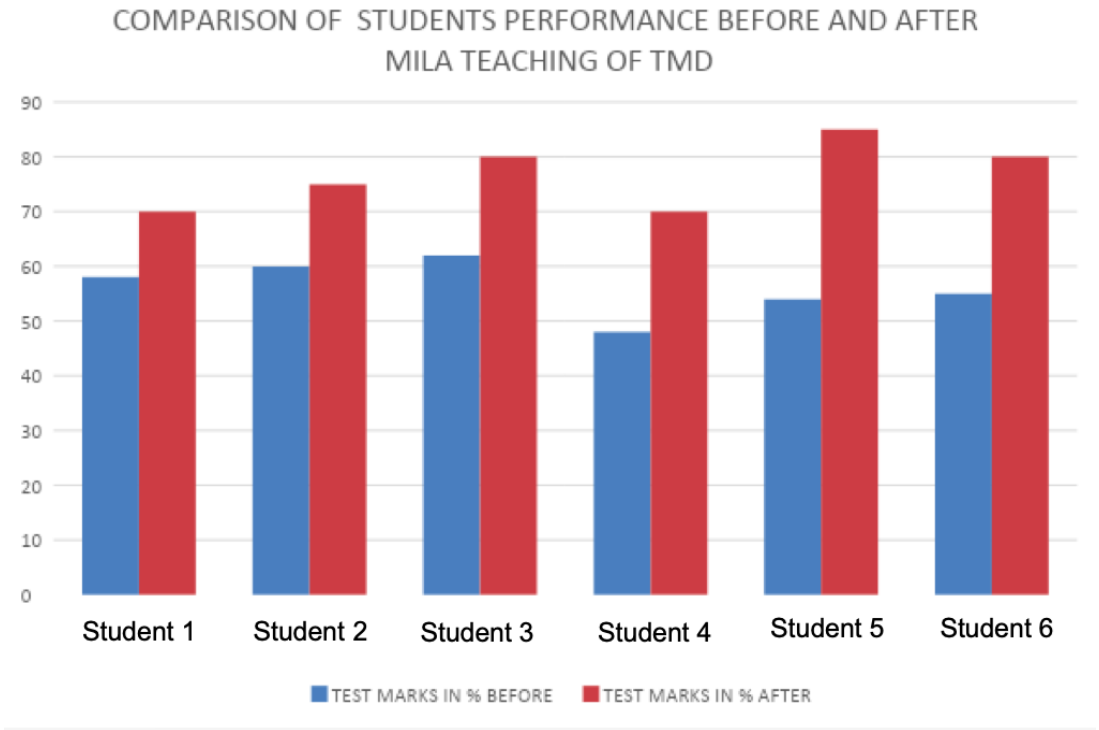


Figure 3: Graphical Representation of the Students Performance Before and After Using the Mila Teaching Method

Oral Manifestation of Systemic Diseases

Oral manifestation of systemic diseases is a vast topic in the subject of Oral Medicine and Radiology. The topic basically deals with the various oral manifestations of systemic diseases such as diabetes, vitamin deficiencies, haematological diseases etc. Students often find this topic to be difficult to understand. To be specific they find it difficult to remember the various oral manifestations found in each disease. Hence an activity called 'CONNEXIONS' was tried for the students to make them remember the various oral features of the systemic disease easily. In the activity the students are first taught about each disease by showing pictures of various oral manifestations. 4 pictures having the oral features of the systemic disease were shown to the student and student will guess the underlying systemic disease. This activity connects the various pictures together and the student was able to identify the disease and also easily remember the features of the disease.

'A picture tells a thousand words' is a famous quote which forms the core of this method of teaching. Even when a particular feature of a disease is well described by the teacher in the class, the understanding of that feature is only effective when the student actually sees the picture. A large percentage of the human brain is exclusively meant for visual processing. Images instantly capture our attention more than words [13].

This activity 'connexions' also is partially inspired from a simple game available for android & iOS devices called '4 pics 1 word'. In this game 4 pictures are shown with letters jumbled below the person has to guess the word using the pictures & the words [14]. Connexions also uses a few pictures which stimulates the reasoning and deduction skills of the student. This makes the students think about the pictures. The mind of the student then tries to connect the pictures and find something common about them. The students understood the disease features by seeing the pictures and finally when they were shown a few pictures common to that disease they were able to easily identify the disease.

Radiation Physics

Radiation Physics is a complicated topic. Students have difficulty in understanding the principles of Physics about Ionising radiation, their types, components of X-ray tube, X-ray beam production, interaction of X-rays with matter etc. By understanding the physics of radiation, one becomes familiar with the terminology and concepts used in the radiological sciences [15]. An article recommend that new teaching and information processes are needed to provide more beneficial learning environments about radiation and radioactivity [16] and by doing this, students' awareness towards radiation should be improved and information about radiation should be transferred at the right stage of education accurately [17]. Students show progress in their conceptual understanding about ionizing radiation and radioactivity after using some instructional strategies such as hands-on laboratory-based activities, interactive lectures, and worksheets prepared with directed-inquiry approach.

The plan included students advised to watch the short flipped class videos [18] the previous day before coming to the class. Video contains illustrative images and simultaneous explanatory voice over on types of radiation, parts of x ray tube, factors that can be used to alter X-ray beam, dosimetry and its various techniques, animation on step wise working of x-ray tube starting from heating up of tungsten filament to useful production of X-ray photons, bremsstrahlung and characteristic radiation, interaction of x-rays with matter.

The session started with an initial short explanation about the basic concepts such as introduction to X-radiation, types of radiation and parts of an X-ray tube, again refreshing those concepts with flipped videos followed by an activity to make an X-ray model with coloured clays and labelling them.

The next session had a short lecture on X-ray production and interaction of X-rays with matter and listening to flipped videos on that. After understanding the concepts thoroughly, activity on electron movements in orbital shells in X-ray photon production, its interaction is depicted by drawing the orbits and demonstrating the electron movements from one shell to another by moving the coloured small paper balls thereby knocking the electrons out aiding in X-ray formation and interaction.

The final session was on factors controlling X-ray beam and dosimetry. The students were made aware of the factors controlling X-ray beam and various radiological terminologies like Exposure, Radiation absorbed dose, Equivalent dose, Effective Dose by dividing them into 4 groups. Each group picks a topic. This activity is 'jigsaw'. From each group after learning about the topic, the person goes to the other groups to teach about their topic. In the end everyone learns about the concept by sharing what each learnt about their topic.

Hence, we believe teaching students by MILA method is very effective and beneficial as it makes learning and understanding a complicated topic such as radiation physics easy and enjoyable.

Intraoral Periapical Radiography and Radiographic Diagnosis

MILA in teaching has helped students to understand the angulations required for taking an intraoral radiograph and the radiographic appearances of the lesions or any pathology in Oral Medicine and Radiology which are considered to be very complicated and confusing. Unless the students know how to make a radiographic exposure of the teeth, they cannot understand the radiographic aspects of the oral diseases.

There are many students who have difficulty in understanding the radiographic angulations required for taking an intraoral radiograph. This is because different teeth require different angulations. Radiographic appearances of the pathology helps to differentiate radiographically the lesions present and also aids in coming to a definitive conclusion. This will ensure the correct treatment planning and provide great relief to the patient.

Interactive methods of pedagogy were utilised in the class. The plan included 20 mins of explanation and 20 mins of interactive session for a total of 6 sessions. We have used images and demonstrations to explain the students about the topic. We also used a modelling method by choosing 2 students randomly where one student acts as a dentist and other as a patient. In this way the students were able to understand the angulation required for a radiograph in all perspectives. After teaching for 20 mins the interactive session was taken where students were given activity and were provided with photos and materials to understand the various radiographic appearances [figure 4]. This was done to find out how much a student has grabbed the topic. For example, the Odontogenic myxoma has tennis racket like appearance radiographically or the calcifying epithelial odontogenic tumor shows snow driven appearance hence the images of a tennis racket and snow driven pattern using flour powder were done by the students [figure 5].

The visual method helps the students to retain the information because they could easily correlate them. This method resulted in an increase in the understanding of concepts. This will eventually help the students to become better radiographic diagnosticians and also helps in formulating the correct and an appropriate treatment plan.

Figure 4: Students Provided with Photos and Materials to Perform the Activity for Understanding Various Radiographic Appearances

Figure 5: Student Performing Activity Using Flour Powder to Mimic Snow Driven Appearance Seen in Clarifying Epithelial Odontogenic Tumor

Magnetic Resonance Imaging (MRI)

Teaching about Magnetic Resonance Imaging (MRI) is a very challenging task. The difficulties faced by the students are the principles of MRI and the modes used during the scan process. Interestingly in MRI the different modes have a direct bearing on the appearance of the tissues in the images. After reviewing the literature [19][20] and understanding the difficulties of the current trend of students, we decided to use an activity based learning to

help the students to understand the principles of MRI which provides a foundation for an effective use of MRI in Dental practice.

The plan was to use clay modelling in the demonstration of the principles of MRI followed by an active participation of the students to engage in the activity. The following materials were used in the activity,

- A bar magnet was made with clay with separate colours for the poles.
- To represent hydrogen atoms small paper balls were made.
- The paper balls had a different colour in one of the ends to indicate the polarity.
- A total of 6 paper balls were made.
- A white paper showing a graph of the x,y and z axis.

First the course facilitator placed the paper balls representing the hydrogen atoms of the body in random orientation, but in a manner where the net charge was 0. Then a bar magnet was modelled in clay with different colours for either poles and placed near the paper balls. On placing the bar magnet the paper balls were aligned such that the majority of the balls were aligned with the magnetic field in the spin up state and a smaller section of the balls were aligned antiparallel or in the spin down state. Subsequently one of the students was given a graph paper and asked to draw a net graph. Before placing the bar magnet the net graph was zero as all the atoms were aligned to cancel each other. On placing the bar magnet there was a development of a net vector moment.

In the second stage, an RF Pulse in the form of a pencil was placed perpendicular to the magnet and resulted in the paper balls representing hydrogen atoms to align themselves with the RF field in a perfect sense. The student keeping a track of the vector pointed out that the vector was much stronger in a direction with the RF field. This was explained as the cause of the T1 signal.

In the final stage of the activity, the RF pulse was taken away and the atoms represented by the paper balls fall back to their state in alignment as dictated by the magnetic field. The relaxation of the atoms was in two stages: viz: first stage were the atoms aligned to the magnetic field and in the second stages the atoms aligned either parallel or anti parallel to the field. This was explained as a T2 signal.

The same activity was repeated twice by the facilitator followed by the students playing it as a guessing game among themselves.

The students were given 5 questions in the form of a pre test (checking their understanding of the keywords) and post-test. We had also taken a verbal feedback from the students which showed that the students enjoyed the activity and felt it was easy. Further as the activity was more interactive it gave them an opportunity to repeat the activities and improve their understanding.

Radiodiagnosis

Students have difficulty in understanding the various pathological radiographic patterns in the extraoral radiographs and applying the same to interpret and to arrive at the diagnosis was challenging. This has been widely reported in various publications [21][22].

A method called DIY (Do It Yourself) - X rays was used. Following the first 20 minutes of pedagogy, students were given a set of cards that represents the pathologies and materials that are required to describe the various radiographic patterns were displayed. They were given a time period of 20 minutes in which they discuss the pathology and correlate the radiographic patterns and arrive at a possible radiographic impression. After a brief

discussion, with the use of given materials, they simulated the given radiographic patterns. For example-They demonstrated a honeycomb pattern for ameloblastoma, cherry blossom appearance for Sjogren's syndrome with the given materials. Following the DIY-Xrays, the capability of the students in identifying and interpreting the patterns in the given radiographs was dramatically increased. The students were evaluated at the end of the class by asking them to identify the classical radiographic appearances of the pathologies involving skull and jaws. This activity improved critical thinking, the problem-solving capacity of the participated students. Also, their competitive skills, communication, teamwork were tremendously improved among the students. MILA is a subtle but powerful hands-on way of learning the concepts. MILA has helped to deliver the concepts in a strong way. The order of teaching followed by activity has positively influenced the students to engage in the classrooms. This method of teaching with a small group of students helps to give personal attention to the students. In contrast to conventional teaching, one-one interaction with all the students is made possible. The flipped classes, which is a pre-recorded video on the classes, helps to deliver the concepts in a nutshell. MILA has made teaching so lively and interactive, the application of this teaching method greatly influences the memory and retaining capacity of a student which by itself is the strength of this system. Overall, teaching students by this method is effective for teaching the most challenging chapter Radiodiagnosis among undergraduate students.

CONCLUSION

The proof of the pudding is in eating. How do we prove that this method was effective? We had compared the university exam of students who had the conventional teaching method and the MILA teaching method. It was quite a difference. The highest mark differs by 20 marks. The 2016 batch who had conventional lecture classes scored 139 om 200 whereas the 2017 batch scored 159 on 200 as the highest. The number of students who scored above 60% was 55 in conventional teaching methods while 77 students scored above 60% in students taught by MILA. Thus multiple interactive learning algorithm proved to be an effective teaching methodology.

REFERENCES

[1] Remesh A. Microteaching, an efficient technique for learning effective teaching. J Res Med Sci 2013; 18: 158–163.

[2] Bartsch RA, Cobern KM. Effectiveness of PowerPoint presentations in lectures. Computers & Education 2003; 41: 77–86. https://doi.org/10.1016/s0360-1315(03)00027-7.

[3] Apperson JM, Laws EL, Scepansky JA. The impact of presentation graphics on students' experience in the classroom. Computers & Education 2006; 47: 116–26. https://doi.org/10.1016/j.compedu.2004.09.003.

[4] Long T, Logan J, Waugh M. Students' Perceptions of the Value of Using Videos as a Pre-class Learning Experience in the Flipped Classroom. TechTrends 2016; 60: 245–52. https://doi.org/10.1007/s11528-016-0045-4.

[5] Passingham RE, Rowe JB, Sakai K. Has brain imaging discovered anything new about how the brain works? Neuroimage 2013; 66: 142–150.

[6] Krishnan R, Mahphoth MH, Nur Azreen Farihah, A'yudin NA. The Influence of Emotional Intelligence on Employee Job Performance: A Malaysian Case Study. International Journal of Academic Research in Business and Social Sciences 2018; 8. https://doi.org/10.6007/ijarbss/v8-i5/4097.

[7] Grieve R, Mahar D. Can social intelligence be measured? Psychometric properties of the Tromsø Social Intelligence Scale – English Version. The Irish Journal of Psychology 2013; 34: 1–12. https://doi.org/10.1080/03033910.2012.737758.

[8] Hartati S. THE INFLUENCE OF INTELLIGENCE QUOTIENT AND EMOTIONAL QUOTIENT ON THE TENTH

GRADE STUDENTS' ENGLISH ACHIEVEMENT OF STATE SENIOR HIGH SCHOOL 6 OF PALEMBANG. English Community Journal 2019; 2: 242. https://doi.org/10.32502/ecj.v2i2.1317.

[9] Okeson JP, De Leeuw R. Differential diagnosis of temporomandibular disorders and other orofacial pain disorders. Dent Clin North Am 2011; 55: 105–120.

[10] Zakrzewska JM. Differential diagnosis of facial pain and guidelines for management. Br J Anaesth 2013; 111: 95–104.

[11] Guidelines for Diagnosis and Management of Disorders Involving the Temporomandibular Joint and Related Musculoskeletal Structures. CRANIO® 2003; 21: 68–76. https://doi.org/10.1080/08869634.2003.11746234.

[12] Schiffman E, Ohrbach R, Truelove E, Look J, Anderson G, Goulet J-P, et al. Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) for Clinical and Research Applications: recommendations of the International RDC/TMD Consortium Network* and Orofacial Pain Special Interest Group†. J Oral Facial Pain Headache 2014; 28: 6–27.

[13] Website n.d. 1. James Balm, The power of pictures. How can we use images to promote and communicate science? http://blogs.biomedcentral.com/bmcblog/2014/08/11/the-power-of-pictures-how-we-can-use-images-to-promote-and-communicate-science/ (accessed October 26, 2020).

[14] Website n.d. 2. https://www.commonsensemedia.org/app-reviews/4-pics-1-word (accessed October 26, 2020).

[15] National Research Council, Division on Earth and Life Studies, Board on Radiation Effects Research, Committee to Assess the Scientific Information for the Radiation Exposure Screening and Education Program. Assessment of the Scientific Information for the Radiation Exposure Screening and Education Program. National Academies Press; 2005.

[16] Millar R, Klaassen K, Eijkelhof H. Teaching about radioactivity and ionising radiation: an alternative approach. Physics Education 1990; 25: 338–342. https://doi.org/10.1088/0031-9120/25/6/310.

[17] Eijkelhof HMC. Radiation Risk and Science Education. Radiation Protection Dosimetry 1996; 68: 273–278. https://doi.org/10.1093/oxfordjournals.rpd.a031878.

[18] V DN, S SP, Subha M. Effects of flipped class based teaching in orthodontics & dentofacial orthopedics – A prospective study. International Journal of Research in Pharmaceutical Sciences 2019; 10: 1415–1419. https://doi.org/10.26452/ijrps.v10i2.619.

[19] Swensson J, McMahan L, Rase B, Tahir B. Curricula for Teaching MRI Safety, and MRI and CT Contrast Safety to Residents: How Effective Are Live Lectures and Online Modules? Journal of the American College of Radiology 2015; 12: 1093–1096. https://doi.org/10.1016/j.jacr.2015.04.012.

[20] Mc Arthur SDJ, Davidson EM. Concepts and Approaches in Multi-Agent Systems for Power Applications, (Invited Paper). Proceedings of the 13th International Conference On, Intelligent Systems Application to Power Systems n.d. https://doi.org/10.1109/isap.2005.1599295.

[21] Kansagra AP. Early Resident-to-Resident Physics Education in Diagnostic Radiology. Journal of the American College of Radiology 2014; 11: 59–62. https://doi.org/10.1016/j.jacr.2013.08.002.

[22] Naeger DM, Phelps A, Shah V, Avrin D, Qayyum A. Clinician-Educator Pathway for Radiology Residents. Academic Radiology 2011; 18: 640–4. https://doi.org/10.1016/j.acra.2010.11.020.

MILA in Public Health Dentistry - A Learner Centred Model Approach

Dr. Deepak Nallaswamy Veeraiyan, Professor, Department of Prosthodontics, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, India.
E-mail: dir.acad@saveetha.com

Dr.M. Subha*, Associate Professor, Department of Oral Medicine & Radiology, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, India.
E-mail: doctorsubha@gmail.com

Dr.I. Meignana Arumugham, Professor and Head of the Department, Department of Public Health Dentistry, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, India. E-mail: drmei.sdc@saveetha.com

Dr.R. Pradeep Kumar, Professor, Department of Public Health Dentistry, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, India.
E-mail: pradeepkumarr.sdc@saveetha.com

Dr.D. Sri Sakthi, Reader, Department of Public Health Dentistry, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, India. E-mail: srisakthi@saveetha.com

Dr. Samuel Srinivasan Raj, Reader, Department of Public Health Dentistry, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, India.
E-mail: samuelrajs.sdc@saveetha.com

Dr. Jayashri Prabakar, Senior Lecturer, Department of Public Health Dentistry, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, India.
E-mail: jayashri.sdc@saveetha.com

Dr.L. Leelavathi, Senior Lecturer, Department of Public Health Dentistry, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, India.
E-mail: leelavathi.sdc@saveetha.com

Dr. Arthi Balalsubramaniam, Senior Lecturer, Department of Public Health Dentistry, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, India.
E-mail: arthib.sdc@saveetha.com

Abstract--- Our significant shortcoming in the education system for many decades has been to ignore the Brain based active learning that utilizes all senses maximizing the learning experience as well as nurture the greater depth of reasoning. A student sitting at a square table, with a square piece of paper, in a square room with departmentalized topics and a regurgitating curriculum utilizes approximately 3% of the brain's capacity. This classic industrial age approach of teaching was found to be more prevalent among many Dental Universities in India. Dental educators should therefore attempt to utilize creative and innovative methods of teaching to accommodate students with differing learning styles to provide an opportunity to maximize their learning skills. One such learning method was adopted in Saveetha dental college is MILA (Multiple Interactive Learning Algorithm) which promotes active learning

among students and also ensures that they truly retain the knowledge and information they receive. Activities such as POGIL (Process Oriented Guided Inquiry Learning), Classroom Cartoon Character (game based learning), peer-led team based learning, role play, critical pedagogy and Jigsaw classroom method which enabled the students to find and apply information relevant to clinical cases and foster higher-order reasoning skills. Therefore, This paper aims to discuss the lecturer's experience and student's perception towards MILA in Public Health Dentistry topics. This model was employed on Saveetha Dental college third year dental students during their Pit & Fissure sealants, Atraumatic Restorative treatment, Tobacco cessation counselling, Fluorides in dentistry, Health Planning cycle, Evaluation, Levels of Prevention and Primary Health care lectures.

Keywords--- Flipped Class, Public Health Dentistry, MILA, Teaching, Learning.

INTRODUCTION

Chinese philosopher and reformer Confucius (551 BC to 479 BC), who stated *"I hear and I forget. I see and I remember. I do and I understand* (1). A true learning continues until it is put into action. Learning is a natural human process and several models have been put forward to explain this process, or the ways that a student can acquire his or her knowledge and skills.

The impact of teaching plays a very important role in the learning outcomes which in turn plays a significant role in generating effective professionals. Teaching is a multiplex activity which involves not only giving instructions but also stimulation of learning. The effectiveness of teaching depends on how much has been understood by the students (2).

Times are changing and the students are totally different from decades ago. However, the education system followed in the majority of dental colleges in India remains the same and most of the teaching methods are still limited to giving lectures to large groups.

According to The State of Tennessee's Student/Teacher Achievement Ratio (STAR) Project (3) reducing the size of the class will bring about more benefits for the students and the teachers (3). The advantage of small group learning, where the teacher spends less time for managing the students, more time can be utilized in teaching (4).

Hence, a unique and exclusive teaching protocol was followed in Saveetha Dental college, India, which involves small group learning, short lectures and a particular algorithm approach. This is a learner-centered model where there is an integration of class room and applied work based experience. In this model, the onus is on the student to direct their own learning. On the other hand, lecturers need to be innovative and understand that there are numerous ways in which a student learns the subject. Studies have reported that promoting innovative and interactive sessions is equally important than just teaching to a mere small group of students (2).

With the above mentioned Chinese quote, that a student will remember and hopefully understand more by reading, hearing, seeing, saying and teaching someone else- therefore teaching methods should be inclusive of all of these activities in class. Dental Educators should adopt to mix and match their teaching methods to assist dental students with differing learning styles.

MILA (Multiple Interactive Learning Algorithm) model was followed by lecturers in Saveetha Dental College to maximise student learning. This method stimulate interest, provide core knowledge about a particular topic and encourages higher order of thinking among students. MILA provides a optimal learning environment and aims towards holistic development of the students in all dental subjects.

This paper aims to share the lecturers experience and student's perception towards MILA in Public Health Dentistry topics. This model was employed on Saveetha Dental college third year dental students during their Pit & Fissure sealants, Atraumatic Restorative treatment, Tobacco cessation counselling, Fluorides in dentistry, Health Planning cycle, Evaluation, Levels of Prevention and Primary Health care lectures.

A. Pit and Fissure Sealant

Pit and fissure sealant is a very important concept in Preventive dentistry. Students have difficulty in remembering and understanding the various steps in application of a sealant.

The role of fissure sealants in caries prevention is well established in the literature (5). A recent update of a Cochrane review evaluated the caries preventive effect of sealants in children and adolescents, compared with a no sealant control group. The application of sealant reduced the caries increment (6).

Pit and fissure sealant is an effective means of preventing pit and fissure caries in primary and permanent teeth. Dentists should therefore be encouraged to apply pit and fissure sealants in combination with other preventive measures in patients at a high risk of caries. Sealant placement is a sensitive procedure that should be performed in a moisture-controlled environment. Maintenance is essential and the reapplication of sealants, when required, is important to maximize the effectiveness of the treatment (7).

We utilized the following method of pedagogy in a class.

The Learning objective included a 20 minutes of active teaching of various concepts in Pit and fissure sealants. Introduction, History, Morphology, Type, Indications & contraindications using Slides and videos.

I. POGIL - The POGIL Project is not about egos and CVs, but about putting the students first and providing teachers with tools to optimize learning."— Shawn Simonson, Boise State University

POGIL Project was carried out for a duration of 20 Minutes where the student is shown various materials used for pit and sealant procedure and further encouraged to search various commercially available pit and fissure sealants available in the market. Later, the student is asked to categories various types of sealants accordingly.

Later 20 minutes of discussion about steps in application of sealant is explained to the student. The same is explained to the student in the form of a cartoon character Named "Polly" (refer Figure 1a to 1h).

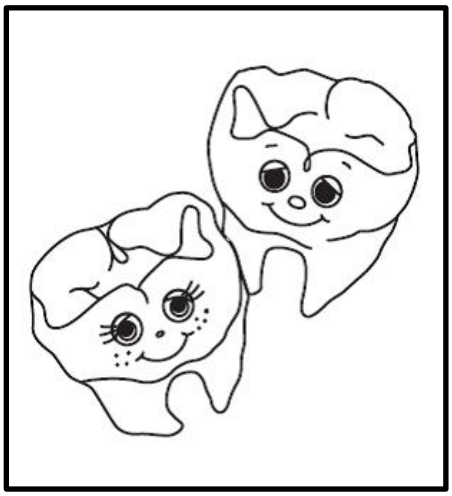


Figure 1a: Select the Teeth Indicated for Sealant

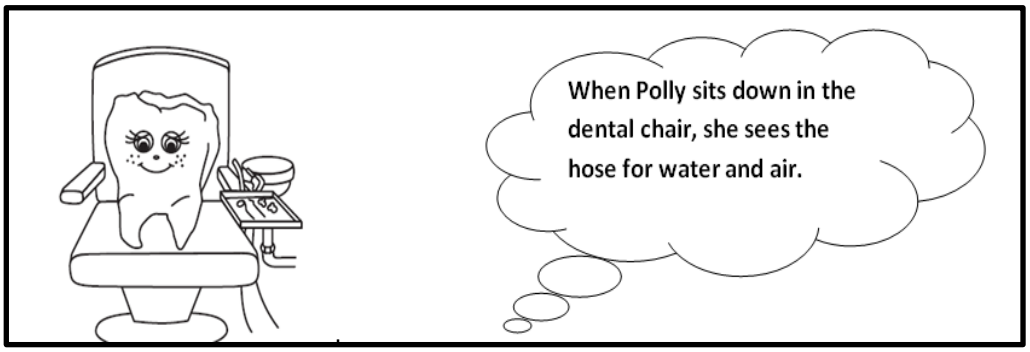


Figure 1b: Isolation of Teeth

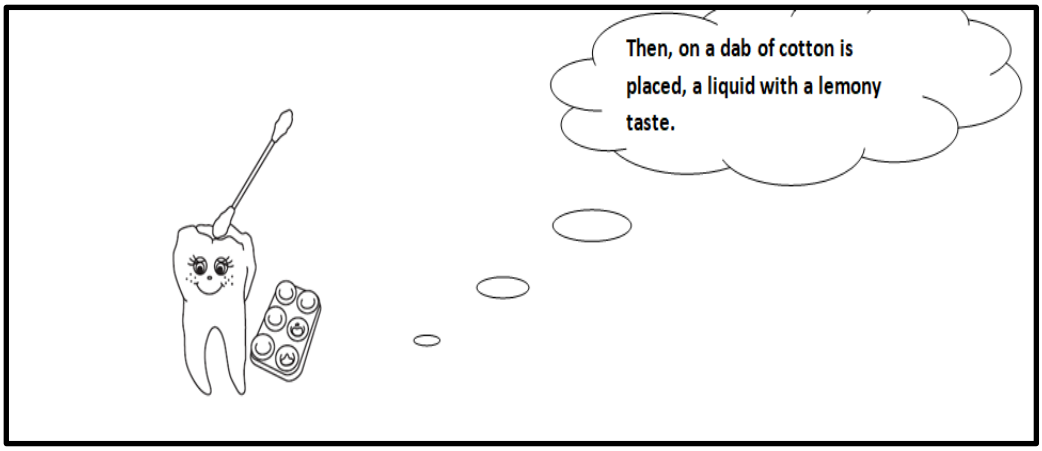


Figure 1c: Clean the Tooth Surface

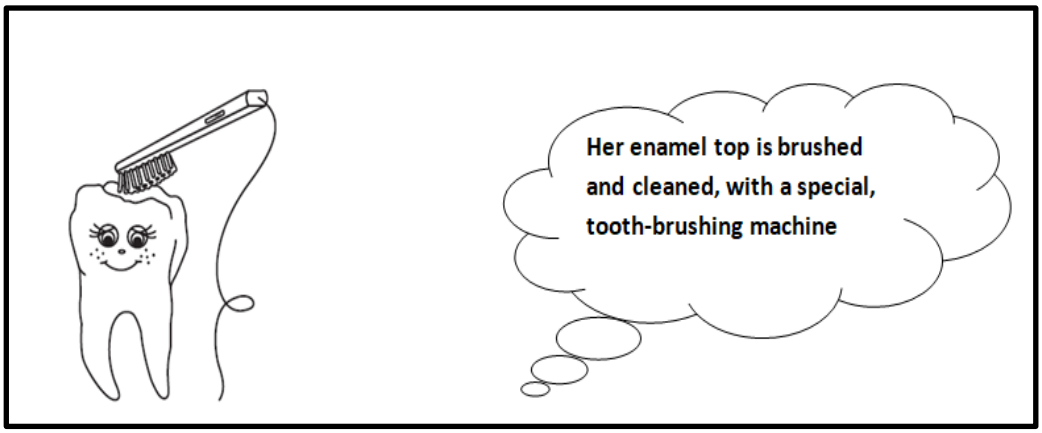


Figure 1d: Etch the Tooth Surface

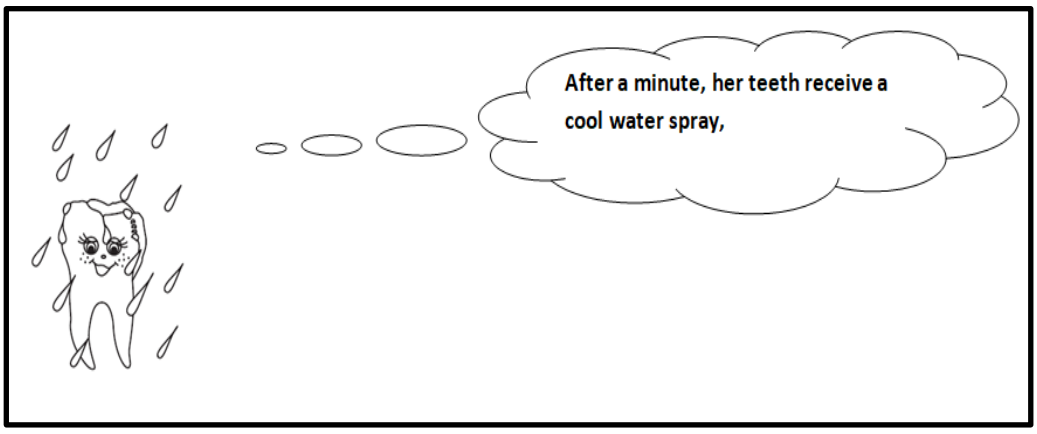


Figure 1e: Rinse the Tooth Surface for 30 Seconds

Figure 1f: Dry the Tooth Surface for 10 Seconds

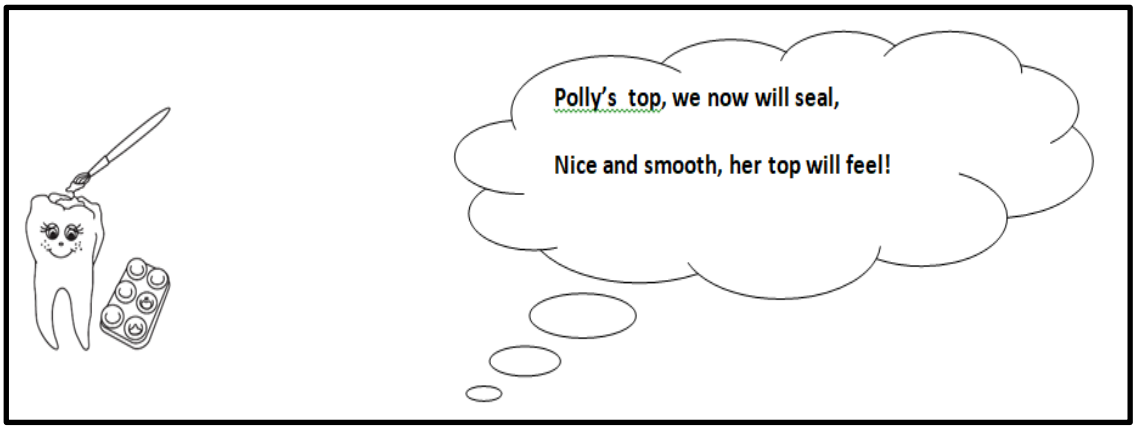


Figure 1g: Apply the sealant material

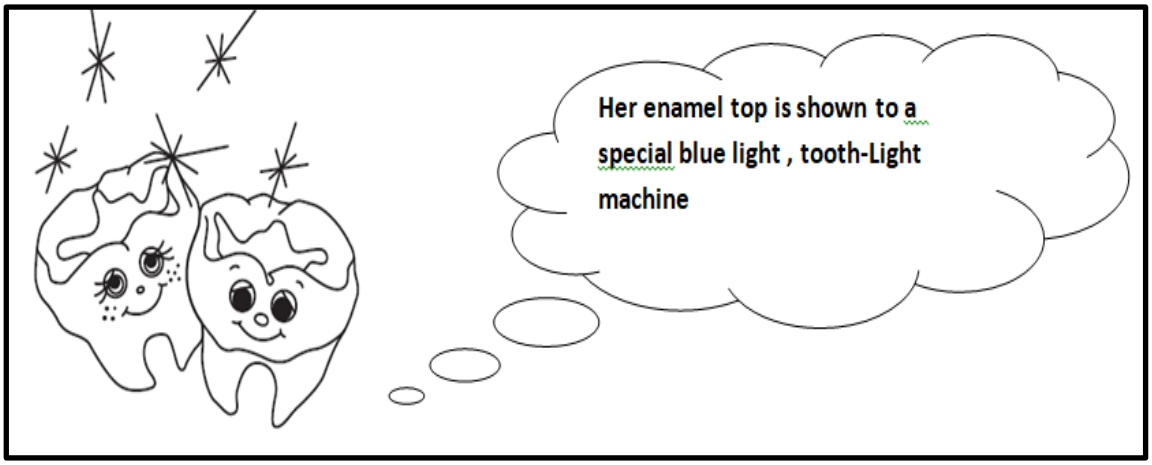


Figure 1h: Light Cure it for 20 Seconds

II. Hands on Work on a Model (Refer Figure 2)

The student is divided into pairs and asked to work on model teeth. They are allowed to place the sealant on the model; this helps them to understand the viscosity of the material so that the class is able to differentiate the property of the sealant with regular composite light cure resin.

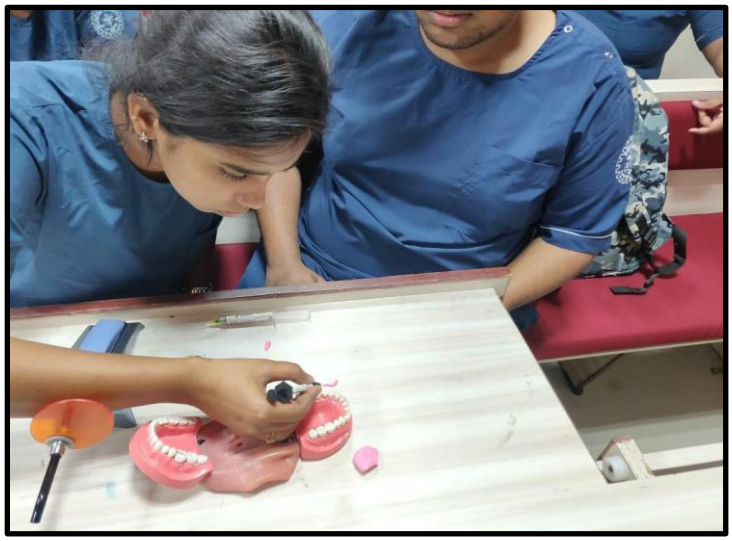


Figure 2: Class Activity for Applying Pit and Fissure Sealants

III. Classroom Cartoon Character (Illustration Method)

Art is one of the most important building blocks of a child's development. Working and learning in a creative manner has been shown to benefit a learners motor skills and decision making. According to Hayden R. Smith and Dean A (8), young people who participate regularly in the arts (three hours a day on three days each week through one full year) are four times more likely to be recognized for academic achievement than children who do not participate.

Essentially, art encourages students to think outside of the box, to consider different perspectives, and to invent ideas instead of simply following directions, which leads to happier and more confident professionals in and out of the classroom.

Have students choose one of the cartoon characters from the text. Using this cartoon character as the protagonist (main character – new vocabulary word!), the students create a short story. For a prompt, students are encouraged to follow a story arc. The story may have 6-8 scenes. Because comic strips consist mostly of monologue and/or dialogue, have students find individual voices for each character. To begin, the students make a list of characteristics for each character using both the picture and their imagination. Now that students have a story and dialogue, it's time to illustrate the comic strip! Each scene needs a picture, so students will draw 6-8 cartoons (on 3×5 pieces of paper).

Discussion Questions

What was the crucial portion of the technique and why?

Cartoons are powerful teaching tools and can tell a complex concept in a few images. It Provides comment and provokes thought on events and issues. Use of a cartoon introduces the idea of humour in a classroom. The pictures were cut and the students were instructed to re-order the story (Figure 1a-1h).

The student is divided into pairs and asked to work on model teeth (Figure 9). They are allowed to place the sealant on the model; this helps them to understand the viscosity of the material so that the class is able to differentiate the property of the sealant with regular composite light cure resin.

The Student is now allowed to make a cartoon drawing to explain the same procedure to the School children if they were posted in School oral health awareness camps. This creates the students to understand the concept of sealant and also converts the same into a simpler concept to explain to the level of school children.

There has been a dramatic increase in the interest of the students. Students' minds get registered with the character named “Polly” and they are able to recollect the various steps easily in exams.

Overall, we believe teaching students by this method is effective for teaching the topic Sealants.

A) Atraumatic Restorative Treatment

ART is a process-oriented topic and is a complicated concept to apply in real time scenarios. The phase of translational learning where the student applies his text-book knowledge to actual practice engenders the inadequacies of traditional teaching philosophies. Students have difficulty in anticipating the technical and physical barriers one must face when applying ART in real time. ART was introduced as a basic package of oral care by the World Health Organization, ultimately to fulfil the health for all goal, encompassing oral health.

ART was designed to treat the most common chronic disease affecting humans ‘Dental Caries’, and was pilot tested in several countries like Tanzania, Zimbabwe, Thailand, Pakistan and Nepal. It basically had two principles; use of hand instruments to cut the teeth and restoring the cavity in the tooth using a material that sticks to teeth (9).

Current day technology enables students to learn all aspects of modern dentistry which allows the use of state of the art armamentarium to restore teeth back to life, but ART is indicated for regions which lacks access to such sophistication and relies on basic support facilities where in the manual skill of the operator is quintessential. The students hardly understand how difficult it is to cut a natural tooth with hand instruments, the hardest substance in our body, and they often fail to understand that dexterity is the key toward manual preparation of enamel using hand instruments.

Hence, I wanted the students to understand the practical difficulties that they can anticipate while performing ART on a natural tooth. Towards this aim Multiple Interacting Learning Algorithm (MILA) was used to teach this topic for final year BDS residents. The students were led into an active and entertaining phase of learning ART. The process (refer Figure 3) began with the most basic information about the background of ART and were encouraged to further explore the details as to why ART was introduced and its primary purpose through SCALEUP and POGIL. Students were divided into batches of two (based on the total strength of the class) and were asked to elaborate their findings after the activity.

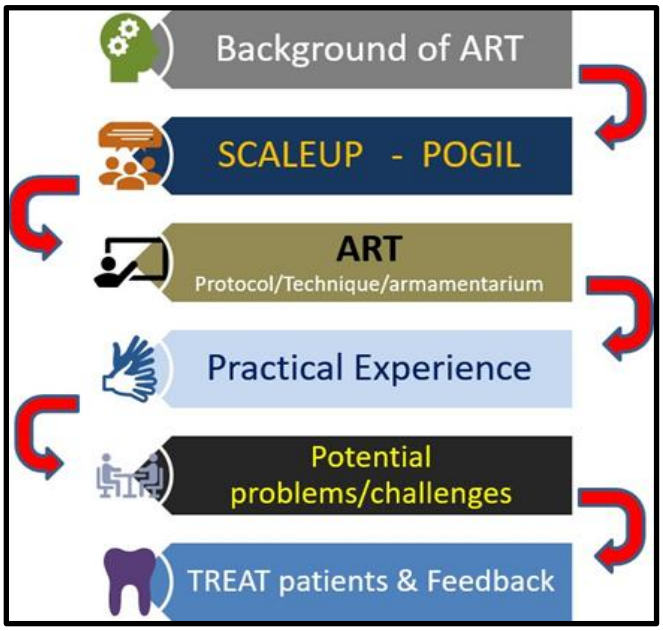


Figure 3: Process of MILA Augmented ART Teaching Protocol

The primary purpose of **MILA** is to augment the role of the teacher as a facilitator of knowledge and beat the banal and pedantic system of lectures which frustrate active learning. The next phase included the process of ART restoration where a power-point presentation was shown regarding the various instruments used, technique of enamel cutting, and material/process used for restoring the prepared cavity.

Further, to help them experience the actual process, each student was provided with a natural tooth and the necessary armamentarium to perform the ART (refer Figure 4). They were guided in a step by step process in preparing the cavity and understanding the 'Finger press' technique of restoration. The challenge in understanding ART is that it requires the student to unlearn their traditional dental practices and must orient themselves in a setting dependent upon appropriate technology and intersectoral coordination (10).

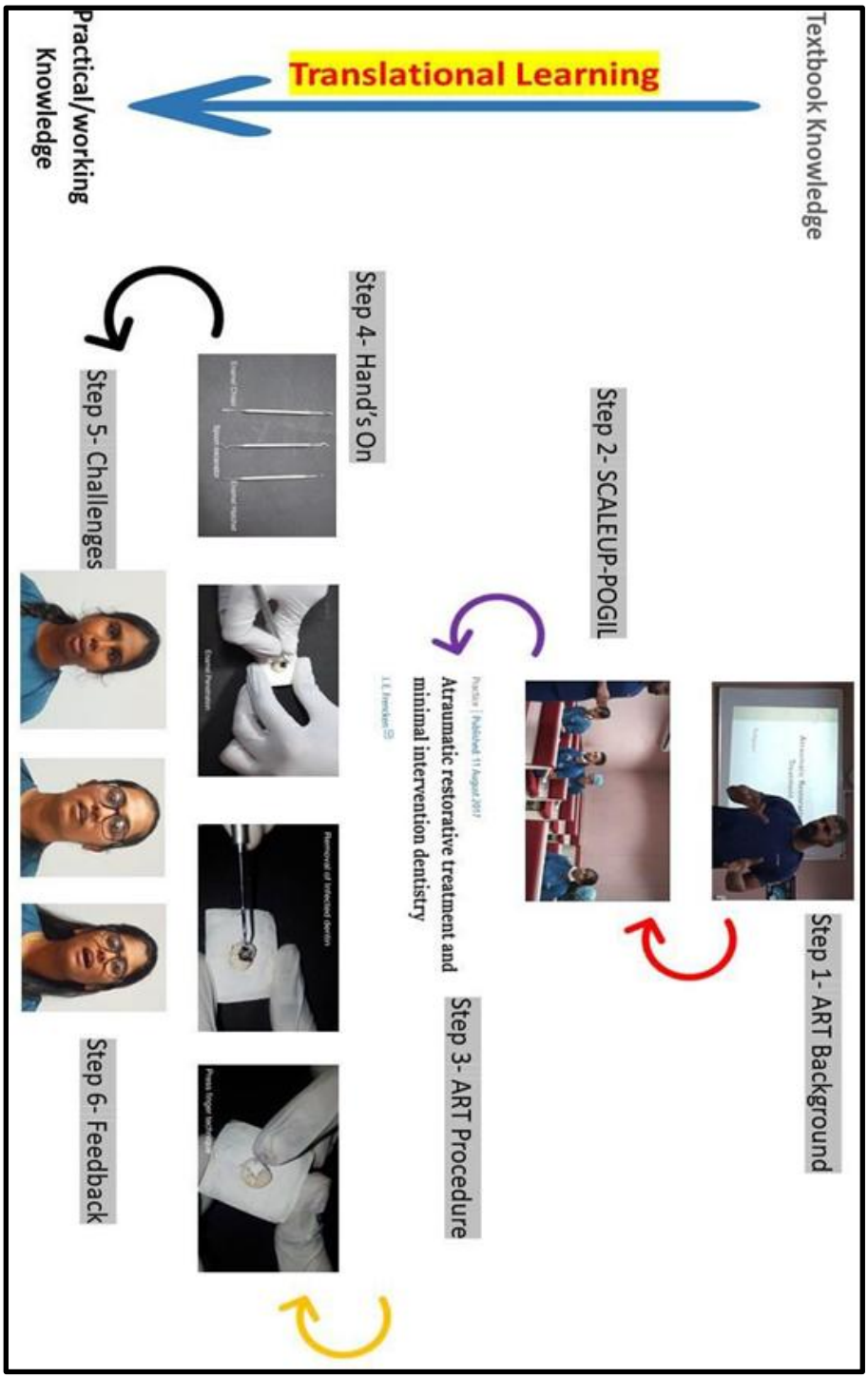


Figure 4: Learning Process

The students realized the importance of effective instrument grasp techniques which significantly affects the outcome of the restorative procedure. Moreover, it was a revelation for the students that how difficult it is to cut a natural tooth only using hand instruments. They didn't quite understand the terminology 'press finger technique'(11) but when they performed the process, they finally could comprehend what it meant!

This process of learning helped the students to actively experiment the knowledge acquired and inculcated a habit of asking doubts during the procedure which is often not the case in traditional teaching resulting in disastrous consequences during actual patient care. ***Traditional teaching propagates textbook knowledge, which is like teaching the students how to fly an aeroplane using a book and next time make them fly one in real time inside a cockpit***. The feedback from the class was very positive and students did try and implement the procedure learnt in class in real patients and exclaimed in awe the beauty of God's creation, the anatomy and texture of Human Teeth. I firmly believe this learning exercise helped our students to appreciate the skills acquired and realize the importance of basic knowledge gained through their course. Most of all I feel satisfied that we could teach Holistic Dentistry!

Evaluation Prior to Class

1. Do you know the importance of proper hand/instrument grasp techniques?
2. Name of the common instrument grasp you practice everyday?
3. Ever prepared a cavity in natural teeth using hand instruments?
4. Are you confident that you can prepare a cavity in natural teeth using hand instruments alone?

Response

1. 78% reported they knew the importance and 19% were ambivalent and 3% did not provide any response.
2. Almost all of the reported modified pen grasp, but when asked to demonstrate they were not confident if they knew it right.
3. Unanimously No.
4. 85% were confident and 15% were not.

Following ART Learning through MILA

1. 100% realized the importance of instrument grasp in dentistry, in particular, operative dentistry
2. All of them learnt Modified pen grasp and understood it completely
3. Yes, all of them prepared on the natural teeth
4. Before the technique demonstration, they were asked to try and prepare a cavity in natural teeth, almost all of them failed in disbelief, But after the demonstration through power point and proper instrumentation sequence, they were successful. Most of all they reported they could feel the consistency of dentin which they had never felt before when using high speed rotary instrumentation.

B) Tobacco Cessation Counselling

Teaching **"Tobacco Cessation Counselling"**, is a very essential part of Undergraduate Curriculum, at the same time it is a complex process; because the cessation process involves guiding and motivating one individual by talking to them at an intellectual and empathetic level. Even after **elaborate lecture** sessions on the concept of cessation, the students were not able to **tailor** it to an individual patient's needs and **translate it** into practice. A Survey was taken among the IV year BDS students of Saveetha Dental college and Hospitals regarding the barriers they had, which were as follows (refer figure 5).

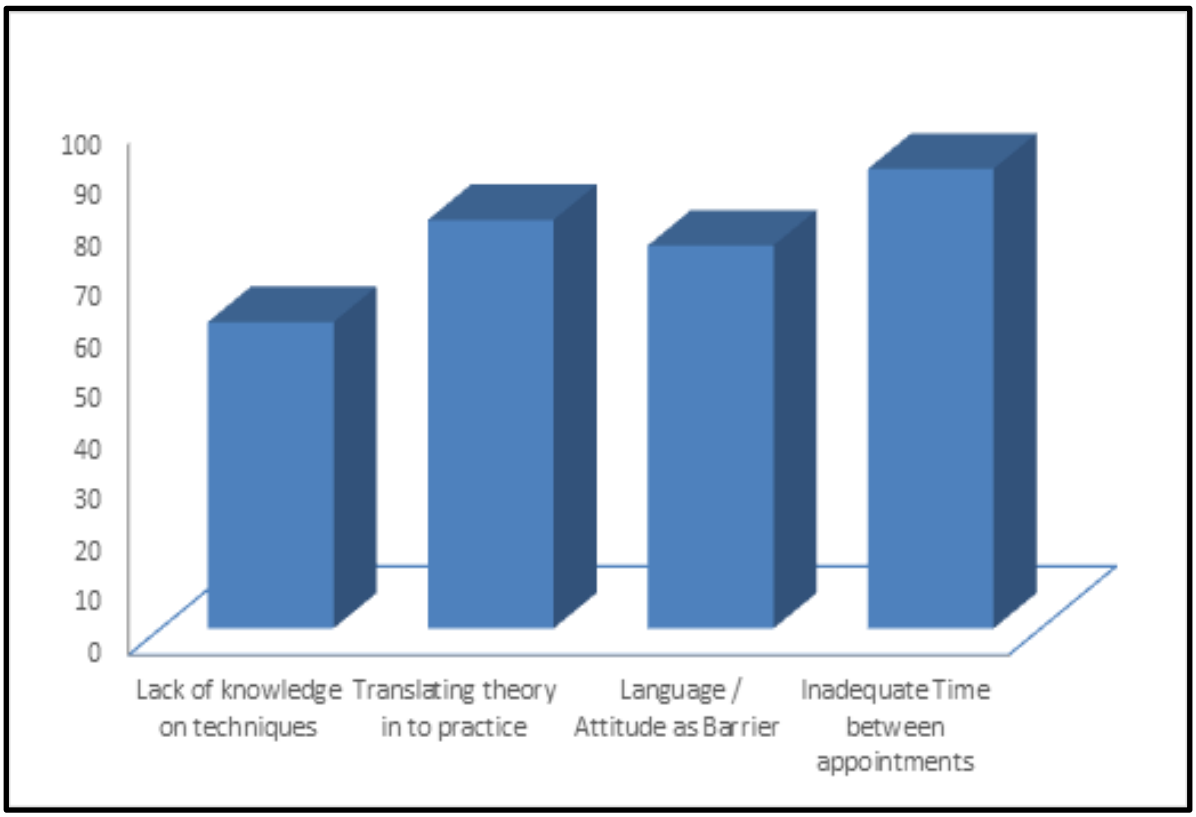


Figure 5: Barriers in Understanding and Delivering Tobacco Cessation Counselling

A survey on Dental students by ***YIP JK et al*** *(12)* emphasised that barriers like, inadequacy in time and knowledge and attitude towards their role in counselling only improved with formal practical training. Yet another study on Indian dental students by ***Vikneshan et al*** *(13)* supported the fact that practice based training and reinforcement through periodic teaching can only remove the barriers like resistance, inadequate skills, knowledge gap and etc. Apart from sharpening the knowledge, attitude and receptivity of the student was one important factor to be addressed during teaching sessions, evidence the studies by ***Bhagyashree. P et al*** *(14)* ***and Omoloara. G et al*** *(15)* indicated that, ***Patient follow up for other procedures, Dentist patient relationship, age difference*** were some of the mind block the students had towards performing sessions and indirectly these reflected on their **perceived interest** towards the current topic. With the strong literature evidence, we decided to address the barriers like lack of knowledge in techniques and translating theoretical concepts into practice. For this a **Role play** and a **demonstration** session was planned.

Communication skills are essential for clinical practice throughout the life of a doctor, and it has found to have a significant impact on patient care and finally correlates with the improved health care outcome in future (16). These skills have been improved by activities like role playing and demonstrations (17). According to ***Manzoor et al*** *(18),* by engaging students in role plays, the component of both cognitive as well as affective domain of medical education can be delivered. A clinical trial to compare two methods to teach smoking cessation to medical students was done by ***Papadakis MA et al (1997)***[19], demonstrating that role play method of teaching was effective when compared to conventional teaching using a standardised patient model. As we don't restrict ourselves with the conclusions of previous researches, we enquired the students prior to the lecture to pick an activity which they would prefer for learning “Tobacco Cessation Counselling and techniques”. And the results are depicted in the graph below (Figure 6).

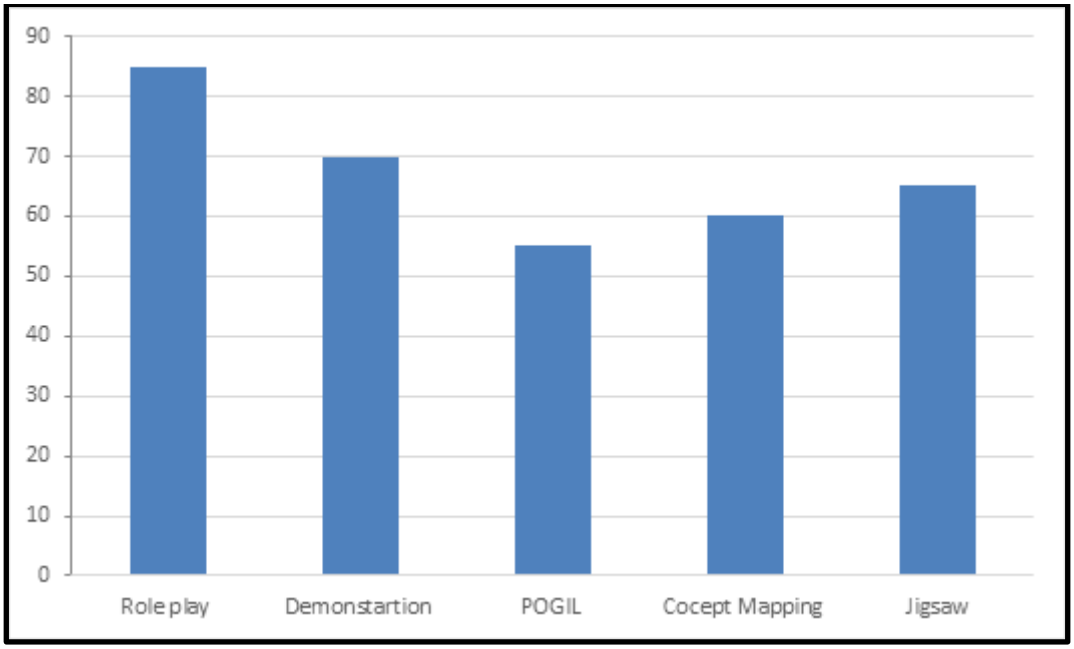


Figure 6: Preference Regarding Type of Activity in Class for Tobacco Cessation Counselling

Similar to the results of our survey on student preference, studies by Nikendei. C et al (20) and Bosse HM et al (21) concluded that, "the role play helped them to learn the correct attitudes required of a doctor to treat his/her patients".

Following a forty Minute lecture session (Split into two) using a Power point, students were given a hypothetical situation of a patient visiting a dental OP and was asked to enact three counselling visits. Following the role play and Demonstration of individual techniques (refer figure 7) like "Wait Out", "Trigger Coping", "Cue Exposure", "Aversive Conditioning" and "Tapering", "NRT – Gum usage", "Progressive Relaxation Techniques" (refer figure 8) along with regular tobacco history recording and CO level monitoring were done by the students with the guidance of the faculty.

Figure 7: IV Year BDS Students Performing a Role Play Simulating a Tobacco Cessation Counselling in a Dental Office

Figure 8: IV Year BDS Students Demonstrating Progressive Relaxation Technique as a Part of Tobacco Cessation Counselling Exercise

Armamentarium Used in the Lecture

- Preformed patient education placards
- Patient education video made by the Department
- E – Cigarette
- Carbon Monoxide Monitor
- Standard TCC Questionnaire
- Fagerstrom Nicotine Dependence scale
- Readiness to quit scale
- NRT Gum – for demonstration purpose

Students Feedback was obtained at the end of the teaching sessions. The results were similar to that observed by ***Singleton JA et al*** *(22).* The collective response from the students were as follows:

- They understood their barriers well
- Subjective norms were improved
- Perceived skills improved
- Efficacy and intentions to provide Tobacco cessation services were better than before
- Role confusion towards providing this service was completely nil

True to the proverb by ***Confucious – "If I hear I forget, If I see I Remember, If I do I Understand".*** The response to this way of teaching was positive and it definitely improved the knowledge on practical applications and attitude towards their role in tobacco cessation counselling in future.

C) Fluorides in Dentistry

Memorizing the year is considered to be the toughest part with respect to **History of Fluorides** in Dentistry. Students always face difficulty in remembering the dates and the year. When learning history it is very important to remember the year in which the important event has happened. Therefore, a new memory technique known as **"IMAGE-EVENT ASSOCIATION"** has been adapted.

This technique involves three simple steps. **Step1**-Creating a DATERONI number table. **Step2**- Converting the historical year into a word using the table. **Step3**- Link the word and the historical event.

Example: **1931**- **Shoe Leather survey- Trendley H Dean**

Step 1- DATERONI number table – Don't include the Vowels (a,e,i,o,u)

0	B	N	Z
1	C	P	
2	D	Q	
3	F	R	
4	G	S	
5	H	T	
6	J	V	
7	K	W	
8	L	X	
9	M	Y	

Step 2- Converting the year in to a word

Remember the last two digits of the year. → 3**1**

The words which corresponds to the digit 3 are F, R

The words which corresponds to the digit 1 are C, P

We can choose either F, R for digit 3 and the same holds good for the digit 1

The final combination of words will be R and P.

Step 2- Correlating the word with the event.

Add vowels to the word. Final word will be **ROPE.** Imagine **rope** similar to a Lace for the Shoe. This letter can be correlated with **SHOE LEATHER SURVEY.** Students were divided into two groups. In groups, clear roles were assigned to the students which in turn encourages each and every student to work effectively in the group. Sticky notes and Charts were given to both the groups to draw the table and create an imaginary word to the event associated.

The second technique will be LOCI (Places) method. The **method of loci** is a strategy of memory enhancement which uses visualizations of familiar spatial environments in order to enhance the recall of information. The **method of loci** is also known as the memory journey, memory palace, or mind palace **technique**. This technique has been followed to remember the **Classification of Delivery of Fluorides in Dentistry**.

In this activity, students were encouraged to Create a mental picture of each information to be remembered.

For example: Kitchen for Systemic Fluoride- Here we prepare the food and Eat which helps to remember the term systemic which is ingested in to the body (refer figure 9).

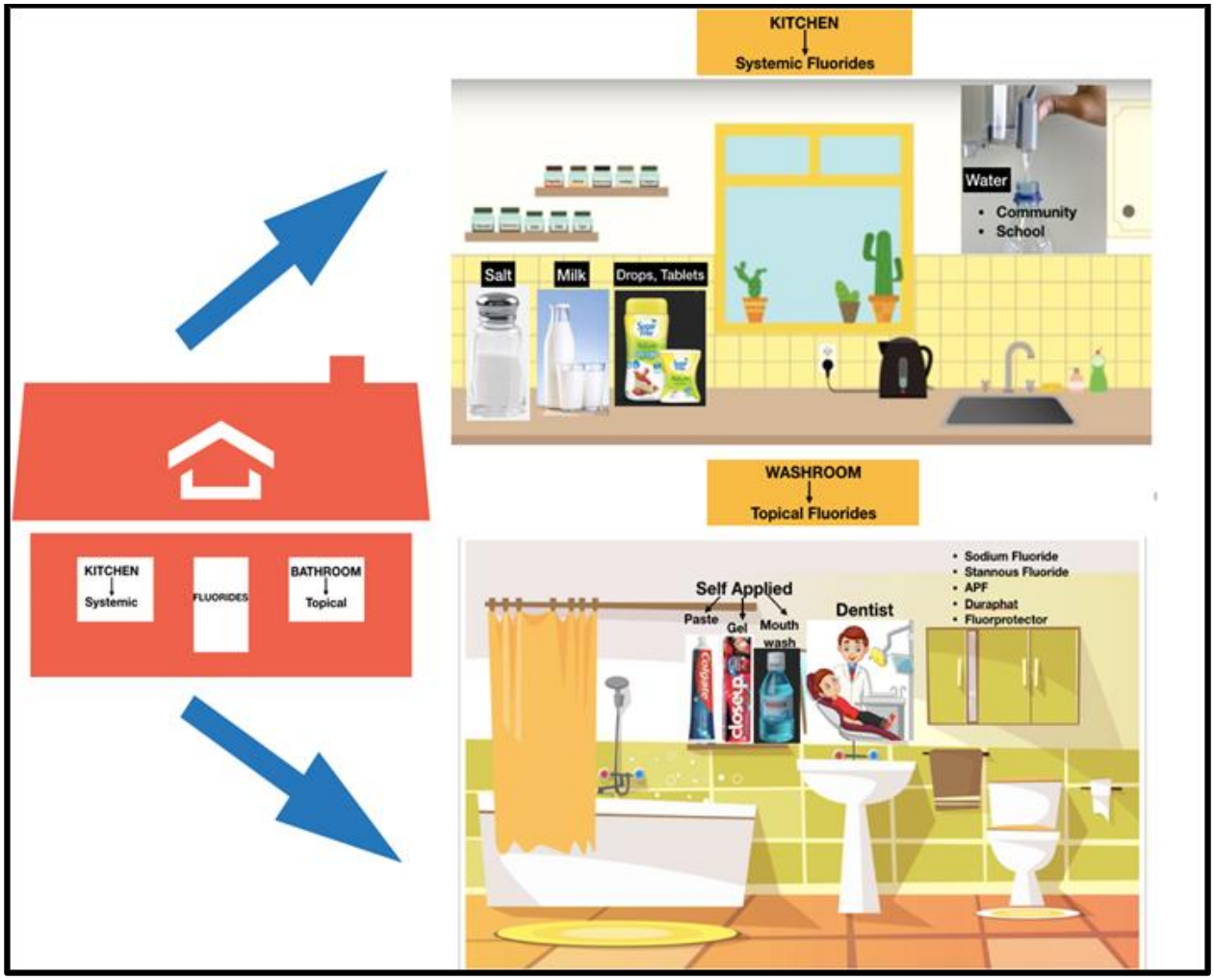


Figure 9: Sources of Fluoride in a Kitchen

1. **Tap water** for Community Water Fluoridation
2. Filling up the **pet bottle** for School Water Fluoridation
3. **Salt** for Salt Fluoridation
4. **Milk** for Milk Fluoridation
5. **Sugar Free** for Fluoride Tablets and Fluoride drops

For example: Wash room for Topical Fluorides- Here we place all the plaque control agents to maintain proper oral hygiene at home

At home or self-applied topical fluorides:

1. Toothpaste for sodium mono fluorophosphate dentifrice
2. **Gel** for Fluoride gel
3. **Mouth rinse** for Sodium Fluoride mouthwash

Mirror for Dentist- Professionally applied topical fluorides (2% Sodium fluoride solution, 8% and 10% Stannous fluoride solution, 1.23% APF solution or Gel, Varnish- Duraphat and Fluorprotector)

Multimedia approach was followed with the help of Internet source: Open source Learning.

Students searched articles (23, 24) related to the Evidence based clinical recommendations for the use of Professionally Topical fluoride for caries prevention for different age groups and its cost effectiveness. This method helped the students to summarize, Critically evaluate and disseminate the scientific evidence into dental practice that is used easily by the dental professionals. Students were able to construct a multi flow charts and summary table for

clinical recommendations stratified by age groups and caries risk categories which can be used as a decision making resource material in dental practice.

Summary Table: Finally students made a summary table for the various professionally applied topical fluorides based on the following headings: Name of the Topical fluoride, Concentration, Method of preparation (Techniques), Mechanism of Action, Indications and contraindications. This summary table was used as a chairside resource material for the exam. Students found it very useful and were able to remember and answer the fill ups. A shift from regular conventional methods of learning and indulging students in activities stimulates their interest towards reading, writing, thinking and finally applying the concepts in dental practice. Therefore, these active based learning were embedded in the lecture class which enabled the students to understand the concept, memorize the event and finally secured good marks in the exam. Students were able to retain the important concepts related to Fluorides as they were encouraged to apply their knowledge and skills through activity based learning.

D) Health Planning Cycle and Evaluation

MILA in teaching **Health Planning cycle and evaluation** is a very complicated concept. Students have difficulty in understanding and remembering each step of the planning cycle and also its application in planning a program to solve a health problem at village level, district level and state level (mention the difficult section) concepts. This has been widely reported in various publications (25, 26).

We used the **designing instructions** method of pedagogy in a class between 10 am to 12 pm. The protocol included how you will plan for a trip with friends. What are all the steps you will consider when you plan for a trip right from choosing a place for the trip? Students were given a chart with colour sketches and play clay to put their ideas to plan for a group trip. They are asked to design their trip plan in their own style. Students were asked to highlight the important trip plan steps. All students have decided to plan for a trip to Goa. Each student had their own style of plan. After collecting the chart, each of their steps in plan for the trip was correlated with a health planning cycle (Figure 10). The steps in the health planning cycle (refer Figure 11) and planning for a trip will be almost similar. This includes:

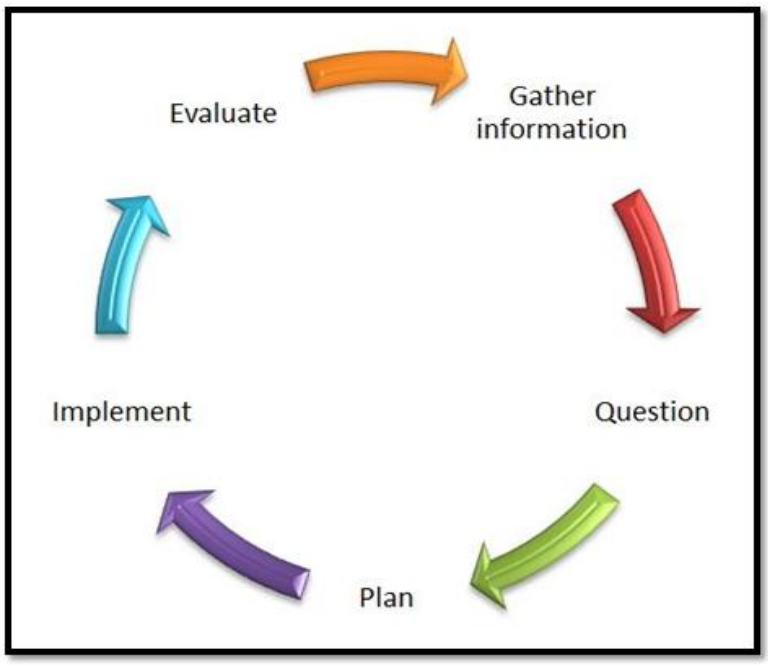


Figure 10: Planning and Evaluation Cycle

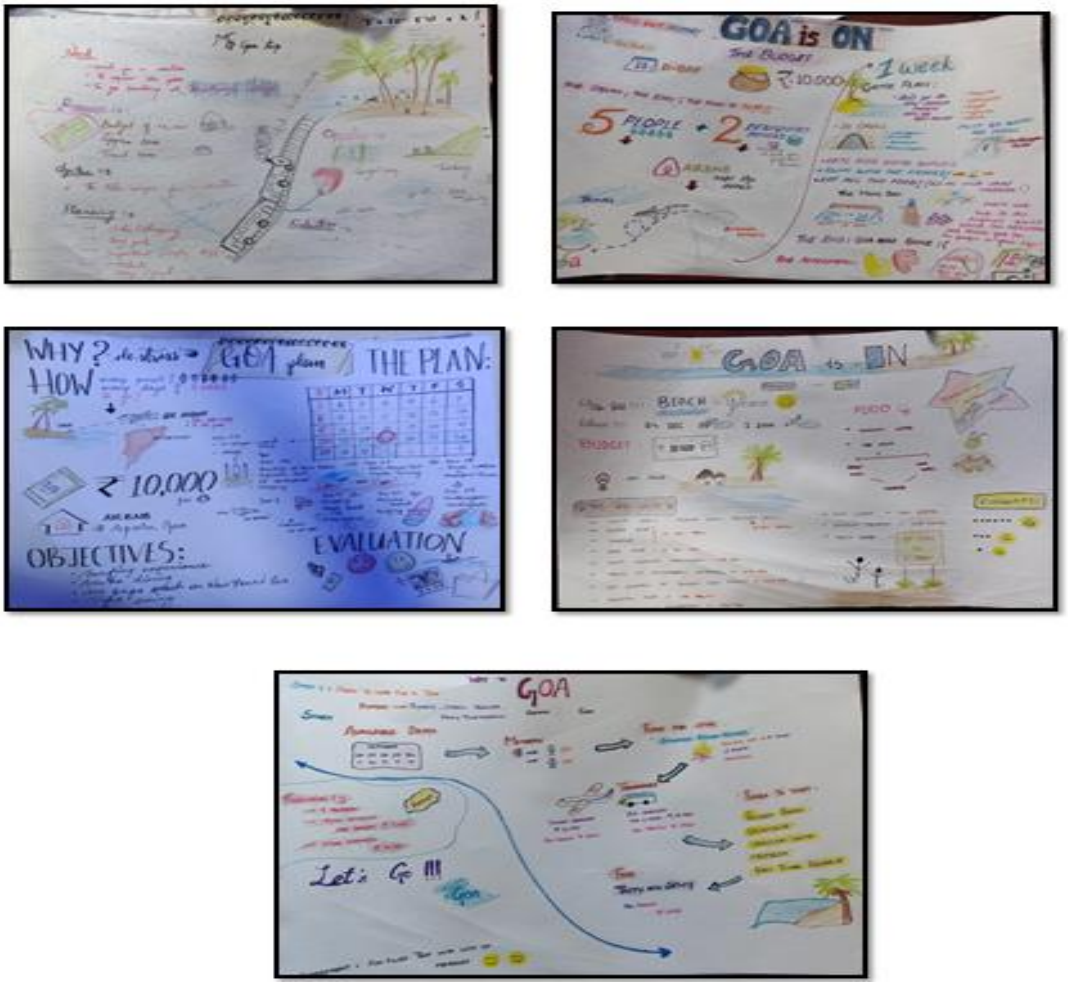


Figure 11: Activities for Health Planning and Evaluation Class

Step 1: Need for a trip (Assessment of health need).

Step 2: Assessment of famous places in Goa to visit and vehicles to travel (Assessment of resources: available health services, transport services, govt budget allocations, govt schemes available).

Step 3: High priority places for the trip (Setting priority health problem with needs for a program to be planned).

Step 4: Setting dates and time for the trip (Setting up goal with aim and objectives for the health plan).

Step 5: The plan that is number of members for the trip, travel cost, food cost, accommodation cost for the trip (Man power calculation, Money calculation, Material calculation).

Step 6: Trip to Goa is on (Implementation of plan).

Step 7: Assessment of the trip – whether the trip goes on as per plan or any changes to made and assessment after trip whether trip was a successful one or not, if not that point has to be rectified in next plan for a trip (Evaluation of plan – subjective & objective; Formative evaluation (evaluation when the program is going on, Summative evaluation (evaluation after the program in terms of cost-effectiveness, cost-utility, cost-efficacy).

There has been a dramatic increase in understanding, remembering capacity and applicability of the health planning cycle. Students were able to remember and answer the steps in the planning cycle by order correctly by remembering the trip to Goa. A dental health problem scenario in the village for the 6-12 year age group was given to them and they were asked to solve the problem in their own style but to remember the steps in the planning cycle. All were able to solve the problem by implementing the steps in the planning cycle with few mistakes.

Overall, we believe teaching students by this method is effective for teaching Health planning cycle and evaluation.

E) Levels of Prevention

Levels of prevention in different oral diseases is a very complicated concept in the aspect where students have difficulty in understanding and categorizing the different treatments of oral diseases on the basis of levels of prevention i.e., primary, secondary and tertiary levels of prevention.

Articles View on Prevention and Students' Knowledge on Prevention

A study was done by Arzu Pınar Erdem et al (27) to evaluate final-year Turkish dental student's knowledge, attitude, and self-perceived competency towards preventive dentistry. It was reported in the article that to manage dental caries both at individual and at population levels, the newly graduated dentists who are the future oral health professionals should be educated and trained on preventive dental care and cariology in the dental curriculum. The value of prevention and its integration into undergraduate dental curricula have become increasingly admitted by the dental profession because dental education plays a crucial role in ensuring future dentists gain both the evidence-based knowledge and clinical skills that are central to patient-specific preventive care. This is applicable not only to dental caries but also to other oral diseases such as periodontal diseases, oral cancer and malocclusion.

Dental disease prevention is one of the most powerful and affordable ways to promote oral health, lower the incidence and prevalence of disease. Oral health care professional have responsibility to develop positive attitude to serve the community (28).

Dental health care professionals and their knowledge and attitude towards oral health care provides a framework as they are the person who convey evidence based knowledge about oral health and educate the individuals as well as groups. Dental professionals act as role models for patients, friends, families and the community at large and hence they can influence others oral health related behaviour (28). In order to create more positive attitudes for future care professionals, there should be an early and sufficient exposure to preventive aspect of oral health in every healthcare professional curriculum (29).

Methods Utilised for Teaching Levels of Prevention

'Real world' learning method was utilized, where real world experiences were infused to enrich the learning process and this was done as **game based learning**. Also **peer led team based activity** was utilized for understanding the concept of levels of prevention.

Teaching Protocol

The protocol included the following:

The class was divided into twenty minutes micro sessions where the lecture was taken for a duration of around eighteen minutes and a related activity was given followed by the lecture. Prerecorded class video pertaining to the topic of the session was played before every session.

Theoretical knowledge about levels of prevention was taught by power point presentation. The first session explained about the three levels of prevention which was followed by a peer-led **team based learning** type of activity where the students were divided into three groups and one member from each group explained about the concept of primary, secondary and tertiary levels of prevention respectively.

Further sessions included levels of prevention of different oral diseases like dental caries, periodontal diseases and oral cancer. Students were asked to explain about the treatment options available for treating different oral

diseases. Students were grouped and they were asked to collect images related to treatment of different oral diseases. Pictures depicting various treatments of dental diseases shown by each group were reviewed by the staff and sent to the students. This include pictures related to dental caries treatment such as topical fluoride application, pit and fissure sealant, fluoride rinses, fluoride supplements, amalgam restoration, root canal treatment, implants; images pertaining to periodontal treatment including plaque control program, scaling, deep curettage, periodontal surgery, removable and fixed partial dentures; photos illustrating oral cancer treatment such as anti-tobacco counselling, biopsy, radiotherapy, complete excision, plastic surgery**. Game based learning method** was employed where the students were asked to categorize the given treatments of dental caries, periodontal diseases and oral cancer based on the levels of prevention for different oral diseases.

Outcome and Student's Perception of Mila

There has been dramatic improvement in the students' understanding about the different levels of prevention. This method helps the students to probe for various treatment modalities available for oral diseases and they found this as a friendly way of learning. Students showed great interest in searching preventive measures of oral diseases and with regard to student's perception about this method of learning, they found this as fun filled knowledge search. Also the students felt that they were able to concentrate in a better way and there was less distraction as this was an interactive session. Overall, we believe teaching students by this method is effective.

F) Primary Health Care

Primary health care includes the following essential components such as providing education concerning prevailing health problems and methods of preventing and controlling them.

Students were asked to express their views on what they felt about primary health needs of a community. What they expect for their community in respect for health? Students are encouraged to think in what ways healthcare can be improved?

Then the components are described in detail to the students as follows. Primary health care includes the following essential components (30):

- Providing education concerning prevailing health problems and methods of preventing and controlling them.
- Provision of food supply and proper nutrition.
- Adequate supply of safe and clean drinking water and basic sanitation.
- Provision of maternal and child health care.
- Immunization against major infectious diseases.
- Prevention and control of local epidemic diseases.
- Appropriate treatment of common diseases and injuries.
- Provision of essential drugs.
- Promoting health education in schools and colleges.

Activity 1

Students are asked to write their experience about the primary health care services available in their community. Experiences on immunization camp, have they visited primary health care centre, Availability of emergency drugs etc.

Then each student is asked to narrate their experience shortly to each other.

Evolution of Primary Health Care

Alma Ata conference and its subsequent evolution of PHC concepts are discussed. Area covered and No. of People benefited by PHC are also discussed. Manpower allocations in PHC are well described.

Activity 2

Students are asked to search details on PHC in their native place via web and collect details on manpower. ASHA, Anganwadi Workers, Health assistants etc., roles to be defined. Details on the number of Primary health centres available in our country etc are collected.

Concepts

- Affordable
- Available
- Acceptable

The approaches should be affordable by the community and the conventional methods deployed should be acceptable by the community.

Activity 3: Peer to Peer Teaching

Use of mnemonics for the remembering and memorizing the elements of Primary Health care. Students discuss among themselves and shall make the following mnemonics during the flipped classroom activity.

E- Education regarding prevailing diseases

L- Local epidemic diseases prevention and its control

E- Essential drugs provision

M- Maternal and Child health care services

E- Health **E**ducation Promotion in schools and colleges

N- Nutrition and food supply

T- Treatment of common diseases and injuries.

S- Safe water supply and Sanitation

This technique helped to retain the elements of primary health care and answer the fill ups.

Activity 4: Game based Learning- Making of Color Wheels

This activity-based learning was embedded in flipped classroom activity to remember the important points in a definition of Primary health care. Students were asked to construct a **colour wheel** with all the terms needed for the definition.

For example: Essential health care, Scientifically sound, Socially acceptable and Affordable.

Activity 5: Tree Chart Graphic Organizer

Tree chart can be of great help to take a trip down memory lane to recollect the main Five principles of Primary health care based on Alma ata Declaration. Students were asked to form a tree with the following details. The topmost section is the main title which is five principles of Primary health care, below that are the subtopics which will be principles (Equitable distribution, Community participation, Intersectoral coordination, Appropriate technology and Focus on prevention.) (30).

Below the subtopics, the relevant information related to each principle forms a list.

Students are asked to discuss their experience about immunization camps etc among themselves and one student is asked to summarize their views.

Activity 6: Critical Pedagogy

A paragraph on PHC with false inputs is given to students. Students were asked to identify the false statement and to correct it.

Failure to improve the underlying conditions for health is compounded by insufficient allocation of resources to address priority needs with equity (universality, accessibility and affordability). Based on this students are enlightened about various novel methods to reach each and every citizen of our country.

Moving beyond Health Policy to Healthy Public Policy

The conventional developments belong mostly within the traditional context of 'health care policy'. However, if we must look beyond this to embrace a much larger domain: 'healthy public policy', which has evolved into a major movement to stimulate health-promoting policies around the world. 'Healthy public policy' prescribes that 'health' must be on the agenda of *all* government ministries. Hence, students are trained in analyzing inter-sectoral coordination among various departments Municipality, corporation, Transport, Engineering etc in implementing community oriented preventive measures.

Activity 7 – JigSaw Technique

The jigsaw technique is a method of organizing classroom activity that makes students dependent on each other to succeed. It breaks classes into groups and breaks assignments into pieces that the group assembles to complete the (jigsaw) puzzle. Such as, No. of PHCs in each state, Analysing whether existing numbers meet the demands of the population, No. of people benefited by existing PHCs etc. Finally all the students are asked to complete the puzzle.

CONCLUSION

The future of dental professionals highly depends upon the upbringing of dental students in dental colleges. Effective teaching of dental subjects is very much required to produce more efficient dentists. MILA method showed that learning in the classroom can be "Enjoyable, Educational and Enriching" for dental students.

REFERENCES

[1] Vaillancourt R. I hear and I forget, I see and I remember, I do and I understand. Can J Hosp Pharm [Internet]. 2009; https://www.ncbi.nlm.nih.gov/pmc/articles/pmc2826962/

[2] *RUP, *SDU, *PGP, *RS, *PS, *SG. Is Small Group Teaching among the Under Graduate Dental Students Really Effective? J Clin Diagn Res [Internet]. 2011 Aug [cited 2020 Oct 26]; 5(4): 822–825. https://eprints.manipal.edu/2321/

[3] Word E, Others A. Student/Teacher Achievement Ratio (STAR) Tennessee's K-3 Class Size Study. Final Summary Report 1985-1990. 1990 [cited 2020 Oct 26]; https://eric.ed.gov/?id=ED320692

[4] Kennedy M. Sizing up Smaller Classes. Am J Ethics Med [Internet]. 2003 [cited 2020 Oct 26]; 75(6): 16–20. https://eric.ed.gov/?id=EJ666246

[5] Evidence-based Clinical Practice Guideline for the Use of Pit-and-Fissure Sealants. Pediatr Dent [Internet]. 2016 Oct 15; 38(5): 120–136. https://www.ncbi.nlm.nih.gov/pubmed/28206888

[6] Ahovuo-Saloranta A, Forss H, Walsh T. Pit and fissure sealants for preventing dental decay in permanent

teeth. Cochrane Database Syst Rev [Internet]. 2017; https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD001830.pub5/abstract

[7] Naaman R, El-Housseiny AA, Alamoudi N. The use of pit and fissure sealants—A literature review. Dentistry journal [Internet]. 2017; https://www.mdpi.com/2304-6767/5/4/34

[8] Smith HR, Leptich DA. Effective Use of Cartoons in the Classroom. The Clearing House: A Journal of Educational Strategies, Issues and Ideas [Internet]. 1963 Sep 1; 38(1): 38–41. https://doi.org/10.1080/00098655.1963.11475937

[9] Frencken JE, Pilot T, Songpaisan Y, Phantumvanit P. Atraumatic restorative treatment (ART): rationale, technique, and development. J Public Health Dent [Internet]. 1996; 56(3 Spec): 135–40; discussion 161–163. http://dx.doi.org/10.1111/j.1752-7325.1996.tb02423.x

[10] Dorri M, Martinez-Zapata MJ, Walsh T, Marinho VC, Sheiham Deceased A, Zaror C. Atraumatic restorative treatment versus conventional restorative treatment for managing dental caries. Cochrane Database Syst Rev [Internet]. 2017 Dec 28;12:CD008072. http://dx.doi.org/10.1002/14651858.CD008072.pub2

[11] Frencken JE. Atraumatic restorative treatment and minimal intervention dentistry. Br Dent J [Internet]. 2017 Aug 11; 223(3): 183–189. http://dx.doi.org/10.1038/sj.bdj.2017.664

[12] Yip JK, Hay JL, Ostroff JS, Stewart RK, Cruz GD. Dental students' attitudes toward smoking cessation guidelines. J Dent Educ [Internet]. 2000 Sep; 64(9): 641–50. https://www.ncbi.nlm.nih.gov/pubmed/11052341

[13] Murugaboopathy V, Ankola AV, Hebbal M, Sharma R. Indian dental students' attitudes and practices regarding tobacco cessation counseling. J Dent Educ [Internet]. 2013 Apr; 77(4): 510–517. https://www.ncbi.nlm.nih.gov/pubmed/23576597

[14] Pendharkar B, Levy SM, McQuistan MR. Fourth-year dental students' perceived barriers to providing tobacco intervention services. Journal of dental [Internet]. 2010; https://onlinelibrary.wiley.com/doi/abs/10.1002/j.0022-0337.2010.74.10.tb04962.x?casa_token=ywdicWjirLYAAAAA:tRGzniEWjxZ2ZQVXL_unmrlCmTLuslGDgk31HNWY1f4IiRYdtHW-NCDJMB2UrAO2CCyEx8CTH3LAfoXx

[15] Uti OG, Sofola OO. Smoking cessation counseling in dentistry: attitudes of Nigerian dentists and dental students. J Dent Educ [Internet]. 2011 Mar; 75(3): 406–412. https://www.ncbi.nlm.nih.gov/pubmed/21368264

[16] Rider EA, Hinrichs MM, Lown BA. A model for communication skills assessment across the undergraduate curriculum [Internet]. Vol. 28, Medical Teacher. 2006. p. e127–34. http://dx.doi.org/10.1080/01421590600726540

[17] Nair BT. Role play - An effective tool to teach communication skills in pediatrics to medical undergraduates. J Educ Health Promot [Internet]. 2019 Jan 29; 8: 18. http://dx.doi.org/10.4103/jehp.jehp_162_18

[18] Manzoor I, Mukhtar F, Hashmi NR. Medical students' perspective about role-plays as a teaching strategy in community medicine. J Coll Physicians Surg Pak [Internet]. 2012 Apr; 22(4): 222–225. http://dx.doi.org/04.2012/JCPSP.222225

[19] Papadakis MA, Croughan-Minihane M, Fromm LJ, Wilkie HA, Ernster VL. A comparison of two methods to teach smoking-cessation techniques to medical students. Acad Med [Internet]. 1997 Aug; 72(8): 725–727. http://dx.doi.org/10.1097/00001888-199708000-00021

[20] Nikendei C, Kraus B, Schrauth M, Weyrich P, Zipfel S, Herzog W, et al. Integration of role-playing into technical skills training: a randomized controlled trial. Med Teach [Internet]. 2007 Nov; 29(9): 956–960.

http://dx.doi.org/10.1080/01421590701601543

[21] Bosse HM, Nickel M, Huwendiek S, Jünger J, Schultz JH, Nikendei C. Peer role-play and standardised patients in communication training: a comparative study on the student perspective on acceptability, realism, and perceived effect. BMC Med Educ [Internet]. 2010 Mar 31; 10: 27. http://dx.doi.org/10.1186/1472-6920-10-27

[22] Singleton JA, Carrico RM, Myers JA, Scott DA, Wilson RW, Worth CT. Tobacco cessation treatment education for dental students using standardized patients. J Dent Educ [Internet]. 2014 Jun; 78(6): 895–905. https://www.ncbi.nlm.nih.gov/pubmed/24882775

[23] Weyant RJ, Tracy SL, Anselmo TT, Beltrán-Aguilar ED, Donly KJ, Frese WA, et al. Topical fluoride for caries prevention: executive summary of the updated clinical recommendations and supporting systematic review. J Am Dent Assoc [Internet]. 2013 Nov; 144(11): 1279–1291. http://dx.doi.org/10.14219/jada.archive.2013.0057

[24] American Dental Association Council on Scientific Affairs. Professionally applied topical fluoride: evidence-based clinical recommendations. J Dent Educ [Internet]. 2007 Mar; 71(3): 393–402. https://www.ncbi.nlm.nih.gov/pubmed/17389574

[25] Zaahirah M, Puvanese Rebecca S Faridah, Saba A FR, Juni MH, Rosliza AM. PLANNING THEORIES IN PRIMARY HEALTH CARE PLANNING. International Journal of Public Health and Clinical Sciences [Internet]. 2018 Aug 14; 5(4): 12–28. http://publichealthmy.org/ejournal/ojs2/index.php/ijphcs/article/view/773

[26] Reynolds HW, Sutherland EG. A systematic approach to the planning, implementation, monitoring, and evaluation of integrated health services. BMC Health Serv Res, 2013 May 6; 13: 168. http://dx.doi.org/10.1186/1472-6963-13-168

[27] Pınar Erdem A, Peker K, Kuru S, Sepet E. Evaluation of Final-Year Turkish Dental Students' Knowledge, Attitude, and Self-Perceived Competency towards Preventive Dentistry. Biomed Res Int [Internet]. 2019 Nov 19; 2019: 2346061. http://dx.doi.org/10.1155/2019/2346061

[28] Dodamani AS, Khairnar MR, Karibasappa GN, Naik RG, Deshmukh MA. Knowledge, Attitude And Behavior Towards Preventive Dentistry Among Health Care Students In Dhule City [Internet]. Vol. 9, Journal of Oral Health and Community Dentistry. 2015. p. 115–9. http://dx.doi.org/10.5005/johcd-9-3-115

[29] Ghasemi H, Murtomaa H, Torabzadeh H, Vehkalahti MM. Knowledge of and Attitudes towards Preventive Dental Care among Iranian Dentists. Eur J Dent [Internet]. 2007 Oct; 1(4): 222–229. https://www.ncbi.nlm.nih.gov/pubmed/19212471

[30] Park K. Park's textbook of preventive and social medicine. Preventive Medicine in Obstet, Paediatrics and Geriatrics [Internet]. 2005; https://ci.nii.ac.jp/naid/10021929774/

MILA in Teaching Oral & Maxillofacial Surgery

Dr. Deepak Nallaswamy Veeraiyan, Professor, Department of Prosthodontics, Saveetha Institute of Medical and Technical Sciences, Saveetha Dental College. E-mail: dir.acad.sac@saveetha.com

Dr.M. Subha, Associate Professor, Department of Oral Medicine & Radiology, Saveetha Institute of Medical and Technical Sciences, Saveetha Dental College. E-mail: doctorsubha@gmail.com

Dr. Madhulaxmi, Professor, Department of Oral Surgery, Saveetha Institute of Medical and Technical Sciences, Saveetha Dental College. E-mail: madhulaxmi11@gmail.com

Dr. Hemavathy Muralidoss, Reader, Department of Oral Surgery, Saveetha Institute of Medical and Technical Sciences, Saveetha Dental College. E-mail: hemadocmd@gmail.com

Dr. Pradeep Dhasa, Reader, Department of oral Surgery, Saveetha Institute of Medical and Technical Sciences, Saveetha Dental College. E-mail: pradeep.dhasa@gmail.com

Dr. Senthilmurugan, Reader, Department of Oral Surgery, Saveetha Institute of Medical and Technical Sciences, Saveetha Dental College. E-mail: senthilomfs@yahoo.co.in

Dr. Mahathi Neralla, Senior Lecturer, Department of Oral Surgery, Saveetha Institute of Medical and Technical Sciences, Saveetha Dental College. E-mail: nerallamahathi@gmail.com

Dr.R.P. Abhinav, Senior Lecturer, Department of Oral Surgery, Saveetha Institute of Medical and Technical Sciences, Saveetha Dental College. E-mail: abhinav.sdc@saveetha.com

Dr. Balakrishnan, Senior Lecturer, Department of Oral Surgery, Saveetha Institute of Medical and Technical Sciences, Saveetha Dental College. E-mail: balakrisdr8394@gmail.com

Dr. Jagadish, Senior Lecturer, Department of Oral Surgery, Saveetha Institute of Medical and Technical Sciences, Saveetha Dental College. E-mail: jegadishv.sdc@saveetha.com

Abstract--- In most of the dental colleges in India lecturing in large groups is the usual mode of teaching. Students find it difficult to understand, particularly in certain topics of oral surgery. MILA technique involves dividing students into smaller groups and coupled with activity training. Teaching students in smaller groups is more effective and also increases the attention to each and every individual. This increases interaction between students and teachers, less time for teachers to manage the larger group of students, helps students to think better and transfer of knowledge in smaller groups is more effective. MILA provides an equal opportunity for all students to take part in the discussion which is also coupled with activity which will make lecture classes more of an interactive session rather than being uneventful. This article gives a outlook of MILA technique in teaching topics like impaction, local anesthesia, medical emergencies, lymphatic drainage of head and neck, salivary gland disorders, midface fractures, mandibular fractures, zygomatic fractures, maxillofacial cysts, pre-prosthetic surgeries, orthognathic surgery, space infections etc.

Keywords--- MILA, Activity Training, Small Group Lectures, Oral Surgery.

INTRODUCTION

Dental college curriculum is aimed at undergraduate students in practical and theoretical areas. Main objectives of our curriculum should be based on developing students' technical and clinical skills(1). Lecture class for a large group

of students is a very common practice in India and it is also one of the oldest forms of teaching. Teaching students in smaller groups is more effective and also increases the attention to each and every individual. This increases interaction between students and teachers, less time for teachers to manage the larger group of students, helps students to think better and transfer of knowledge in smaller groups is more effective. Oral surgery deals with more clinical aspects and application oriented, which needs individual training. This type of small group training MILA proves to be more effective in training undergraduate students in our institution with better clinical knowledge when compared to traditional methods. In this article we have discussed MILA training in various oral surgery topics which is as follows.

MILA in Teaching Impaction

Management of an impacted tooth and transalveolar extraction are usually one of the fundamental topics in oral surgery. Though it appears to be a simple topic, any failure in proper assessment, clinical judgement and skills can make it extremely complicated. Undergraduate students have difficulty in understanding the classification, assessing the difficulty index and choice of surgical procedure. This has been widely reported in various publications(2)(3).

We utilised Learner-Centred, Problem based learning method of pedagogy for a class of final year undergraduate students. The protocol included preliminary flipped class teaching and textbook reading. This was followed by each student to trace an intraoral periapical radiograph of an impacted lower third molar and the adjoining anatomical structures, including the second molar, mandible and inferior alveolar canal. Then each of them were asked to draw the WAR lines on the traced radiograph (fig-1). This was supervised and checked individually by the instructor (an oral surgery faculty; staff: student ratio 1:15). Following this, keeping an open textbook to cross check the Winters and Pell and Gregory‘s classification, each student charted the classification and Pederson‘s difficulty index. Along with this the tracing of inferior alveolar nerve was done and the relationship of the nerve to the tooth was evaluated.

Having completed the above exercise, the discussion was now focussed on treatment planning. The decisions the student had to make were 1. the feasibility of doing the procedure as a simple elevation (soft tissue impaction with no bone or tooth lock) or surgical removal, 2. In case of surgical removal –the choice of LA vs GA was to be made, 3. The choice of incision, 4. The need for tooth split or not, 5. The pattern of bone cutting, 6. The technique of tooth splitting, 7. Socket debridement and wound closure. Although the indications and classification can be consistent, diagnosis and treatment planning may have variations(2)(4). Hence, the answers to the above questions were written out and again discussed with the tutor and explanations were given with reasoning.

When the theoretical concepts are well understood, hands-on pedagogy is implemented. Hands-on operations have been associated with the stages of developmental theory. When students are exposed to activities that engage the minds with concrete things and perform with hands, the knowledge provided becomes trustworthy and re emphasised with long lasting memory (5). Students are trained to feel and cut bone and tooth on cadaveric mandibles to simulate real patients.

The experience of bone cutting, tooth splitting and tooth elevation gives the student an inner confidence and enhances their interest in the subject. There has been a dramatic increase in student understanding, case diagnosis and treatment planning. This is evident in their everyday clinical case judgements, answer papers and interest to explore their postgraduate colleagues acts in minor OT.

Overall, we believe teaching students by this method is effective for teaching Impactions or transalveolar extractions and most surgical procedures.

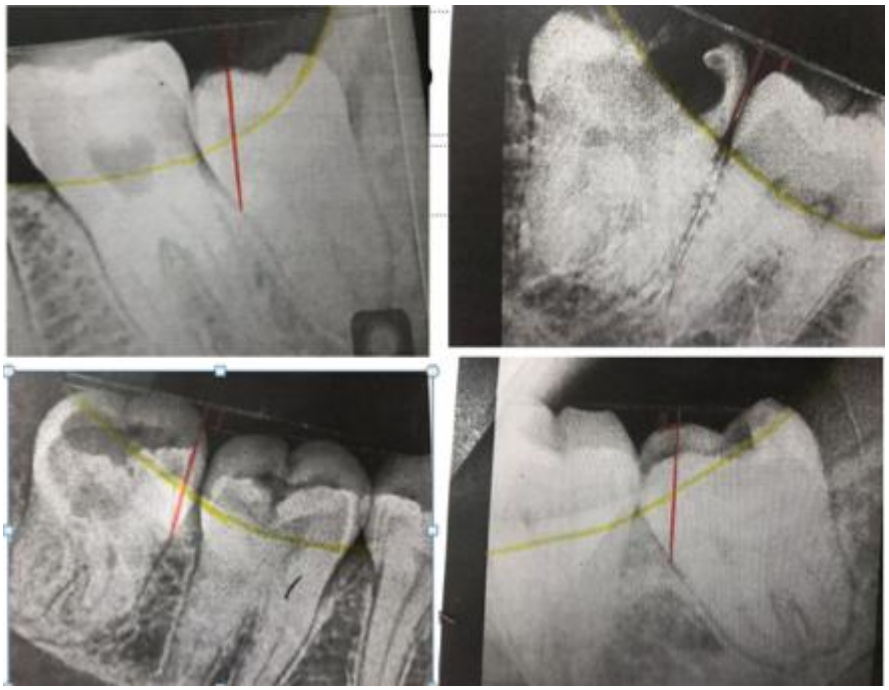


Figure 1: Tracing WAR Lines

MILA in Teaching Local Anesthesia

The topic of Local Anaesthesia (LA) is very important as it is the first step in every oral surgical procedure. An undergraduate student should know about the anatomy of nerves, the mechanism of action of the LA solution and the various injection techniques. When they start their clinical postings, they find it very hard to identify and relate the landmarks and sites clinically. Students have difficulty in understanding the mechanism of action of LA, anatomy of the nerves, various injection techniques. This has been widely reported in various publications(6). (Cite 1,2, 3 etc..)

We utilised a student centered learning method of pedagogy in a class between 2017 to 2018. The protocol included flipped class teaching and textbook reading followed by interactive activities such as roleplays, demonstrations of various injection techniques using skull models and by tracing the anatomical pathways of the nerves on skulls. They were also given an activity where they were asked to load an LA solution in a syringe and inject it into fruits and vegetables to get a feel of giving the injections in patients. This in turn made them more confident when handling patients requiring procedures under local anaesthesia.

There has been a dramatic increase in the response and the understanding of the students about LA. Earlier, before we switched over to this form of pedagogy, during the clinical postings of the undergraduate students, they would not be aware of the techniques and the anatomy that much. We had to teach them the same thing again to get them to understand. But once we started this method, we saw an increase in the level of understanding among the students. They were confident in their clinical postings to identify the landmarks and give the injections with very little help from us. Their ability to answer questions based on LA was also much improved compared to the previous teaching methodology.

Overall, we believe teaching students by this method is effective for learning local anaesthesia. We believe that there is a greater understanding of the subject at the theoretical as well as the clinical level for the student.

MILA in Teaching Lymphatic Drainage

Lymphatic drainage of the head and neck is one of the complex topics. Anatomy in general is difficult to teach and also difficult for the students to understand unless they have practical experience. Unless the students master head

and neck anatomy, diagnosis and treatment of patients with maxillofacial diseases becomes arbitrary. One such topic that helps the students to master head and neck anatomy is lymphatics.

Head and neck lymphatics is first taught to students with a power point presentation detailing the anatomical structures in general and their drainage pattern. Next text book reading of the same is encouraged. Flipped classes model is followed throughout as the flipped classroom encompasses some approaches like active and collaborative learning, problem-based learning and project-based learning(7). The advantages of flipped classroom model has been documented.

Some advantages of the flipped classroom(8)(9).

For students	For teachers
Learn at their own pace	Work closely with students in the classroom
Engage concepts with peers	Improve student attitudes
Frustration levels remain low	Teachers can group students together
Particular benefit to those students whose personality types and preferred learning styles impair their performance in traditional educational environment	Improve students' ability to solve open-ended problems

These are covered in a single class and then once the students are taught the basics, next different clinical scenarios are discussed wherein each student is given a case scenario and asked to present it and discuss the lymph drainage pattern.

Case based learning in medical teaching has been used for years. Today medical teaching is being charged with presenting discipline-specific concepts with an emphasis on clinical relevance while advancing active learning, critical thinking, communication skills, and other professional competencies. Problem-based learning has been widely introduced to support these educational goals(10). It has been concluded from the above article that CMT represents a feasible and resource-conservative pedagogical format to promote critical thinking and to integrate basic science principles during the preclinical curriculum.

Also the students are divided into partners and encouraged to examine of all the head and neck lymph nodes on their partner. Team Based Learning allows medical educators to provide students with resource effective, authentic experience of working in teams to solve real life clinical problems (11). Prior to this exercise the students are first taught the hand movements to examine the lymph nodes on a model student. This type of individual teaching encourages the students to examine a patient confidently and present the case diagnosis to a faculty with much ease.

Active learning is an umbrella term that embraces a variety of teaching and learning techniques. These include case-based learning, experiential learning, peer problem solving, and project-based learning (12). All or combination of these are used in the classrooms of our college to enhance the student‘s perception of the subject and increase his confidence to treat a patient with ease.

MILA in Teaching Maxillofacial Cysts

MILA in teaching Maxillofacial Cysts and its treatment is a very complicated concept. Students have difficulty in understanding the treatment procedures and indications of each procedure in different cystic conditions concepts. This has been widely reported in various publications (13).

We utilised balloons to demonstrate marsupialization and enucleation….method of pedagogy in a class between 9:30 to 12:00. The protocol included was for Enucleation 2 balloons were taken and inflated first balloon was filled with alginate mix tied and allowed to set the second balloon was slightly inflated and the alginate filled balloon was

put inside the second balloon and tied, now a enucleation kit was taken and students were allowed to give incision on the first balloon (as the mucosal layer) then the second balloon (cystic lining) was reflected with a soft tissue curette and the whole of second balloon (as the cyst with lining) whole was completely enucleated.

Marsupilization for this procedure 2 balloons were taken and first balloon was filled with water and tied the second balloon was inflated slightly and the first balloon was put inside the second balloon and tied now marsupialization kit was taken and students were asked to give incision on the first balloon (mucosal incision) after which second balloon was encountered (cyst with cystic contents) then an elliptical incision was placed on the second balloon and the cyst decompressed then the first balloon and the second balloon margins were sutured together and keeping the cystic cavity patent.

There has been a dramatic improvement in answering their theory paper because they are able to understand the procedure properly and there was no confusion between the two procedure which was the common mistake everyone did earlier (increase/ decrease/ no change) there is a definite improvement in their viva related to these two procedures they were able to explain step wise the overall procedure impressively.

Overall, we believe teaching students by this method is effective (whatever the result is) for teaching treatments of cysts i.e: enucleation and marsupialization.

MILA in Teaching Pre-prosthetic Surgeries

Teaching Pre-prosthetic surgeries for Undergraduates is challenging. Understanding the techniques of Pre-prosthetic surgical procedures involves understanding of 3 Dimensional anatomy of the structures involved, which cannot be explained effectively by theoretical presentations.

To be able to orient the anatomical landmarks as the theory is explained simultaneously makes the class more effective.

A learner centred problem based learning method of pedagogy was undergone. The protocol involved preliminary flipped class reading and text book learning. The objectives of Pre-prosthetic surgery are to eliminate the pre-existing disease, to conserve oral structures, to provide residual ridge for withstanding masticatory forces and restore aesthetics and function.

Skull models were used to explain and were distributed among groups of 4. Replication of buccal mucosa was done using wax sheets and it was easier to demonstrate concepts and procedure of vestibuloplasty, by performing mock/model surgery. Thereby POGIL was implemented.

For demonstrating concepts of Direct and Indirect Sinus lift, analogy of trenching in Warground was explained, and the students were given the situation as to how they will react and active discussion happened. Thereby concepts of direct sinus lift and indirect sinus lift were explained.

Alveoloplasty procedures were simply explained through cast models and also the need of ridge augmentation and various techniques involved were demonstrated in simulation models(14). Pictures of edentulous ridges, and case photos where pre-prosthetic surgical procedures were indicated were projected among students who were divided into teams of 4. Students were given time and discussed. The discussion mainly focussed on diagnosis of the existing condition, the prosthodontic options available and the procedures that can be performed to achieve the maxillary and mandibular ridges to achieve desired results. Based on which the procedures were explained step by step till a clarity is attained among the students. The discussions were very interactive and two-sided in contrast to the conventional large group classroom learning.

This has led to a dramatic increase in student understanding ability. Procedures that are difficult to explain such as Transpositional flap vestibuloplasty also known as the lip switch, which is technically difficult to discuss even with tools like videos of preformed surgeries. The orientation would be still difficult unless the student gets his/her hands on in a model. This is very important for every student to thoroughly understand as he/she will have to explain the procedure to the patient before performing.

Basically the procedures were broadly classified into two. Hard tissue procedures and Soft tissue procedures. And depending on the complexity, they were classified into simple and advanced. Advanced procedures such as visor osteotomies and ridge extensions were explained, videos were projected and the students were made to do them in models.

Thereby this Interactive Learning Algorithm effectively helped in thorough understanding of the concept which were previously considered difficult by conventional means.

MILA in Teaching Maxillofacial Space Infection

Maxillofacial space infections are one of the most interesting and most complicated sections in the field of oral and maxillofacial surgery. It is interesting because the drastic improvement noted in patients immediately after providing the right solution. To know the right solution the source of infection has to be found in the first instance (15).

This portion of understanding the source of comes from understanding the intricate anatomy and paths of spread of pathology. These concepts no matter what illustrated with diagram on a white board and marker pen will not be sufficient, because this will need a 3-dimensional pictorial or model based visualisation of the above mentioned concepts.

For this reason two techniques were used.

1. Clay model preparation:

- Students were asked to depict models of each space using coloured clays marking all the layers and contents of the space. This made it easier for them to visualise the real time structures in a more convincing way.
- Following preparation they were asked to explain this to their friends, who raised doubts in the same and this made it more interesting as well find out the missed areas of conceptual understanding.

2. Balloon inflation with alginate models:

- The treatment of space infection involves a decompression of the abscess cavity. Descriptive explanation of this will not give the student a feel and motor coordination of the procedure. As with surgery any procedure needs a lot of refined motor skill and good hand eye coordination.
- Hand eye coordination is a result of continuous practice of a selected set of procedures. Coordination is at its best when the procedure is practised on a near look alike models.
- So we created a balloon model.
- Balloons were inflated with three different solutions
    1. Water
    2. Red coloured solution
    3. Alginate
- Water:
    - It was used to depict swelling due to cellulitis.
    - During decompression cavity oozes clear fluid rather than pus

- Red coloured solution:
    - Few swelling have blood filled cavities. To depict blood red coloured solution was used.
    - Alginate
    - This was kept to depict pus exudation.
    - Students were asked to arrange the armamentarium needed for the procedure. Again reinforcing the theoretical explanations
    - Once the armamentarium was ready they were asked about the sterilisation aspect of it and reassuring the previously read theoretical concepts.
    - Students were asked about the methods of holding the instruments and demonstrated with the same.
    - Following this they were asked to perform incision and drainage on the balloon models.
    - Doing this made students have a clear feel of procedure performed and the theoretical steps have now been converted into muscle memory, which needs no effort to memorise the concepts which have to be read many times.

By employing these, out of the box novel ideas we found the overall interest shown by students in theory class turned manifold and their deeper understanding of the complex concepts was at its best. The enthusiasm shown by students in learning newer topics even at the last 20 mins of the theory class was close to 95%. Otherwise the enthusiasm generally fades at the end of class, because the ability of the brain to concentrate such long hours is close to impossibility.

Feedbacks were collected from all the participants of MILA based lectures. Feedbacks pointed out that students were feeling confident about the subject as they have visualised it and it was easy to remember as compared to memorising.

All these positive feedback were reconfirmed with results of the assessment exam which showed an outstanding improvement in scores across the batch and not just the selected few in class.

MILA in Teaching Salivary Gland Disorders

Salivary gland disorders are a complicated concept to understand. These disorders are common and a thorough understanding is necessary for proper diagnosis and treatment. Salivary gland disorders include developmental disorders, obstructive and traumatic lesions, inflammatory conditions, functional disorders, autoimmune conditions, and neoplastic lesions. Students encounter difficulty in understanding the surgical anatomy, physiology and pathology of salivary glands as reported in publications (16).

We utilised student-centered method of pedagogy in the class, as students participate in the evaluation of their learning (17). The protocol included initial flipped class teaching followed by book learning. Students were divided into groups and were involved in small group discussions. Each group was given separate activities. Team based learning was encouraged as it will create healthy competition and motivate the students of one group to outperform the others, thus increasing the overall productivity in learning. Students were asked to classify salivary gland disorders and explain about specific conditions in detail. If there are any mistakes, students of other groups will point them out and rectify them.

A power point presentation on the topic was given to reinforce the points that they learnt during their previous activities. Also, videos were presented to showcase the various surgical procedures in detail. Later Quiz was conducted to assess their level of understanding. Faculty also discussed with the student on one to one basis and clarified their doubts.

Later various case scenarios were given and the students were asked to identify the condition and provide a suitable treatment plan with a note on complications of the surgical modalities. Thus, case-based learning was promoted and the students were engaged in active rather than passive learning. It helped in their critical thinking, professional communication skills, thereby improving their overall competency in solving real-life clinical problems (18).

Having completed the above exercises, the students were presented with patients having salivary gland disorders during their clinical postings and were asked to diagnose them. They would take a proper case history in a systematic way, provide provisional diagnosis and propose a treatment plan. Thus, the habit of active case-based learning was inculcated among the students (19).

There has been a dramatic increase in students ‘ability to understand the pathology of salivary glands, its diagnosis and management. This was evident in their answer papers, everyday clinical case judgements, and were able to recommend proper treatment options for their patients. Thus Overall, we believe training students by this active learning method is effective for teaching salivary gland disorders.

MILA in Teaching Mandibular Fracture

Mandibular fracture is an important topic to be covered for undergraduate students. Just by taking lectures and reading books will not give complete understanding on maxillofacial trauma (20). Surgical anatomy, diagnosis and management of mandibular fracture is difficult to understand by undergraduates as they are usually not exposed to post graduate department and operation theatre.

We utilised the new method of teaching called MILA (A NEW EDUCATION SYSTEM BY PROF.DR.DEEPAK NALLASWAMY), which creates the active learning environment for the students. Instead of hours of lecture and entire students in a class, MILA replaced with 20 minutes of lecture followed by activity based learning for a small group of students. This method of teaching gives a individual student care and motivates student to perform well in class.

Incorporating MILA in teaching mandibular fractures makes the student understand the subject in depth, even if they are not exposed to post graduate department and operation theatre. For a duration of 120 minutes lecture class, MILA is framed in such a way that both lecture and activity is interspersed to make students interactive and attentive (Table-2). This improves their concentration and lateral thinking. Hours of lecture alone make the student bored, sleepy and they won‘t understand the subject three dimensional. So this MILA is scheduled as three 20 minutes lecture and three activity based learning followed by assessment.

Table 2

Class	Time	Topic
Lecture	20 minutes	Surgical anatomy& classification
Activity	20 minutes	Game based learning E.g. Clay model and threads
Lecture	20 minutes	Clinical and Radiographic diagnosis
Activity	20 minutes	POGIL (Process Oriented Guided Inquiry Learning)
Lecture	20 minutes	Management 1. Conservative 2. Surgical
Activity	20 minutes	1. wiring technique in stone model 2. plating system demonstration 3. Hand on in skull model

Flipped Class

Pre-recorded keynote video about mandibular fracture. Students will go through this video before the class and it helps the student to understand the concept much easier and can ask their doubts in class and clarify.

Assessment by Concept Mapping

Students can be assessed by doing concept mapping about the mandibular fracture. This method of learning encourages students to show keen interest in the subject. After completion of this session, every student is able to do a clinical and Radiographic diagnosis for a trauma patient who comes to their respective clinics and they will be able to do treatment planning and explain the patient as well. Over all MILA is an effective method of teaching.

MILA in Teaching Midface Fracture

There are so many methods of teaching that have evolved for centuries, dating back from the Gurukulam system to recent technology mediated ''e ''education methods like Byju Apps. Even though so many teaching methods are there, we the department of Oral and Maxillofacial Surgeons felt that task was a little tough to make our students completely understand the inner core of our subjects. After reading students test papers, class notes and their answers for viva voice, I personally felt that even the meritorious students themselves cannot fully understood the maxillofacial surgery, then I realized that our subject needs to taught in a different manner because ours is the only subject in the undergraduate curriculum in which students are unexposed to practical aspects. Our Saveetha under graduates are highly fortunate in this world because they are one and only students who are able to do Fixed Partial Dentures, Implants, flap surgeries, Root canal Treatments particularly molar RCT, and Fixed ortho appliances. In this way they are unique when compared with other college students who are unable to perform all these at U.G level. But when considering our OMFS department, the problem is common everywhere because of the curriculum which concentrates extraction as the one and only U.G level practical module, but for theory they must study all topics starting from Impaction to latest distraction Osteogenesis that too without even seeing one surgery. Undergraduate student in our college is doing all practical works like FPD, Implants, RCT s, Fixed Orthodontic Appliance on their own, which makes them to easily understand the theoretical aspects of the subjects, but for surgery they are doing only extraction as practical, so I found that just by imagining the subject will not help them to understand, so I felt that the Pedagogy in teaching lies in giving some practical demos in models, and live case discussions, demo surgical videos.

So, I kept MILA as Making students Intellectual in their Learning Aspects. Keeping this in mind, the midface trauma chapter was taught to students.

In this student were initially taught with conventional power point methods and they were asked whether they understood. Then students were grouped into two groups. The skull model was shown to them, the basic anatomic structures in the mid face like maxilla, piriform rim, pterygoid plates, zygoma, infra orbital rim, fronto zygomatic suture were shown. Then students were asked to study about Lefort fractures in a book and then asked to draw Le fort lines in the dried skull models and if unable to do then Le fort fracture I,I,III lines were demonstrated (21). Later with the dried skull model itself the clinical features like displacement, deranged occlusion, orbital rim fracture causing entrapment were demonstrated. With this the students were able to understand the concepts in midface fractures easily.

Apart from this to easily understand the clinical features, the students were grouped into 3groups and clinical picture photos were shown to them initially and they were also demonstrated about clinical features like occlusal derangement, numbness of infra orbital region, depression of malar region, step defect during palpation, decreased

mouth opening in zygomatic arch fracture, circum orbital ecchymosis, sub conjunctival hemorrhage, decreased vertical movements of the affected eye ball due to entrapment were demonstrated. This helped me to make students easily understand about the clinical features of mid face, zygomatic complex fractures, orbit fractures.

Then comes the task like radiographic findings. For that also the grouped students were shown and individually explained about radiographic findings of mid face, ZMC and orbital fractures like starting from showing them the basic fracture line how it will look in OPG and CT, then how to identify the fractures in CT, check with normal side, and hemosinus, muscle entrapment like honey dew appearance in coronal sections of CT in case of orbital trapdoor fracture and in Zygomatic arch fracture, the depressed arch how it affects the mouth opening, Dolan‘s lines, Roger‘s lines were explained.

In books also there are pictures for clinical features and radiographic findings but students could better orient themselves when they were shown different images of different patients, live patients, and images of CT, OPG, PNS XRAY with pictures and films.

What‘s next? The difficult task in management of fractures the books they will simply keep some pictures with most theory which was difficult for the students to orient themselves into the surgical aspects. So the students were shown with photos how the fractures will look if you operate, how to approach, identify the fracture. They were explained about the concepts of Open Reduction/ closed Reduction, and how to reduce fractures for example Gille‘s approach for zygomatic fracture, and reduction of infra orbital and ZMC fractures.

Later in dried skull models plating technique were also demonstrated to the three groups. And if some students want, they are asked to make a drill in the skull so that they can able to get the feel of operating., for Post Graduates, apart from all these they asked individually to drill and do volunteer fractures and fix it with plates and screws. In the operation theatre the Post graduates were asked questions regarding the mid face fracture topic and they were also asked to present the case before surgery. The students will study and come with the notes they prepared, then with the live patient the P.G will be asked to do starting from incision, identification of fractures, reduction and fixation of fractures by themselves and guided them accordingly.

Implication for Future

Post graduates have chance to experience the live surgery and they can easily understand after seeing the surgeries personally, but for undergraduates after all these demonstrations they can understand the subjects well, rather I am of view that if even under graduates were allotted with few weeks of OT posting to observe and assist major surgeries, they can easily orient themselves with the theoretical aspects like other branches as they do the practical works on their own. Patient images were used for demonstration of clinical features in mid-face fractures (Fig-2).

Figure 2

Video of Demonstration of Vertical Gaze in Mid Face Fracture

The video demonstrating the restricted vertical eyeball movements of the affected side are enclosed separately as we could not upload here.

Similarly, CT image were used for demonstration of mid-face fractures (Fig-3).

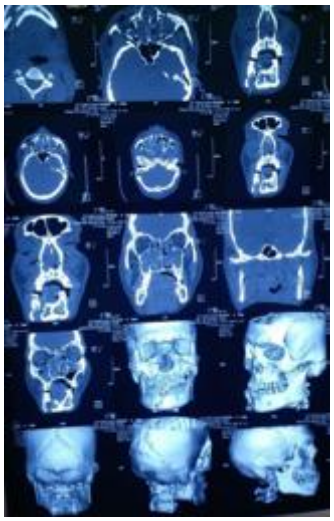


Figure 3

For better correlation, we used Surgical treatment photos for demonstration (Fig-4).

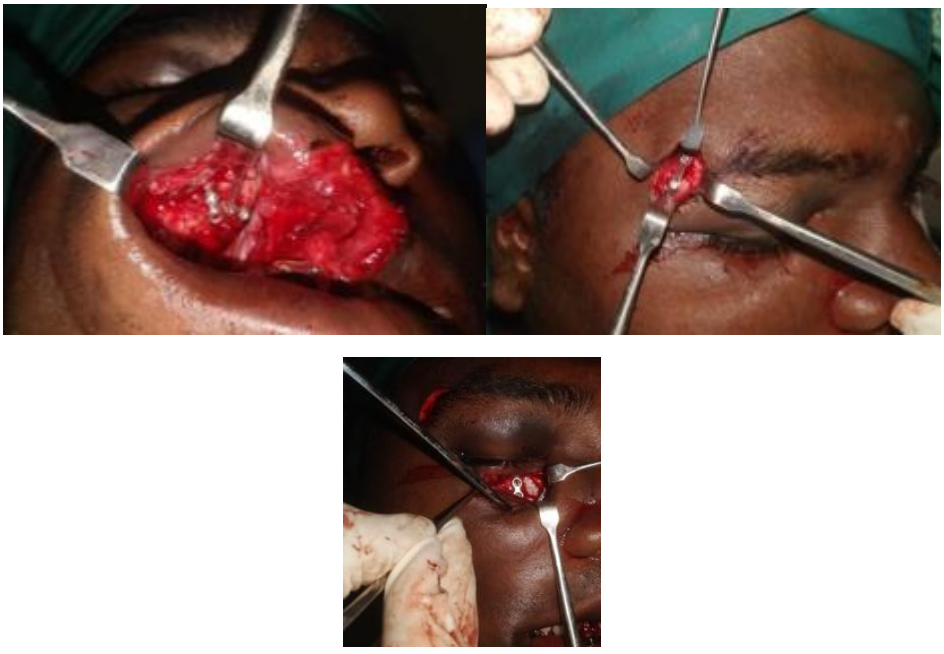


Figure 4

MILA in Teaching Surgical Reduction of Zygomatic Arch Fracture

Dentists are bio-engineer!? said anonymously. Thus an academician in dentistry is a glorified tooth bio-engineer. “Oral maxillofacial surgery is a unique speciality of dentistry as it is a bridge in between medicine and dentistry. Hence teaching maxillofacial curriculum for undergraduate as well as postgraduate will be challenging since and the maxillofacial surgeon has to knowledge bridge in imparting medical and dental speciality curriculum to undergraduate and postgraduate students.

Teaching maxillofacial surgery curriculum for undergraduate has certain shortcoming as an undergraduate as not exposed to all surgical procedures done in post-graduate syllabi. Moreover, the subject (OMFS) itself requires correlation with clinical as well as applied anatomy to understand. Henceforth an undergraduate student might feel unrealistic and boredom if maxillofacial surgery is taught as routine PowerPoint presentation classes, chalk and board or OHP sheet etc.

I felt "MILA" teaching methodology will make syllabi of "Oral maxillofacial surgery more interesting and approachable, even applicable in their clinical practice. Hence I started practising MILA teaching methodology for undergraduate in my routine teaching schedule.

Below here I am narrating one of my topics being taught to undergraduate students with simulation -kind of surgery activity for better understanding of surgical technique and to get the live feel of instruments used in that particular procedure.

Maxillofacial trauma is one of the cumbersome topics in Oral and maxillofacial surgery.

Moreover teaching an undergraduate and making it understandable on Surgical management technique of Zygomatico-Maxillary Complex (ZMC) fracture is not easy. Undergraduates have difficulty in understanding various aspects in zmc -topic starting from its complex anatomy to numerous surgical approaches as wells various surgical techniques like open & closed reduction etc (22).

After discussing with undergraduate students at the end of a conventional lecture class about all other surgical techniques of management of Zygomatico-Maxillary Complex (zmc) fracture. I decided to apply MILA teaching methodology for one specific surgical technique for better clarity and to avoid confusion.

I realised activity-based learning will make them imbibe the topic. I decided to proceed with Medical Imitation/(Simulation) Learning Activity (MILA) (whereas MIlA actually stands for MULTIPLE INTERACTIVE LEARNING ALGORITHM),for a specific topic namely " Gilles method of Closed Reduction of Zygomatic arch fracture" I utilised the" Simulated based learning" method in on a topic namely 'Gilles Temporal approach of reducing the zygomatic arch fracture (Fig-5)(23).

The protocol /steps included:-

I) Simulation of surgical technique step by step using routine materials or props available in our department or clinic namely as follows:-

a) Modelling dental wax sheet
b) Rubber dam
c) Adhesive tape
d) BP Handle no 3
e) BP blade no 15
f) Resin skull model with mandible articulated

II) After Simulation-activity being demonstrated to all undergraduate students, Students were divided, two groups. Where every one of either group actively participated and demonstrated at least one step of simulated surgical activity.

At the end of the activity, there was an overwhelming response from the students in both groups. Students in both groups felt a better understanding of the above topic because of simulated hand on surgical technique.

Overall, I believe teaching students by this method was found effective for teaching topic namely ”GILLES METHOD OF CLOSED REDUCTION OF ZYGOMATIC ARCH FRACTURE”. I believe if the same sort of activity-based learning method (i.e. like MILA) will improve students' learning aspects in maxillofacial surgery. As a faculty, I felt happy when those students were able to understand and respond correctly to questions being asked at the end of the lecture session.

The Learning Curve in My Carrier

During my post-graduation in omfs, Junior resident - (academics) (@MGPGI) was the designation given to me because, It was my routine schedule to teach undergraduate third and final year BDS where even all other specialities junior residents along with my self taught the conventional chalk and board with a PowerPoint presentation. After joining as a faculty in SIMATS my perspective towards teaching students has entirely changed.

I have learned a new methodology of teaching which can reach students easily and also students friendly. Hence I would rather say '' MILA" as a milestone in my teaching career.

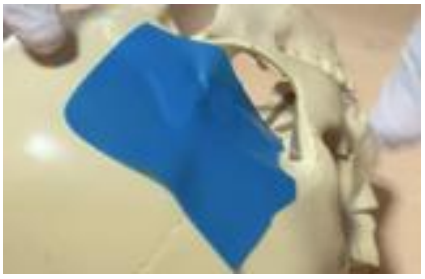
Future Perspective of Mila

Observation-based learning for undergraduate students in omfs curriculum - a promising future methodology of learning?!

Undergraduate, as well as Postgraduate in dentistry, learn and implicate their surgical skill only after observing as well as assisting surgical procedure done by faculty. Henceforth undergraduate especially while learning complicated or difficult maxillofacial surgery topic will be able to orient to the topic if those students observe cases related to the topic in operation theatre while being operated in operation theatre or through audiovisual -aid in classes itself in near future. During the internship, a student can observe and assist which is often super -exciting for student in maxillofacial surgery post-operative ward also preoperative surgical preparation to get an overall idea of how a patient is being as inpatient since most of the dental treatment is done as outpatient or day care basis only.(23,24)

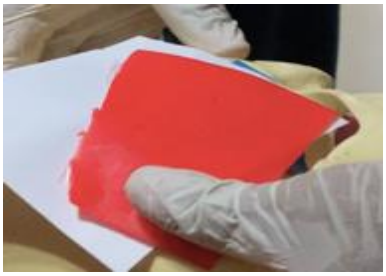
Figure-5: Picture showing stepwise (step-1 to 9) from incision to dissection of SCALP layer with final elevation of zygoma using rowe‘s elevator.

STEP 1



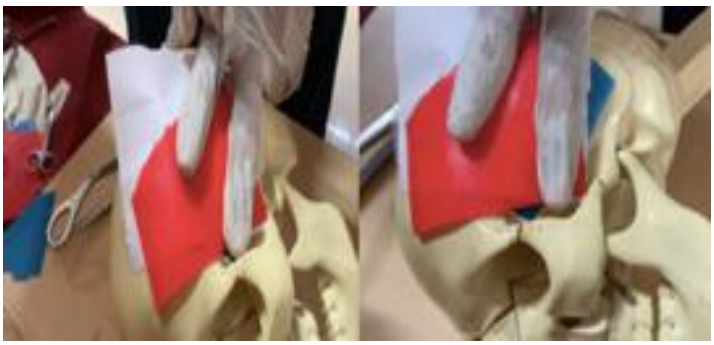
STEP 2

STEP 3



STEP 4

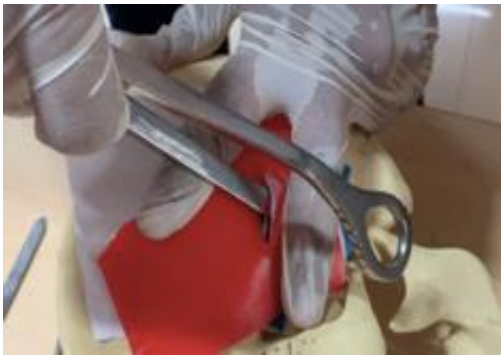
STEP 5



STEP 6

STEP 7

STEP 8



STEP 9

MILA in Teaching Orthognathic Surgeries

Orthognathic surgeries are usually one of the customary and routine procedures in the field of oral and maxillofacial surgery. Though it appears to be a difficult subject to understand and perform, knowledge on proper assessment, clinical judgement and skills can make it extremely simpler. Undergraduate students have difficulty in understanding the diagnosis of skeletal malocclusion and assessing using cephalometric analysis and choice of surgical procedure.

We in our institution teach students without box training. The protocol included preliminary flipped class teaching and textbook reading. This was followed by each student making diagnosis using cephalometric radiographs and the adjoining anatomical structures, including the second molar, mandible and inferior alveolar canal, Lingual nerve Then each of them were asked to make the cuts which are done in Bilateral sagittal split osteotomy. This was supervised and checked individually by the instructor. Following this, keeping an open textbook to cross check the classification of malocclusion and various maxillary and mandibular orthognathic procedures. Along with this the tracing of cephalometric and knowing predominant points to do better orthognathic results.

Having completed the above exercise, the discussion was now focussed on diagnosis and treatment planning. The decisions the student had to make were how to prepare the mock surgery models, to know interpretation of cephalometric radiographs and come to conclusive diagnosis of malocclusion, the choice of incision, the need for removal of third molar in case of bilateral sagittal split osteotomy, the pattern of bone cutting, the technique of bone splitting, plating system. Although the indications and classification can be consistent, diagnosis and treatment planning may have variations(14). Hence, the answers to the above questions were written out and again discussed with the faculty and explanations were given with reasoning.

When the theoretical concepts are well understood, hands-on pedagogy is implemented. Hands-on operations have been associated with the stages of developmental theory. When students are exposed to activities that engage the minds with concrete things and perform with hands, the knowledge provided becomes trustworthy and re emphasised with long lasting memory(5). Students are trained to feel and cut bone on cadaveric mandibles to simulate real patients.

The experience of bone cutting, bone splitting and plating and screw fixation on the natural or acrylic bone model gives the student an inner confidence and enhances their interest in the subject. There has been a dramatic increase in student understanding, case diagnosis and treatment planning. This is evident in their everyday clinical case judgements, answer papers and interest to explore their postgraduate colleagues acts in OT.

Overall, we believe teaching students by model surgeries with natural bone or STL models is effective for teaching orthognathic surgery and most surgical procedures.

CONCLUSION

This approach of teaching students is found to be very effective in understanding very difficult topics. Small group teaching helps in concentrating on each and every individual and students are less distracted, whereas lecturing to larger groups makes it difficult to concentrate on students with less receptive skills. MILA provides an equal opportunity for all students to take part in the discussion which is also coupled with activity which will make lecture classes more of an interactive session rather than being uneventful.

BIBILOGRAPHY

[1] Burdurlu MÇ, Cabbar F, Dağaşan V, Çukurova ZG, Doğanay Ö, Yalçin Ülker GM, et al. A city-wide survey of dental students 'opinions on undergraduate oral surgery teaching. Eur J Dent Educ. 2020 May; 24(2): 351–360.

[2] Pippi R. Evaluation capability of surgical difficulty in the extraction of impacted mandibular third molars: a retrospective study from a post-graduate institution [Internet]. Annali di Stomatologia. 2014. http://dx.doi.org/10.11138/ads/2014.5.1.007

[3] Susarla SM, Dodson TB. How well do clinicians estimate third molar extraction difficulty? J Oral Maxillofac Surg. 2005 Feb; 63(2): 191–199.

[4] Ali K, McCarthy A, Robbins J, Heffernan E, Coombes L. Management of impacted wisdom teeth: teaching of undergraduate students in UK dental schools. Eur J Dent Educ. 2014 Aug; 18(3): 135–141.

[5] Kyere J. Effectiveness of Hands-on Pedagogy in STEM Education. Walden Dissertations and Doctoral Studies. 2017;

[6] Lee JS, Graham R, Bassiur JP, Lichtenthal RM. Evaluation of a Local Anesthesia Simulation Model with Dental Students as Novice Clinicians. J Dent Educ. 2015 Dec; 79(12): 1411–1417.

[7] Prince M. Does Active Learning Work? A Review of the Research [Internet]. Vol. 93, Journal of Engineering Education. 2004. p. 223–31. http://dx.doi.org/10.1002/j.2168-9830.2004.tb00809.x

[8] Zappe S, Leicht R, Messner J, Litzinger T, Lee HW. "Flipping" The Classroom To Explore Active Learning In A Large Undergraduate Course [Internet]. 2009 Annual Conference & Exposition Proceedings. http://dx.doi.org/10.18260/1-2--4545

[9] Dollar A, Ulseth R, Steif P. Blending Interactive Courseware into Statics Courses and Assessing the Outcome at Different Institutions [Internet]. 2011 ASEE Annual Conference & Exposition Proceedings. http://dx.doi.org/10.18260/1-2--17572

[10] Bowe CM, Voss J, Thomas Aretz H. Case method teaching: an effective approach to integrate the basic and clinical sciences in the preclinical medical curriculum. Med Teach. 2009 Sep; 31(9): 834–841.

[11] Parmelee DX, Hudes P. Team-based learning: A relevant strategy in health professionals 'education [Internet]. Vol. 34, Medical Teacher. 2012. p. 411–3. http://dx.doi.org/10.3109/0142159x.2012.643267

[12] McCoy L, Pettit RK, Kellar C, Morgan C. Tracking Active Learning in the Medical School Curriculum: A Learning-Centered Approach [Internet]. Vol. 5, Journal of Medical Education and Curricular Development. 2018. p. 238212051876513. http://dx.doi.org/10.1177/2382120518765135

[13] Fidele NB, Yifang Z, Liu B. The Changing landscape in treatment of cystic lesions of the jaws [Internet]. Vol. 9, Journal of International Society of Preventive and Community Dentistry. 2019. p. 328. http://dx.doi.org/10.4103/jispcd.jispcd_180_19

[14] Hill JMD, Ray CK, Blair JRS, Carver CA. Puzzles and games [Internet]. Vol. 35, ACM SIGCSE Bulletin. 2003. p. 182–6. http://dx.doi.org/10.1145/792548.611964

[15] Iwanaga J, Watanabe K, Anand MK, Tubbs RS. Air dissection of the spaces of the head and neck: A new teaching and dissection method. Clin Anat. 2020 Mar; 33(2): 207–213.

[16] Leung DYP, Kember D. The Influence of Teaching Approach and Teacher-Student Interaction on the Development of Graduate Capabilities [Internet]. Vol. 13, Structural Equation Modeling: A Multidisciplinary Journal. 2006. p. 264–86. http://dx.doi.org/10.1207/s15328007sem1302_6

[17] Kember D. Promoting student-centred forms of learning across an entire university [Internet]. Vol. 58, Higher Education. 2009. p. 1–13. http://dx.doi.org/10.1007/s10734-008-9177-6

[18] Lammers WJ, Murphy JJ. A Profile of Teaching Techniques Used in the University Classroom [Internet]. Vol. 3, Active Learning in Higher Education. 2002. p. 54–67. http://dx.doi.org/10.1177/1469787402003001005

[19] Kember D, Leung DYP, Kwan KP. Does the Use of Student Feedback Questionnaires Improve the Overall Quality of Teaching? [Internet]. Vol. 27, Assessment & Evaluation in Higher Education. 2002. p. 411–25. http://dx.doi.org/10.1080/0260293022000009294

[20] Stacey DH, Heath Stacey D, Doyle JF, Mount DL, Snyder MC, Gutowski KA. Management of Mandible Fractures [Internet]. Vol. 117, Plastic and Reconstructive Surgery. 2006. p. 48e – 60e. http://dx.doi.org/10.1097/01.prs.0000209392.85221.0b

[21] Milne S, Walshaw EG, Webster A, Mannion CJ. Active learning in head and neck trauma: Outcomes after an innovative educational course. Br J Oral Maxillofac Surg [Internet]. 2020 Jul 2; http://dx.doi.org/10.1016/j.bjoms.2020.05.003

[22] İlgüy D, İlgüy M, Dölekoğlu ZS, Ersan N, Fişekçioğlu E. Evaluation of radiological anatomy knowledge among dental students [Internet]. Vol. 13, Yeditepe Dental Journal. 2017. p. 31–6. http://dx.doi.org/10.5505/yeditepe.2017.49140

[23] Sweeney WB. Teaching surgery to medical students. Clin Colon Rectal Surg. 2012 Sep; 25(3): 127–133.

[24] Agha RA, Papanikitas A, Baum M, Benjamin IS. The teaching of surgery in the undergraduate curriculum. Part II – Importance and recommendations for change [Internet]. Vol. 3, International Journal of Surgery. 2005. p. 151–157. http://dx.doi.org/10.1016/j.ijsu.2005.03.016