International Journal of Medical and Health Research

Volume: 1, Issue: 2, 09-14
Sep 2015
www.medicalsjournals.com
ISSN: 2454-9142

Rajeev Saxena
Professor & Head, Reader, Department of General Pathology & Microbiology, Sinhgad Dental College & Hospital, Pune, Maharashtra

Chinmay Shah
Associate Professor, Department of Physiology, Government Medical College, Bhavnagar, Gujarat, India.

Savita Ladkat
Lecturer, Reader, Department of General Pathology & Microbiology, Sinhgad Dental College & Hospital, Pune, Maharashtra

Mukhit Kazi
Lecturer, Reader, Department of General Pathology & Microbiology, Sinhgad Dental College & Hospital, Pune, Maharashtra

Ashwini Bhosale
Lecturer, Reader, Department of General Pathology & Microbiology, Sinhgad Dental College & Hospital, Pune, Maharashtra

D Panchwadkar
Lecturer, Reader, Department of General Pathology & Microbiology, Sinhgad Dental College & Hospital, Pune, Maharashtra

S Diwanay
Lecturer, Reader, Department of General Pathology & Microbiology, Sinhgad Dental College & Hospital, Pune, Maharashtra

Correspondence
Rajeev Saxena
Professor & Head, Reader, Department of General Pathology & Microbiology, Sinhgad Dental College & Hospital, Pune, Maharashtra

Improving learning through Innovative "LIMCA" technique

Rajeev Saxena, Chinmay Shah, Savita Ladkat, Mukhit Kazi, Ashwini Bhosale, D Panchwadkar, S Diwanay

Abstract
Professional education is an ever changing process. It becomes very important to change old and traditional mind set of health profession educationists to make Health professional education effective and relevant to the health need of the society.
However, the old and traditional teacher centric classes with didactic monotonous lectures are not able to hold the students interest and develop their creativity. Hence it becomes utmost necessary that classroom atmosphere and teaching techniques should evolve with the changing times. LIMCA is a unique innovation. It is superior & consistent with well-known Principles of instructions & learning theories. It is applicable in every teaching module that is practical as well as theory. It is the possible solution for problems in current teaching/ learning process.

Key Words: LIMCA (Learning Interactively: Memory -tree Creativity Approach), Interactive, Student, Learning

1. Introduction
Professional education is an ever changing dynamic process. It becomes very imperative that the old and a traditional mindset of health profession educationists undergoes a sea change, making education effective and relevant to the health goals of the country and thereby improving the quality of human life.
However, the old and traditional teacher-centric classes with didactic monotonous lectures are not able to hold the students interest and develop their creativity. Besides the vast curriculum, piling of new information on everyday basis becomes an added burden. Hence it becomes utmost necessary that classroom atmosphere and teaching techniques should evolve with the changing times. Lectures need to be more interactive. Teaching should be such that it develops a sense of motivation and interest in the students for the subject besides creating a stress free and relaxed environment.
Further, with the advent of the internet revolution, there has been an information boom. Too much information is easily accessible and available at the click of a button. The question is how much of it is relevant and required. Here, the role of the teacher plays a more crucial role in deciding what to teach, how much to teach and how to transfer this knowledge in an interactive & problem solving manner. The teacher should be very effective in making a clear demarcation between "Must know area", "desirable to know area" and " good to know area" and teach students accordingly as this knowledge and skills taught is going to be applied for the well being of the patients in the future. Knowledge transfer should be in intensive and exhaustive manner in the "you must know area" and "desirable to know area". This will help students to focus on their curricula from the perspective of achieving national health goals.
In such a scenario, time spent in the classroom becomes the most crucial for learning and understanding the subjects with a view to its applied value in future.
We propose a technique to improve the teaching-learning process. LIMCA (Learning Interactively: Memory -tree Creativity Approach).
The emphasis of this technique will be on interaction and involvement in the creativity of teacher and learner when the memory-tree is being formed. Further, this technique will facilitate in-depth learning in a stress free environment of the class. Moreover, the visual impression will aid in learning with understanding and retention of the knowledge for a longer

duration. It will be easier for them to revise the topic taught in a very short duration with good time management. This will improve the attendance of students in the classroom, physical as well as mental. This technique will help in bringing the focus of students to "must know the area" as well as "specific learning objectives" in accordance with the national health goals. Standardized teaching and learning process should give priority to specific learning objectives. Faculty will be well trained in this technique. They should determine clear learning objectives for the session. Teachers must decide what experiences should be provided to assist students to achieve those objectives and when the students have achieved the objectives, immediate assessment and feedback on performance are very effective components of teaching.

They will be more focused to teach "You must know" and "desirable to know area" and will be able to conduct their lectures in an interactive, interesting and methodical manner adhering to the principles of standardized teaching. This technique becomes all the more significant in this information boom era. Firstly the teacher needs to be very clear about what to teach and how much to teach." Many studies have found correlations between *teacher clarity*& learning outcomes. He has to be highly selective as per the need of the students. In lecturing clarity will be promoted particularly through use of language such as accurate definitions, precise vocabulary, straight forward sentences, fluent speech & avoidance of vagueness, false starts, incomplete sentences or excessive qualifications." Unnecessary overloading of the students can be curbed to a great extent by this technique. Consequently, attendance and performance of students will improve. Performance students in internal as well as external examination of the university will improve and can be gauged by any outsider. By the end of the teaching session, students will be more focussed on "What's to be read" (you must know the area) and how to retain important aspects of the subject, they will be motivated to prepare their own notes in the same manner for better understanding. Teaching will be more interactive, focused, systematic and methodical. Putting in a nutshell, learning will be standardized as per specific learning objectives, good time management & relaxed environment. The teacher has to necessarily consider the aspects like "Motivation, Attention, Incorporation" [1, 2, 3, 4].

Solution: Improving learning through 'LIMCA' technique–'**Learning Interactively: Memory-tree Creativity Approach'.**

The emphasis of this technique will be on interaction and involving the creativity of teacher and learner with the memory-tree. This technique would facilitate in-depth learning in a stress- free environment. Teachers would be more focussed to teach "You must know" and "desirable to know area" and would be able to conduct their lectures in an interactive, interesting and methodical manner adhering to the principles of standardized teaching. This technique becomes all the more significant in this information boom era. The teacher would be very clear about 'what to teach' and 'how much to teach'. "Many studies have found correlations between teacher clarity& learning outcomes. He has to be highly selective as per the need of the students. In lecturing, clarity will be promoted particularly through use of language such as accurate definitions, precise vocabulary, straight forward sentences, fluent speech & avoidance of vagueness, false starts, incomplete sentences or excessive qualifications." Unnecessary overloading of the students can be curbed to a great extent by this technique. Teaching would be more interactive, focused, systematic and methodical. Putting in a nutshell, teaching will be standardized as per specific learning objectives.

At the end of the teaching period, students would be more focussed on "What is to be read" (you must know the area) and to retain the most essential aspects of the subject. They would be motivated to prepare their own notes for better understanding. They would be very clear as to how much time to devote on a particular topic depending on its importance level. Thus, this clarity in learning would inculcate proper time management skills in students besides reducing their stress level to a great extent. Consequently, attendance in class and performance in internals and final examination would improve.

Overview of Limca: LIMCA technique is a constructive diagrammatic model just like a *blue print* of an engineering project, where all things are systematically planned & organised covering all aspects of desired outcomes.

Visual impression, colours and mnemonics would aid in learning with understanding and quick revision. It would be easier for students to revise and retrieve the information as and when required. This will help to improve the mental attentiveness of students in the classroom. This technique consists of following six phases:-

1. Introduction of subject co-relating it with real world problems.
2. Gaining attention through brain storming.
3. Development and demonstration of memory–tree with interaction (representing Specific learning objectives). Supported by a specific, pleasant and soft music in the background.
4. Formation of small groups for discussion &developing their own memory – tree and submission to the teacher after class.
5. Demonstration of real life problems related to the topic taught with the help of role play / electronic media etc.
6. Giving Assignments to find the solution of the problem with the help of Memory-tree and submission.

The teacher will develop a Memory-Tree with active interaction of students. Each part of the tree will represent different areas of learning with regard to the curriculum. The seed site will represent pre-existing knowledge of students (Fig.1) and the roots will represent "you must know area" (Fig.2). A fresh lecture will begin from the seed site. Beginning from the pre-existing knowledge ensures that the basic knowledge of the students is sound and strong before they proceed to the more complex ones. The trunk and branches of the Memory- Tree will represent "desirable to know area". A Memory-tree will be formed to simplify the learning process by giving numbers, mnemonics and colour combinations which can be co-related and elaborated by students easily.

Fig 1: Seed Germination site represents Pre- Existing Knowledge, It is grown by Brain Storming and Interaction

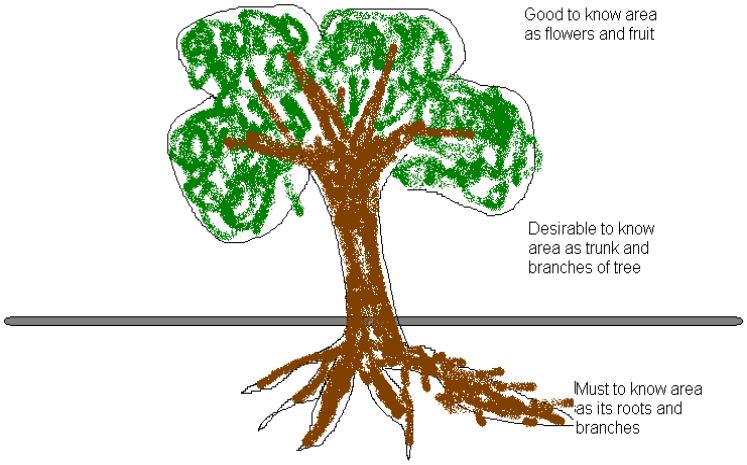

Fig 2: Representing specific learning objectives of the topic with LIMCA Memory-Tree

Coloured Symbols and images will be used for retention of the subject for longer duration. Multiple colours will be used for visual memory emphasis and learning associations. For instance, in Microbiology, Gram positive bacteria retain violet colour on gram-staining. Gram negative bacteria retain pinkish colour on gram-staining. While teaching Gram positive bacteria, the tree will be colour violet and while teaching Gram negative bacteria, the tree will be colour pink. This visual correlation will leave a long lasting impression in the minds of students, thereby facilitating in proper diagnosis and treatment of ailment.

A soft back ground music will make the environment relaxed and conducive for learning. Faculty will co-ordinate and co-operate in developing a standard Memory-tree, keeping in view the integrated teaching curriculum for all topics and display it on computer library so as to enable students to use and modify it, and thereafter, use it as and when required. Parts of the memory tree will be taught by different faculty as per specialisation thereby enabling the student to integrate the topic by himself on his e-media. This material saved on e-media will become a ready-reckoner. This will help students in revising the subject anywhere and anytime besides sharing and discussing about it with friends and in the long run in his professional life. This would help the students in learning and absorbing the topics learnt, deep into their memory in a very relaxed and playful manner. As a consequence, the application of knowledge and skills learnt will be more effective during real life exposure. (Table 1)

Leadership Role in Implementation of "Limca" In College:

I applied the "LIMCA" technique for teaching two theory topics of Microbiology for students of second year BDS. The results and feedback of the students were quite encouraging.

Steps for LIMCA pilot project:

1) Permission from competent authorities and written informed consent from participants.
2) Two groups will be formed randomly comprising of minimum thirty participants in each group of 2nd year BDS students in Microbiology.
3) One group will be taught using LIMCA technique as explained above and the other control group will be taught in regular method.
4) Feedback form filled by students on Grading scale: poor =1, fair=2, average=3, good=4, excellent=5 for different variables, eg. comfort level, perception, interest, learning etc will be used for statistical analysis (Qualitative).
5) Assessment of performance of students by Pre & Post test results. The test will comprise Thirty Multiple Choice Questions (MCQs') will be given to both groups.

Table 1: LIMCA technique APPLICATION in "Grey areas in teaching- learning process where intervention is needed.

Specific learning objective	Learning objectives are necessary to create interest, increase attentiveness as well as create a level of expectancy for learning
Collective Learning by group formation	'Limca' technique provides for forming small groups to form memory-tree. It enhances learning capabilities.
Understanding the learner's Creativity	During a creativity session, the learner uses left and right side of the brain. It enhances attention span and gives an opportunity for reflection.
Teacher as motivator	Teacher should help students for developing his own learning style and motivate them by giving feedback on assignments to improve further.
How to tackle knowledge decay	In LIMCA technique, on completion of a module, students are given assignments to develop their own memory-tree. This will give them an opportunity for self-assessment, thereby reducing the knowledge decay.
Relaxed environment	Role of the teacher to make the learning environment conducive to the learner to better learning with understanding. Background music will help.

Instruction and Integration of Learning Theory

Discussion: LIMCA technique is superior to a concept map as the latter is a diagram showing the relationships among concepts. It is a graphical tool for organizing and representing knowledge. However, in LIMCA technique, pre-existing knowledge is the starting point on which the roots and the tree trunk and branches are developed in a systematic and methodical manner. This is more convenient to facilitate learning with understanding.

Joseph D. Novak & Alberto J. Cañas, in their model of concept maps, have explained that Concepts, usually represented as boxes or circles, are connected with labeled arrows in a downward-branching hierarchical structure [6].

There is research evidence that knowledge is stored in the brain in the form of productions (situation-response conditionals) that act on declarative memory content which is also referred to as chunks or propositions [7, 8]. Concept Maps are also having certain characteristics of the mind map. A mind map is often created around a single word or text, placed in the centre, to which associated ideas, words and concepts are added [9].

Table 2: "LIMCA" technique with reference to Gnane's "Conditions of learning theory" [13]

"LIMCA" technique	Gnane's "Conditions of learning theory"
Introduction with real world problems.	**Gain attention of students through interesting discussion which is oriented to assessment, patient practice, ethical issue and personal issue. Stimulate recall of pre-existing knowledge and experience**.
Gaining attention through brain storming. In Memory-tree, seed site will represent pre-existing knowledge of students.	
Development and demonstration of memory –tree (representing Specific learning objectives)	Inform learners of the objective Present the contents
Formation of small groups for discussion & developing their own memory – tree & submission to the teacher after class.	Providing feedback to learners Performance assessment
Demonstration of real life problems related to the topic covered with the help of role play scenario / electronic media etc.	Provide learner guidance
Assignment will be given to find the solution with the help of memory-tree& submission.	Elicit performance Providing feedback to learners Retention of information and transfer in solving problem.

Table 3: "LIMCA" technique with reference to Principles of Instructions of M.D. Merill [16].

"LIMCA" technique	Principles of Instructions of M.D. Merill
Introduction with real world problems.	Principle 1- Problem- centered: Learning is promoted when learners are engaged in solving real world problems.
Gaining attention through brain storming. In Memory-tree, seed site will represent pre-existing knowledge of students.	Principle 2 – Activation: Learning is promoted when relevant previous experience is activated
Development and demonstration of memory –tree (representing Specific learning objectives)	Principle 3 – Demonstration (Show me):
Formation of small groups for discussion & developing their own memory – tree & submission to the teacher after class.	Principle 1- Problem- centered Principle 4 –Application (let me)
Demonstration of real life problems related to the topic covered with the help of role play scenario / electronic media etc.	Principle 1- Problem- centered
Assignment will be given to find the solution with the help of memory-tree & submission.	Principle 1- Problem- centered Principle 4 - Application (let me) Principle 5 - Integration

Problems in presentation of current teaching system

- Student has to imagine the concept
- Link of first point to the last point is distracted and decaying of knowledge is there by that time.
- Revision of topic is not possible at a glance.
- Emphasis of importance, i.e., Must know zone is not made out.

LIMCA Technique has good scope for assessment – reinforce the competence & potential to inspire learning, development of values & reassure the public [12]. It may be seen that Gnane's "Conditions of learning theory" [13] is inherent in this technique. (Table 2) as well as First Principles of instructions of M. D. Merrill. (Table 3).

Gnane's "Conditions of learning theory consists of

1. *Gain attention* -is facilitated by brain- storming & introduction with real world problems (LIMCA)
2. *Inform learners of the objectives*: This creates the level of expectancy for learner (must know area and desirable to know the area)
3. *Stimulate recall of prior learning* by asking questions and discussions in groups. This helps in retrieving the pre-existing knowledge (seed germinating site in LIMCA)
4. *Present the contents*. It is explained with the help of a memory tree in LIMCA.
5. *Provide Learner's guidance*

6. *Elicit Performance (practice)*
7. *Providing feedback to learners* In LIMCA this is achieved by:
- Reinforcement and assessment of correct performance
- The teacher will get immediate feedback about his lecture from the Memory – tree developed by the students
- Teacher and students can analyse and improve themselves.
- Help in collaborative learning and ideal group formation of a very creative group leader with other students
- Individual counselling for slow learners & other students.
- Timely intervention is possible for students, better performance to achieve the desired benchmark.

1. *Performance assessment:* In LIMCA also it is applied as follows-
- Timely assessment is possible with LIMCA. No time lag between teaching and assessing performance of the teacher and students.

Problems in Present teaching system is long time-interval of 3-6 months between teaching and internal assessment performance of the teacher and students.

2. *Retention of information and transfer to job:* In LIMCA there is Problem Based Learning (PBL) [14] that has an effect on cognitive: knowledge & cognitive: problem solving.
- Real life problem based learning with a role model scenario in alignment with must know areas is the great tool.
- Video – real life problems
- Finding the solution for the problem.
- Submit the assignment after completion of the module.

Further steps of LIMCA are as follows:
- After summarization of the topic the groups will be formed (5 to 10 students /group)
- With recalling and discussion, each student has to build-up their own Memory tree in a time schedule of 5 to 10 minutes.
- They would be free to make changes and incorporate their own ideas in their Memory – tree by their own learning style.

Advantages of LIMCA technique:
1. Interaction of students
2. Recalling the knowledge gained, there by memory improvement
3. Freedom of learning with understanding and memorising technique
4. Immediate self-assessment of memory retention and reproducibility.
5. Scope for reflection and metacognition and creativity.

After review of the other learning techniques and educational methods[10] a wide range of objectives mentioned below are also achieve in LIMCA technique.
- Cognitive: Knowledge
- Cognitive: Problem solving
- Affective: Attitudinal
- Psychomotor: Skills or competency
- Psychomotor: Behavioural or performance

LIMCA is superior to established teaching techniques as per following advantages-
- Bird's eye view of topic always in front of them.
- Natural flow of understanding from source to end.
- Complete idea of topics with priorities from seed to apex branches.
- Basic framework for the future new knowledge building.
- Revision and retention are very easy.
- Can be made available for electronic media and distant learning.

Barriers of Limca
- Teachers should be highly motivated for change.
- Administrative support
- Good ratio of teacher: student
- Infrastructure like electronic media support

Summary

LIMCA is a unique innovation. It is superior & consistent with well-known Principles of instructions & learning theories. It is applicable in every teaching module that is practical as well as theory. It is the possible solution for problems in current teaching/ learning process. (Table 4). "Whichever method you decide to use to achieve the learning objectives which you have defined, always plan the session to ensure that there are activities which will arouse motivation, guide students, attention to the important material and allow time and opportunity for reflection[11], application and practice".

Table 4: Problems and their solutions by "LIMCA" Technique

Problem	Possible solutions
Retention of knowledge, retrieval of knowledge	Brain storming and problem based learning,
Decaying of knowledge	Giving assignments and projects for reinforcement.
Lack of reflection and metacognition	Group discussion and exposure to real world problem.
Poor performance in examination	Counselling and mentorship.
Absence of integrated learning	Integrated curriculum to be implemented / motivate students to integrate learning at a personal level.
Standardized teaching and assessment	Teachers to be trained in Learning Principles and Instructional designing.
Teacher lacking clarity of thoughts about objectivity	Teachers to be trained to know the importance of Specific learning objectives.

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