Innovative Teaching Learning Methodologies By Ashwani Dhingra

Education is a very powerful instrument for social change and transformation. Students must be empowered to be able to withstand the global challenges of the 21st century. The problems which society faces are essentially the problems of educational institutions which are required to be innovative as they teach new skills and develop new insights and approaches towards the solving of social problems which the nation faces. Therefore, innovative teaching learning practice is the only way to enhance the quality of our education system. The purpose of this paper is to explain various innovative teaching learning methodologies and to evaluate the usefulness of these methods over traditional methods of teaching. Education is the process of facilitating learning, or the acquisition of knowledge, skills, values, beliefs and habits. Educational methods include storytelling, discussion, teaching, training and directed research. Education frequently takes place under the guidance of educators, but sometimes learners may also educate themselves [1].

However, teaching must include two major components i.e. sending and receiving information. Teachers may provide instruction in literacy and numeracy, craftsmanship or vocational training, arts, religion, civics, community roles, or life skills. Formal teaching tasks include preparing lessons according to agreed curriculum, giving lessons and assessing pupil progress. Ultimately, a teacher tries his best to impart knowledge as the way he understood it. So, any communication methods that serve this purpose without destroying the objective could be considered as innovative methods of teaching. The use of innovative methods in educational institutions has the potential not only to improve education, but also to empower people, strengthen governance and galvanize the effort to achieve the human development goal for the country. Thus, the learning mode tends to be passive and the learners play little part in their learning process [2]. Literature survey reveals that effective teaching and learning strategies highlight the importance of

a) Using appropriate just-in-time learning stimuli

b) Engaging students’ preconceptions prior to teaching them new concepts

c) Providing deep foundational knowledge
d) Helping students make appropriate connections within the context of a conceptual framework

e) Organizing knowledge in ways that facilitate information retrieval and application

f) Allowing students more opportunities to define learning goals and monitor their progress in achieving them [3-4].

Instructors often start a course by presenting totally new material without putting it in any context. They make no attempt to relate the material to things students already know about from their own experience or from prior courses, nor do they preview how it will be needed to solve problems of the types the students will encounter later in the curriculum or in professional practice. Begin teaching each course and each new topic within it by describing the physical and chemical phenomena to be studied and the types of problems to be solved, if possible using examples familiar to the students. A good way to begin is to divide the class into groups of three or four and have the groups generate as many examples as they can think of in a brief period of time, adding your own to supplement whatever they come up with.
Innovative teaching methodologies include developing the capability of students to use ideas and information, testing of ideas and evidence, generation of new ideas and evidence, facilitation of personal development and development of a student’s capacity to plan and manage their learning experience.

**Innovative Teaching Learning Methodology:**

1. **Information and Communication Technologies (ICT) Tools:**

In recent decades, the use of information and communication technologies (ICT) for educational purposes has increased, and the spread of network technologies has caused e-learning practices to evolve significantly. The evolution of distance education, as a result of new technologies and the contributions of computer scientists to the field of education along with the conceptualization of education as a lifelong process, poses a major challenge for educational institutions: How to integrate these technologies into their organization and especially, into their teaching. From simple occasional use of ICT to reinforce face-to-face teaching and learning to the use of virtual environments for courses conducted completely online. **E-learning** could be considered a natural evolution of distance learning, which has always taken advantage of the latest tools to emerge in the context of technologies for structuring education.

There are many different definitions for the term **e-learning:**

- E-Learning can be defined as learning facilitated and supported through the use of information and communications technology. It can cover a spectrum of activities from the use of technology to support learning as part of a blended approach (a combination of traditional and e-learning approaches), to learning that is delivered entirely online. Whatever the technology, however, learning is the vital element.

- E-learning is electronic learning, and typically this means using a computer to deliver part, or all of a course whether it's in a school, part of your mandatory business training or a full distance learning course.

- E-learning includes numerous types of media that deliver text, audio, images, animation, and streaming video, and includes technology applications and processes such as audio or video
tape, satellite TV, CD-ROM, and computer-based learning, as well as local intranet/extranet and web-based learning.

**M-Learning (Mobile learning):**

M-Learning means using mobile devices including mobile phones and other handheld devices to facilitate teaching and learning. M-learning is one of the latest developments in e-learning, which takes advantage of mobile devices for learning on accessible portable platforms, ideal for people on the go or for taking your training away when you can’t access a regular computer. The term has more recently been adopted for the use of e-learning on mobile device platforms, meaning smart phones and tablets like the iPad or Samsung Galaxy. In particular, younger generations are growing up using mobile devices to access the Internet and complete tasks as part of their school and college work. Using a mobile device to deliver training means those learners can learn anywhere they have their phone available, so they’re not restricted to an office computer if resources are tight.

Therefore, use of ICT tools while teaching is one of the mandatory requirements to enhance the quality of our education system. These communication tools can also be divided into two categories *i.e.* synchronous and asynchronous. Synchronous tools include skype, google talk, yahoo messenger etc. whereas asynchronous tools include E-mail, Youtube, audiographics, blogs etc. Apart from this, there should be availability of smart classroom for teaching which constitute audio/visual facilities for PPT presentations in addition to WI-FI internet facility for sharing on line content with the students. However, the use of information and communication technologies (ICT) in our life and for educational purposes has increased, and the spread of network technologies has caused e-learning practices to evolve significantly. The knowledge can be passed on to students in many ways (*e.g.*: by online lectures/courses, videoconferences, electronic mailing lists). Undergraduate learners usually prefer the simplest forms of e-learning. They expect teachers to send them texts and lectures or exercises to do by email. The materials need to be short and brief and clear, easy to understand. But that is just very small aspect of e-learning method. Some of the students take advantage of greater possibilities, which e-learning can give, *e.g.* online courses and resources available online at the e-learning platform.
2. Library of learning material-Intranet facility:

A common facility for all learners must be generated for learning purpose which contains all PPT presentations of lectures delivered by teacher, you tube videos of outside experts on the concerned topics of the curriculum, pdf, scan copy of lecture notes, MCQs and other learning material. There should be availability of feedback forms on the computer for any suggestion to any learning content. Therefore the learners can access the available leaning content posted by eminent senior teachers and prepare themselves for open discussion and suggestions thereof. In addition, the guide has been prepared by teachers and its recipients were to be other educators, future creators of e-learning courses. It aims at facilitating and improving work of a teacher having the idea for an Internet course and the necessary preparation and providing the sufficient and adequate content-related materials. The guide takes a form of a short study that includes indispensable directions, advices and practical suggestions how to work step by step, making use of the moodle platform.

3. Innovative teaching learning methodologies:

- Mind Map:

The term mindmap was first of all coined by British psychology author Tony Buzan. A mind map is a diagram used to visually organize information i.e. drawing information in diagrams, instead of writing it in sentences. It is hierarchical and shows relationship among pieces of the whole [5]. Both Figure 1 and 2 are the example of mindmap which represents the possible mechanism of action (MAO) of antibiotics as antibacterial and role of ACE inhibitors in hypertension respectively. Mindmap can be drawn by hand, either as rough notes, during a lecture, meeting or planning session. These pictorial methods record knowledge and model systems, and have a long history of learning, brainstorming, visual thinking and problem solving parameters of educators. The nonlinear nature of mind maps makes it easy to link and cross-reference different elements of the map.
**Figure 1:** Mechanism of action of antibiotics.

**Figure 2:** Renin-angiotensin-aldosterone system

- **DNA gyrase**
  - Quinolones
  - Nalidixic acid
  - Ciprofloxacin
  - Novobiocin
- **DNA-directed RNA polymerase**
  - Rifampin
  - Streptovaricins
- **Protein synthesis (50S inhibitors)**
  - Erythromycin (macrolides)
  - Chloramphenicol
  - Clindamycin
  - Lincomycin
- **Protein synthesis (30S inhibitors)**
  - Tetracyclines
  - Spectinomycin
  - Streptomycin
  - Gentamicin
  - Kanamycin
  - Amikacin
  - Nitrofurans
- **Folate acid metabolism**
  - Trimethoprim
  - Sulfonamides
- **Cell wall synthesis**
  - Cycloserine
  - Vancomycin
  - Bacitracin
  - Penicillins
  - Cephalosporins
  - Monobactams
  - Carbapenems
- **Cytoplasmic membrane structure**
  - Polymyxins
  - Daptomycin
- **DNA**
  - THF
  - mRNA
  - DHF
  - Ribosomes
- **PABA**
  - Cytoplasmic membrane
  - Cell wall

**Legend**
- **Secretion from an organ**
- **Stimulatory signal**
- **Inhibitory signal**
- **Receptor**
- **Active transport**
- **Passive transport**

**Water and salt retention. Effective circulating volume increases. Perfusion of the juxtaglomerular apparatus increases.**
Mind maps are much quicker to make and much easier to remember and review because of their visual quality. **Figure 3** is another example of mindmap which represents the addition and oxidative cleavage reactions of alkenes.

![Mind map diagram](image)

**Figure 3**: Addition and oxidative cleavage reactions of alkenes.

- **Flow Chart:**
  
  Flowchart is a type of diagram that represents an algorithm, workflow or process illustrating a solution to a given problem. The steps in a flow chart are shown in different shapes depending on its purpose. They are connected with an arrow. Flowcharts are used in analyzing, designing, documenting, or managing a process or program in various fields like IT programming, engineering, pharmacy etc. **Figure 4** and **5** represents the flowchart showing typical components of HPLC and working of flame emission spectroscopy respectively.
**Figure 4:** Flow chart showing typical components of HPLC

**Figure 5:** Flow chart showing working of flame emission spectroscopy
• **Z to A Approach:**

This approach attempts to explain the application part of a particular concept first. The teacher must explain the application of a particular concept first and explain the effects of such applications. For example in pharmacy field if anyone wants to teach medicinal chemistry he/she should explain the role of medicinal chemistry/chemist in drug discovery process. Medicinal chemistry provides pharmacy students with a thorough understanding of drug’s mechanism of action (MAO), structure-activity relationships (SAR), acid-base and physicochemical properties, absorption, distribution, metabolism, excretion, and toxicity (ADMET) profiles. A comprehensive understanding of the chemical basis of drug action equips pharmacy students with the ability to answer rationally the “why” and “how” questions related to drug action and it sets the pharmacist apart as the chemical expert among health care professionals [6].

In addition, the educator must provide the scopes and importance of medicinal chemistry in pharmacy. There are two intellectual domains of medicinal chemistry that are of value in pharmacy are drug design/development and ADMET (absorption, distribution, metabolism, excretion and toxicity) assessments. Interpretation of MOA at the molecular level and construction of SAR of drug molecules or biologically active compounds are important scopes of the drug design and discovery domains, which in turn are vital facets of medicinal chemistry. Additionally, ADMET assessments of therapeutic drug classes that have a significant influence on therapeutic decision making are essential components of pharmacy education. With current emphasis on intense clinical training, pharmacists should also are equipped with skills to evaluate scientific literature and develop evidence-based patient-specific pharmacotherapy plans. Thus, by offering a sound knowledge base of the chemical basis of drug action, its stability, SAR, MOA, pharmacology, ADMET, medicinal chemistry instills critical-thinking and problem-solving skills in students that are essential for developing a competent pharmacist.

• **Model- and analysis-oriented teaching:**

This method includes the use of models while teaching. This method is very useful for better understanding the concept or principle involved in a particular technique or instrument. For example Usage of ball and stick models for teaching stereochemistry of organic compounds may enhance the understanding of the students about the shape and structure of the particular compounds.
• The flipped classroom teaching:

Flipping a class means designing lessons such that a student learns content listening to lectures at home. This strategy allows more active engagement with students in the classroom. Classroom time is reserved for content application. This practice leads to increased faculty and student satisfaction, and at the same time results in meaningful and long lasting learning. However, most of us would love to have more time in the classroom, doing group projects, lab activities, extension activities that really allow our students to move from hearing content to mastering content. Well, across the nation, many educators have taken this challenge upon themselves. To know more about flip classroom you can visit on the links provided: https://www.youtube.com/watch?v=se0Ia8IcWtY, https://www.youtube.com/watch?v=csfkQ24Mq8M&list=UUfhRwLUh-c9YpRnqStu_IxA&index=12, etc.

Moreover, if you can successfully flip your classroom, then you have the ability to meet with students one-on-one more often and at a higher rate. You have the ability to have more group projects, problem-based learning and more labs. Now for most of us inside the classroom, this is our typical structure. Students come to class and we have an introduction to new content.

Therefore, we have a variety of tools that we can draw to help students and get them involved in each process. We also make the students work in groups as we have worksheets, we have problem sets, and we can use real-world examples. Typically we run out of time. We can also create homework packets by creating problem sets and sending them home.

In addition, students are expected to go home to complete their homework by using their limited knowledge they have gained in class. The concepts of flipping the classroom are simply that. In this way, we can teach our students to gain the new knowledge outside the classroom. Now, their homework is no longer just reinforcing the knowledge, but gaining the knowledge.

• Virtual lab work:

Through this activity, concepts and skills are learnt by students through hands-on activity in the classroom and laboratory. Real-life situations and problems are faced by them, where they are free to make/take decisions and face the consequences thereof, which they would confront in an actual laboratory setting by these virtual labs. The student may take such additional support
online after he/she has attended the same in the laboratory. There are many virtual domains available which may provide remote-access to labs in various disciplines of Science (Pharmacy and Engineering). These Virtual Labs would cater to students at the undergraduate level, post graduate level as well as to research scholars. In addition, these techniques might also be enthused students to conduct experiments by arousing their curiosity. Examples of few domains where virtual labs are available are: http://vlab.co.in/, http://virtual-labs.ac.in/, http://vlab.amrita.edu/ etc.

4. Creative Teaching:

Teachers should take the help of creative tools to stimulate creativity i.e. by including playful games or forms of visual exercises that will excite the young minds and capture their interest. This is a time tested method to identify young student’s creative abilities and encourage creative contributions.

5. Real-World Learning:

Teachers can try to link the lessons to real world learning. Infusing real world experiences into teaching/instructions by relating and demonstrating through real life situations make the material easy to understand and easy to learn. This activity results in drawing complete attention of the students towards the concept taught. Many real world examples related to adulteration of spices were available that can taught. In addition, Food and Drugs Administration (FDA) department says consuming adulterated spices like red chilli powder, turmeric and coriander in powdered form can be extremely harmful for humans as it can lead to many harmful diseases even cancer. Moreover, the serendipity discoveries of medicinal agents and rationality behind any discovery can also be serving as real world example. The common example of serendipity discovery includes the discovery of sulphonamides as antibacterial agents, sulphonamides as oral hypoglycemic agents, discovery of insulin, nitrogen mustard as anticancer agents etc.

6. Brainstorm:

Brainstorming is a group creative techniques by which efforts are made to find a conclusion for a specific problem by gathering a list of ideas spontaneously contributed by its members. The term was popularized by Alex Faickney Osborn in the 1953. In the traditional approach to higher education, the professor dispenses wisdom in the classroom and the students passively absorb it.
Research indicates that this mode of instruction can be effective for presenting large bodies of factual information that can be memorized and recalled in the short term. If the objective is to facilitate long-term retention of information, however, or to help the students develop or improve their problem-solving or thinking skills or to stimulate their interest in a subject and motivate them to take a deeper approach to studying it, instruction that involves students actively has consistently been found more effective than straight lecturing. The challenge is to involve most or all of the students in productive activities without sacrificing important course content or losing control of the class.

Therefore, teachers must regularly engage student in brainstorming sessions in the classrooms. These sessions are a great way to get the creative juices flowing. Multiple brains focus on one single idea result in getting numerous ideas and also involve everyone into the discussion. These sessions serve as a great platform for students to voice their thoughts without having to worry about right or wrong. Teachers usually set some ground rules before the start of such sessions.

In addition, several times during each lecture period, ask the students to form into groups of 2–4 where they are sitting and give them brief exercises that last anywhere from 30 seconds to 3 minutes. The exercises may involve answering questions of the type instructors routinely ask the class as a whole or they may call for problem solving or brainstorming. For example,

• Outline a strategy for solving the problem just posed.

• Draw a flowchart (schematic) for the process just described.

• Think of as many practical applications as you can of this (system, device, solution method).

• Get started on the solution of the problem and see how far you can get with it in two minutes.

• What is the next step in the derivation?

• Complete this calculation.

• Prove or verify this result.
• Suppose you carry out experimental measurements and the results fail to agree with the theoretical formula we just derived. Think of as many possible explanations as you can.

• What questions do you have about this material?

The groups should generally be given a very short time to respond-long enough to think about the question and to begin to formulate an answer but not necessarily to work out complete solutions. Vary the format of these exercises to prevent their becoming as tedious and ineffective as straight lecturing. Assign some to pairs, some to groups of three or four, and some to individuals. Sometimes ask students to work on a problem individually and then compare their answers with a partner. Sometimes give a rapid succession of such exercises, and sometimes lecture for 10-15 minutes between exercises.

7. Classes outside the classroom:

It is one of the regular features of teaching learning of the institute. Teachers of the institute organize field trips that are relevant to the lessons or just simply take students for a walk outside the classroom (if the facility involved is present in the institution itself i.e. teaching pharmacognosy at herbal garden or teaching tablet manufacturing at industrial lab). This method helps the students in learning and remembering the things faster and for a longer time.

8. Storyboard Teaching:

Storyboard Teaching is a great way to teach any subject which requires step-by-step memorization or visualization of highly-conceptual ideas. Teachers use a storyboard to recreate a famous event. Such visually stimulating activity is performed to ensure that even complex ideas are easily put across to students. Figure 3 and 4 represents the story board on malaria and HIV respectively.

Hence, teaching with technology engages students with different kinds of stimuli- involve in activity based learning. Technology makes material more interesting and therefore it makes students and teachers more media literate [7-8].
QUCH! That mosquito bit me.

It starts off with just a mosquito bite.

You will begin to notice a fever, sweating, and chills weeks after you are bitten.

You must go to the doctor to get the right medication to treat it.

To protect yourself, wear insect repellent.

Or make sure to cover up.

Or you might end up here.

Figure 6: Storyboard of Malaria

thanks sir...

this looks tasty...

enjoy your food...

How me...

Sorry ma'am you have 24 hours to live  maybe...

Sorry ma'am you have 24 hours to live in very sorry this happen to you...

I always love rest in peace...

I have something to say to my I have H.I.V...

I will always love rest in peace...

How me my sister have this she didn't do any thing...

12 hours to live why me god just tell me why...

mean while she died...

Figure 7: Storyboard of H.I.V
9. **Cooperative learning (CL):** It is an instructional approach in which students work in teams on a learning task structured to have the following features:

- **Positive independence:** There must be a clearly defined group goal (complete the problem set, write the lab report, design the process) that requires involvement of every team member to achieve. If anyone fails to do his/her part, everyone is penalized in some manner.

- **Individual accountability:** Each student in the team is held responsible for doing his/her share of the work and for understanding everyone else’s contribution.

- **Face-to-face promotive interaction:** Although some of the group work may be parcelled out and done individually, some must be done interactively, with team members providing one another with questions, feedback, and instruction.

- **Appropriate use of interpersonal and teamwork skills:** Students should be helped to develop leadership, communication, conflict resolution, and time management skills.

- **Regular self-assessment of team functioning:** Teams should periodically be required to examine what they are doing well together and what areas need improvement.

Cooperative learning exercises may be performed in or out of class. Common tasks for CL groups in engineering are completing laboratory reports, design projects, and homework assignments in lecture courses. Only one problem set or report is handed in by a group and one group grade is assigned to the project, but adjustments for individual team citizenship (or lack thereof) can and should be made. Pre-examination group study sessions can also be set up to meet out of class, with bonus points being awarded to members of groups for which the team average test grade exceeds a specified value.

**Conclusion:**

Although innovative teaching and learning method makes effective studying yet it cannot replace a traditional teaching methodology in education sector. However it is clear from the literature, that innovative teaching methods do provide students with greater experience in dealing with the world of work related issues they encounter. These methodologies will lead to a learning society
in which the creative and intellectual abilities of students will allow them to meet the goals of transformation and development. Innovative teaching methodologies include developing the capability of students to use ideas and information, testing of ideas and evidence, generation of new ideas and evidence, facilitation of personal development and development of a student’s capacity to plan and manage their learning experience. In addition, student problems include excessive workloads and insufficient feedback system. Lecturers need to consider these aspects when adopting any methodology. By integrating skills, students are able to become self-motivated and develop an ability to think independently while working with others in a team. Education for the future requires that we explore as many varieties of models and teaching methodologies as possible.

Today, technology plays an important role in every part of our lives as in education. 21st century education requires effective student integration in the classes. To be able to support this, we, educators are searching and trying to apply different techniques to teach in an inductive way and to make teaching and learning process more effective and sustainable.

Reference:


