Teaching-learning Methods and Feedback Used in Effective Teaching

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Abstract

Feedback has been recognized as a tool to enhance the teaching-learning process. Both teachers and students may benefit from relevant information which highlights strengths and achievements as well as areas for improvement. Constructive feedback should be systematic. Feedback for teaching and learning should be relevant, immediate, factual, helpful, confidential, respectful, tailored and encouraging if it is going to be effectively used to achieve successful teaching and learning. Furthermore, input from instructors themselves, students and peers should be sought in order to provide constructive feedback. A review of related literature reveals that feedback has emerged as a means to facilitate the learning process as well as teaching performance [1,2,3]. Additionally, some argue that "students of teachers who emphasize teaching behaviors such as praise and encouragement tend to learn more than students of teachers who emphasize criticism and punishment" [4] and that teacher who "check students' progress regularly and adjust instruction accordingly" are using effective teaching strategies. Similarly, it has been reported that teachers are interested in feedback which provides recognition of effective teaching as well as identifies areas of need in order to achieve student success [5]. Consequently, this paper highlighted the faculty development process for effective teaching-learning; Characteristics of effective learning activities; Strength and weakness of commonly used methodologies in class teaching. Moreover, enhance the teaching effectiveness, techniques of evaluation the teaching, and the requirements of good-teaching are discussed and some suggestions are presented.

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Evaluation of Teaching

In order to understand the true potential of feedback it is necessary to place it in the context of a planning paradigm which includes evaluation as a connecting dimension in the process of decision making for teaching. A decision-making process for teaching includes at least five dimensions, as can be observed in Figure 1. These are purposes and objectives, content, modes of instruction, learning outcomes and evaluation [6]. Each of these dimensions has distinctive characteristics which are outlined below.

Purposes and Objectives: Purpose refers to a general statement which delineates the scope and nature of learning and from which instructional objectives will be derived. Instructional objectives refer to specific statements about what the student will be able to do once the teaching-learning process is completed.

Content: Content refers to the knowledge and information which will be delivered through instruction. It includes a description of the specific content (facts, concepts, generalizations, laws, norms and values) and the organization of the content into specific arrangements such as courses, units, lessons and others.

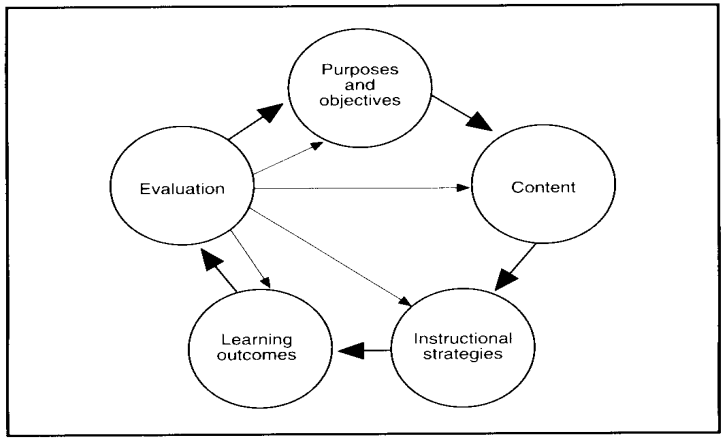

Figure 1: A Decision-making Model for Teaching and Learning

Teaching Strategies: Instructional strategies include specific techniques for instruction. Some examples are direct teaching, discovery method, collaborative learning, computer-assisted instruction and the like. A second component of instructional strategies refers to the grouping of students: small groups, pairs, large classes, etc.

Learning Outcomes: Learning outcomes refer to specific learning results. Some examples are fund of knowledge, intellectual operations, cognitive structure, skills and values.

Evaluation System: The evaluation system provides information about the actual outcomes of teaching and learning. That is, it generates feedback. Evaluation, then, is a linkage component which allows one to recycle the decision-making process and leads to future planning [7].

In general, evaluation refers to the act of appraising or valuing the nature, character, quality or status of something. For the purpose at hand, evaluation is defined as a process to collect information to determine whether or not successful teaching and learning has occurred.

Data generated through such a process may be used to provide specific information to teachers and students concerning their performance and achievement, with specific purposes in mind. According to the purpose of evaluation, three types can be distinguished:

- *diagnostic* – to determine the presence, or absence, of knowledge, experiences, skills and values;
- *formative* – to determine the need for adjustment, modification, or additional study; and
- *summative* – to determine the overall success of teaching and learning [7].

It seems apparent that regardless of purpose one main attribute of evaluation is to provide relevant information to those engaged in the teaching-learning process in regard to their performance, that is, to provide feedback to teachers and students so that modifications and adjustments can be made.

Feedback Viewpoints

According to the thesaurus, feedback refers to “the return to the input of a part of the output of a system, or process”. It is also associated with a “response, especially to one in authority about an activity”. More specifically, feedback has been conceptualized from three perspectives: the student, the

teacher and the teaching-learning process. For instance, Bloom suggests that "feedback can reveal errors in learning shortly after they occur...a self-correcting system so that errors made at one time can be corrected before they are compounded with later errors"[8]. Similarly, Carlson [1] argues that feedback is authoritative information students receive that will reinforce or modify responses to instruction and guide them more efficiently in attaining the goals of the course. More recently, feedback has been defined as a process for "collecting information about students′ performance, their familiarity with the type of tester assessment method, and their background knowledge" [3].

From the teacher′s perspective, feedback is considered as information provided to instructors with the intent of acknowledging effective teaching practices and bringing about agreement on changes or providing suggestions if needed [9]. Teachers also see feedback as a means to acknowledge effective teaching practices, to identify areas of need and to provide suggestions for improvement [9]. In a more global perspective, feedback is contemplated as an "essential part of the teaching and learning process" [3]. Thus, feedback has been recognized as a tool to enhance teaching and learning. More recently, it has also been identified as a critical component of effective teaching practices [10].

Most of these perspectives emphasize the informative nature of feedback. Given its foundation, it is apparent that feedback follows a systematic process, a process in which teaching and learning function as a whole that together carries out the instructional process in order to achieve learning outcomes, from which specific information is collected for teaching and learning. Thus, feedback should be regular, orderly and methodical.

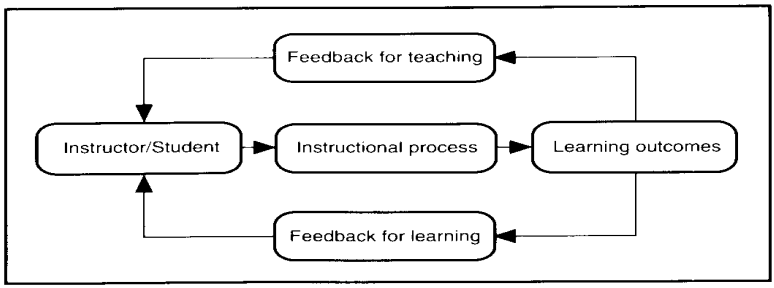

Figure 2 : A Systematic Feedback Process

Feedback for Learning

The information provided to students to guide their learning efforts can come from a variety of sources. Some examples include student performance on tests, students′ assignments, projects and performance in class during instruction. The focus of feedback for learning should address at least two dimensions: content mastery and tools for learning, or study skills. Therefore, it is thought that teachers may be in a better position to provide constructive feedback for learning. Thus teachers need to be aware of students′ characteristics, learning styles, preferred study techniques and limitations as well. The feedback process for learning involves at least the following steps:

- provide clear expectations about student learning and performance;
- explain specific criteria to judge students′ achievement;
- collect pertinent information about student progress;
- acknowledge accomplishments and students′ strengths;
- identify areas which need further study or additional practice;
- recognize students′ efforts towards achievement of goals and objectives;
- suggest learning activities, learning tools and study techniques for additional study;
- encourage students to increase efforts.

Feedback for Teaching

Information concerning teaching practices can come from at least three sources: students, peers and administrators. For instance, it is reported that effective evaluation systems for the purpose of providing constructive feedback seek input from professors themselves (self-assessment), administrators (focused observers), and students (inter-actors).Information gathered from these sources is jointly analyzed during an individual conference [9].

Characteristics of Feedback

Relevant (addresses student and teacher-specific learning and teaching performance, respectively, in addition to achievements, needs and interests), Immediate (provided as soon as information about student and teacher performance is available) Factual (based on actual student achievement (performance on a test, assignment or project) and teacher′s instructional

performance and assessment) Helpful, (provides suggestions for improvement of teaching and learning) Confidential (given directly to student or teacher without an intermediary), Respectful (respects students′ and teachers′ integrity and needs), Tailored (designed to meet individual students′ or teachers′ specific needs and circumstances), Encouraging (motivates student and teacher to continue and to increase teaching and learning efforts) [7]

Educational Paradigm

Small group teaching does not take place in a vacuum. The Figure 3 below shows how teaching and learning methods interrelate with learning outcomes/objectives, assessment, and evaluation and quality assurance. The teacher has a role in ensuring that each session forms part of the whole curriculum by creating opportunities (through selecting appropriate teaching and learning methods and creating a stimulating learning environment) for learners to achieve the stated objectives and thus be capable of passing assessments.

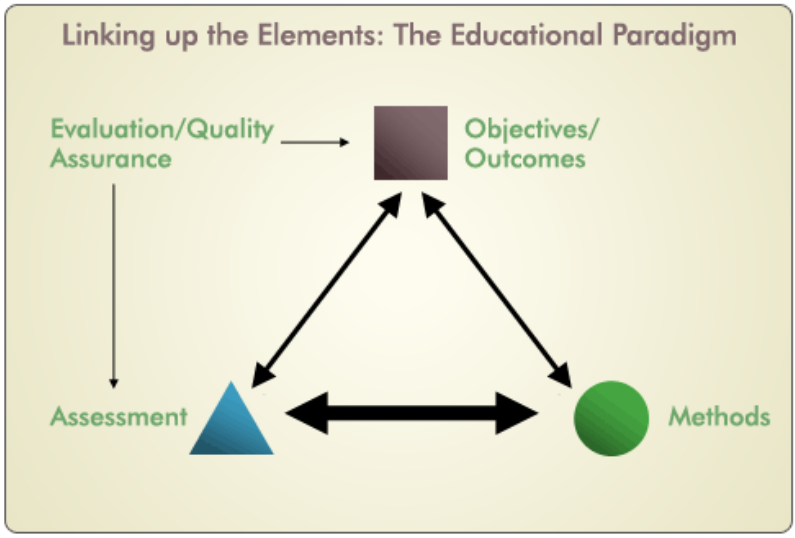

Figure 3 : T-L Methods Interrelate with Learning Outcomes, Assessment-Evaluation and Quality Assurance

Faculty Development for Effective Teaching-learning

In higher education, learning pervades the two key practices at the center of academic life: research or scholarship and teaching. These two practices are frequently, even habitually, regarded as adversaries. Time demands and academic status set the essential learning and knowledge goals of one against the critical student learning outcomes of the other. The Figure 4 shows how re-conceptualizing our understanding of these two practices in a way that aligns their common learning aspirations promises to enhance both.

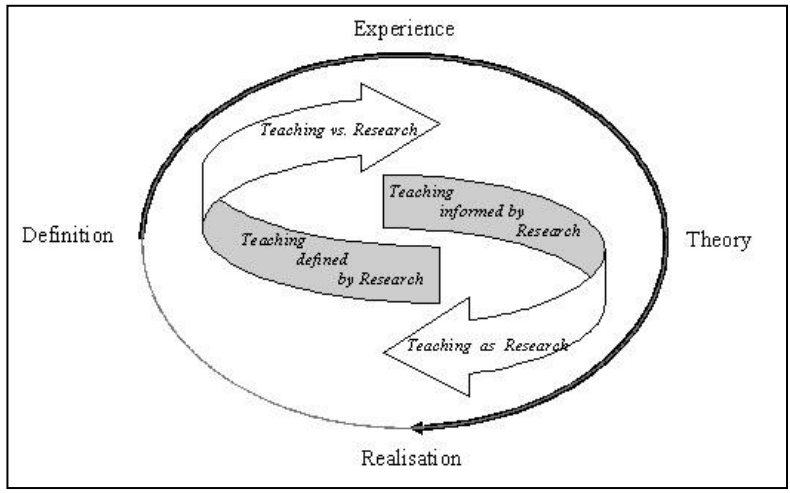

Figure 4: Faculty Development Cycle

The examination drew on recent research on both student understanding of learning and faculty conceptions of teaching to offer an approach for advancing the understanding and practice of teaching and enriching faculty development. The Figure 4 shows the research-characterized framework for faculty development that asks faculty to reconceptualize research and teaching so that instead of being seen as rival activities at the university, they are viewed as activities that share the common goal of learning, both for the faculty and for their students.

As shown in the diagram and implied in the word “cycle” in the title of the model, faculty development is not a linear process; rather it is iterative, with development occurring at all points for faculty. These stages can co-occur as

faculty ponders the relationships between their teaching, their learning, their students' learning, and their research.

There are two basic models of teaching to consider (Light & Cox 2001).Teaching is a monologue. Teaching causes learning. In contrast, the intent of the engaged model of teaching is to share the course content—to engage students in reconstructing the material for them. The assumption here is that teaching is a dialogue. Instead of teaching causing learning, teaching is a by-product of learning. As faculty probe these two contrasting models and deepen their understanding, they often begin to shift from a teacher-focused approach to teaching to an approach that is learning-focused.

Determine Teaching-learning Modes

Qualitatively, teaching time may be classified as instructional, interactive and facilitative. Instructional teaching relates to conventional one-way teacher-directed instruction. Interactive teaching relates to interactive teaching. Facilitative teaching time is time during which students undertake self-directed learning under direct or indirect supportive supervision of the teacher. Non-teaching activities take up some time too. Correspondingly, there are instructional, interactive and self-directed learning modes. There is also non-learning time due to student inattention etc. Based on the model for effective teaching (Figure 5), instructional teaching or learning times should decline whereas interactive teaching or learning times should increase.

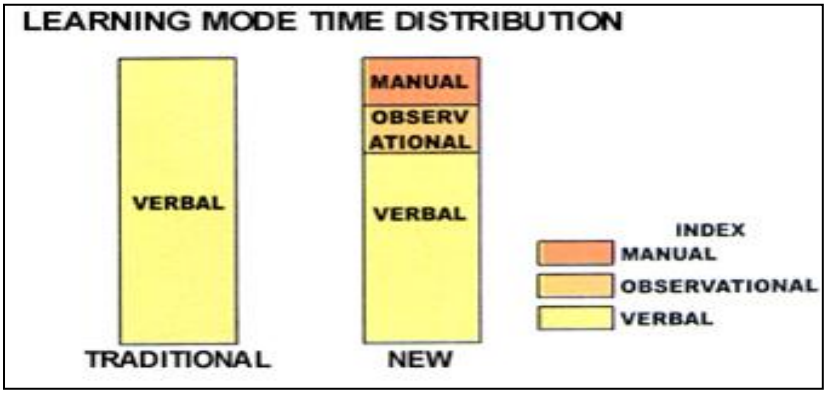

Figure 5: Learning Mode Time Distribution

Facilitative teaching time and self-directed learning time should increase. Self-directed learning should continue during non-teaching time. Non-teaching time itself should reduce if the teacher takes the assistance of students for non-teaching tasks. Non-learning times corresponding to various teaching times should decline, as learning becomes more interesting. Traditional and expected teaching and learning time distributions are depicted in qualitatively, teaching learning modes may also be categorized as verbal, observational and manual. Traditionally, verbal mode dominates.

What are Learning Activities?

Learning activities can be defined as what students do in order to learn in the teaching sessions, courses, and programs. Learning activities are underpinned by what we do as educators, and what we encourage or require students to do as learners, to support them in the achievement of learning outcomes. Learning activities can be classified according to who is principally guiding or directing the activity taking place - for example, the student themselves, fellow students or peers, or the teacher.

Table 1 : Adapted from Biggs, 2000

Type of Learning Activity	**Examples of Learning Activities**
Self-directed	Independent learning and study activities that are initiated by the teacher or the students themselves - for example, reading, researching, writing, and reflecting
Peer-directed	Activities set up and facilitated by the teacher but principally run by pairs or groups of students - for example, group projects, peer review, web-based discussion boards, and learning partners; Activities established by students themselves - for example, study partners or discussion groups, web-based discussion
Teacher-directed	Most formal teaching situations - for example, lectures, tutorials, laboratories, and interactive software

Characteristics of Effective Learning Activities

Effective learning activities are informed by the learning process and are designed to support student learning. The power of a teaching method or learning activity depends on the extent to which it embodies the "construction of a good knowledge base, the perception by students of a felt need to learn, and student activity, including social interaction" (Biggs 2003, p. 96) [14].

How our knowledge of the student learning experience might inform the design and implementation of learning activities in teaching. The following Guidelines provide just a few examples:

- Effective learning is supported when students are actively engaged in the learning process.
- Effective learning is supported by a climate of inquiry where students feel appropriately challenged and activities are linked to research and scholarship.
- Activities that are interesting and challenging, but which also create opportunities for students to have fun, can enhance the learning experience.
- The educational experiences of all students are enhanced when the diversity of their experiences are acknowledged, valued, and drawn on in learning and teaching activities.
- Students learn in different ways and their learning can be better supported by the use of multiple teaching methods and modes of instruction.
- Effective learning is facilitated by assessment practices and other student learning activities that are designed to support the achievement of desired learning outcomes.

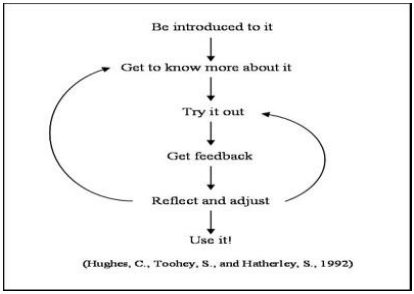

Figure 7: Stage of Learning

Choosing Learning Activities to Support Student Learning

A model of the learning process developed by Hughes and colleagues (1992) [15] provides a helpful guide to the development of learning and teaching strategy through the selection or design of specific learning activities.

In order to effectively facilitate student learning, you should design learning activities that will support students throughout the learning process.

- Be introduced to it: Examples- Overviews, preliminary reading, listening to discussion, presentation, websites, media or video clip.
- Get to know more about it: Examples- Lectures, further reading, group discussion, demonstrations, asking questions, relating to earlier learning experience, interactive websites, audiovisual material, media, research projects.
- Try it out: Examples- Practical projects, discussion of ideas with peers and teachers, design tasks, structured experiences, role play, skills laboratories, writing.
- Get feedback: Examples- Informal and formal feedback with criteria from self, from peers, from teachers, from colleagues, from family and friends.
- Reflect, adjust and try again: Examples- Through contemplation, writing, reflective journals, discussion.

Common Pedagogical Approaches for Class Teaching

Selecting a Delivery Strategies

The term "delivery strategy" is overused and often misunderstood. Books have been written about it and often equate it to the term "method." Most undergraduate teaching-training programs even require a course in methods. For the purpose of this article, choosing a delivery strategy will be presented as a choice among the lecture, demonstrations, or discussion. The common nature of these choices do not answer the question How?, but focus on the question, Why, Where, When, Whose? A series of questions is presented to help you make a decision on which delivery method to use.

Choosing a Lecture (?)

The following questions should assist you in determining the appropriateness of a Lecture:

1. What knowledge, skill, or attitude needs to be learned?
2. How many students need the content?

3. How much preparation time is available?
4. Are you in command of your nonverbal cues?
5. Can you develop interest in the lecture?
6. Are there appropriate multimedia support systems?
7. Could you provide an outline of important parts of the lecture?
8. Do you summarize regularly in the lecture?
9. Do you pose questions in your lectures?
10. Have you ever listened to or watched one of your lectures?

Choosing a Demonstration (?)

The following questions should assist you in determining the appropriateness of a Demonstration:

1. Does the learner need to see the process?
2. How many students need the content?
3. How much preparation time is available?
4. Do you want the students to imitate you?
5. Is there A-V support available?
6. Can you ask questions during the demonstration?
7. Can the students take notes?
8. Will there be practice time for the students?
9. Will you permit the students to ask questions?
10. Have you ever listened to or watched one of your demonstrations?

Choosing a Discussion (?)

The following questions should assist you in determining the appropriateness of a Discussion:

1. Do you need active involvement from the student?
2. How many students need to be involved?
3. Must you hear everything being said?
4. How much time is available?
5. Is divergent thinking a desirable end?
6. Can you accept the students' views?
7. Can interest be aroused and maintained?
8. Is there time to draw conclusions?
9. What needs to be tested?
10. Have you ever listened to or watched yourself in a discussion?

Table 2: The Strength and Limitation of Commonly Used Methodologies in Class Teaching

Methods	Strength	Limitations
Lecture	- presents factual material in direct - contains experience which inspires - stimulates thinking to open discussion - useful for large groups .	- experts are not always good teachers - audience is passive - learning is difficult to gauge - communication in one way.
Lecture with Discussion	- involves audience after the lecture - audience can question, clarify .	-time may limit discussion period - quality is limited to quality of questions and discussion .
Brainstorming	-listening exercise that allows creative thinking for new ideas - encourages full participation because all ideas equally recorded - draws knowledge and experience - one idea can spark off other ideas.	- can be unfocused - needs to be limited to 5 - 7 minutes - people may have difficulty getting away from known reality - if not facilitated well, criticism and evaluation may occur .
Videotapes	-entertaining way of teaching content - keep group's attention - looks professional - stimulates discussion	- can raise too many issues to have a focused discussion - discussion may not have full participation
Class Discussion	-pools ideas and experiences from group - effective after a presentation, film or experience that needs to be analyzed - allows everyone to active participation	-not practical if more than 20 people - few people can dominate - others may not participate - is time consuming

Recommended "New Approaches" in Teaching for 21 C's Learners

- Interactive lecture
- Just in time teaching (jitt)
- Interactive demonstrations
- Peer-led team learning and
- Teaching with visualizations

Interactive Lecture

What is Interactive Lecture?

Interactive lectures can be used in classes of any size, including large classes. Making lectures interactive draws students into the lecture by engaging them in working with the material. In an interactive lecture, the lecture is interspersed with short individual, pair, or small-group activities. These activities also provide feedback to the instructor on student understanding. For example, rather than asking a question and calling on the first student who raises a hand, asking all students to reflect on the question and then discuss with a neighbor before calling for student responses gives everyone a chance to participate (think-pair-share). Other strategies for engaging students include Concept Tests, the Question of the Day, and in-class small-group activities.

Why use Interactive Lectures?

Interactive lectures combine information-rich lectures with activities that engage students, make students think about and apply lecture material in class, and give the instructor feedback in class on student understanding of the material. Interactive lectures are an important way to enhance student learning, particularly in large classes. They help to keep students' attention focused on the class, give students repeated opportunities to practice, and increase student retention of lecture material. They also provide an easy way to experiment with different teaching techniques.

How to Give Interactive Lectures?

Giving interactive lectures involves delivering effective lectures, organizing the class period and selecting student activities, managing the class, and collecting feedback on what the students have learned.

Just In Time Teaching (JITT)

What is Just-in-Time Teaching?

Just-in-Time Teaching focuses on improving learning by the use of web-based assignments that are delivered before a class meeting. The instructor can quickly gather information about student performance and understanding immediately prior to the class meeting so that the day's lesson can be tailored to actual student needs. This type of activity meets several goals:

- Creating a student-centered environment in the classroom
- Improving faculty-student interaction (individually and in groups)
- Improving content mastery (by rapid clarification of misconceptions)
- Developing group interaction skills (through on-line group activity)
- Encouraging students to monitor their own progress.

Why use Just-in-Time Teaching?

Benefits for Students: Students are engaged with course content outside of class and before coming to class, which leads to increased learning and motivation to learn. They come to class prepared for the lesson, which leads to better use of classroom time.

Benefits for Faculty: The pre-class assignments ("Warm Ups," "Pre-flight checks," ...) allow instructors to assess student understanding of the course material. They come to class with a better understanding of their students' state of knowledge, beliefs, misconceptions, frustrations, etc. Instructors who use JiTT can more easily establish rapport with their students, and create an interactive environment in the classroom.

How to use Just-in-Time Teaching?

The first step in implementing JITT is to develop a set of questions which will be posted online for students to answer before class. They may be posted using a course management system, or a basic web site. For a small class, they may even be disseminated and returned via e-mail. The questions should be open-ended, requiring text response. They should explore students' prior knowledge and beliefs about the material to be covered in a single lesson. During the semester, the instructor posts the questions and the students respond online some hours before each class session. Just before class, the

instructor selects excerpts from the student responses and brings these to class. These responses form a basis for the interactive class session. Thus students become active participants in constructing the subject matter content.

Just-in-Time Teaching (JiTT) is an active learning method designed to facilitate student engagement with and reflection on course material prior to arriving in the classroom. It also provides the instructor with a measure of student understanding of that material before class begins.

A Three-Step Feedback Loop

The basic Just-in-Time Teaching format is to have student's complete web-based assignments outside of class and submit their responses online a few hours before class begins. This allows the instructor time to review the student submissions and prepare for an active learning environment based on the student responses 'just in time' for lecture. Finally, as an instructor is wrapping up a particular topic, he or she may assign another online exercise to provide a framework for the wrap up session (Novak & Middendorf, 2004).

Step (I): Warm-Ups

The first step in the JiTT cycle is for students to answer web-based questions related to their reading or other pre-class assignment. These questions are given various names; generically, they are called "Warm -Ups," though discipline-specific names are also used. Laura Guertin, who teaches geology at Penn State Brandywine, calls them GeoBytes; faculty at the US Air Force Academy use 'Pre-flight Checks,' etc. These assignments can be a combination of multiple choice and short answer or essay questions, but the most effective Warm-Ups require students to reveal their understanding of the assigned material. To accomplish this, it is best if at least some of the

questions are open-ended or ambiguous. Entirely multiple choice assignments do not usually provide enough insight.

Students submit their answers to these questions by a deadline. The deadline is usually just a few hours prior to the class, but could be as much as one day before class if this is necessitated by the instructor or student schedules. (Examples might include classes that meet early in the morning or evening classes.) In most cases, the questions are posted and answered within a course management system, e.g., Blackboard.

Example: Perhaps your class studies the process of desertification in the context of global climate change. You may want to prime your class for discussion by having students read articles and answer questions about the Sahara Desert, such as:

1. Was the Sahara always a desert? How do we know?
2. What modern-day animals can be found in the desert? How do they survive?
3. Why have humans - past and present - gone into the Sahara Desert?

Step (II): Interactive Classroom Session

The instructor reads through student responses to the Warm-Up questions, looking for patterns: What do the students understand? What are they struggling with? Are there misconceptions that need to be addressed? The instructor then typically takes a few representative answers into the classroom (via an overhead transparency, PowerPoint slide, or other technology) to form the basis for an interactive classroom session. Students are engaged in discussion, and may be asked to continue to work, individually or collaboratively, to explore the subject further, rather than listening passively to the instructor. (Read more about what you can do in the class that follows a JiTT Warm Up assignment.)

Step (III): Puzzles

As a follow-up exercise, students can be assigned additional online questions to answer to confirm that they understand the information and concepts related to a particular topic. These "puzzles," as they are sometimes called,

can be the kinds of questions you are likely to ask on an exam, or they may be even more difficult problems that require the ability to integrate the new ideas with prior knowledge, or to apply the new knowledge in an unfamiliar context.

Interactive Demonstrations

What is an Interactive Demonstration?

Interactive Demonstrations are physical or conceptual models that replicate part of a system of interest. Often they are constructed out of material or objects that are familiar to students in their everyday lives. It's always fun for students to see something familiar to them used in an unique and unexpected way.

For example, Dave Bice at Penn State uses the "friction rock" to discuss ideas related to fault slip and earthquakes. The demonstration consists of a rock attached to a crank with a rope. The rock sits atop sandpaper and as the crank is turned, the pull on the rock increases until it overcomes the friction and the rock slides or jumps along the sandpaper.

Why Use Interactive Demonstrations?

Interactive Demonstrations have proven to be very useful in addressing student's misconceptions as well as providing stimulating hands-on inquiry into simple parts of complex systems.

How to Use Interactive Demonstrations in Class?

Like any type of in-class activity, Interactive Demonstrations require planning and setup in order to live up to their potential to improve student learning.

Why Use Interactive Demonstrations?

Research in physics classrooms indicates that students acquire significantly greater understanding of course material when traditional lectures are combined with interactive lecture demonstrations (Sokoloff and Thornton, 1997) Interactive demonstrations enable students to become more actively engaged in a lecture and provide unique opportunities for critical thinking and student reflection.

Students' interest is peaked if they are asked to make predictions and vote on the most probable outcome of a demonstration before it is done. When used thoughtfully, in-class demonstrations can better illustrate important concepts than a straight lecture, and can provoke students to think for themselves.

Demonstrations are especially effective if they have a surprise effect, challenge an assumption or misconception, or illustrate an otherwise abstract concept or process. Some research indicates that students are better able to self-correct their misconceptions after observing a demonstration real-time (Brasell, 1987).

In addition, demonstrations employ physical models which are smaller and simpler in scope than the real system they mimic. This allows instructor and students to focus in on key aspects of the system's behavior. This simplicity also makes it easier for students to manipulate, measure, and modify the model than it would be in a real-world system.

Peer-led Team Learning

What is Peer-led Team Learning (PLTL)?

The PLTL Workshops generally supplement the lecture. PLTL can be used in a course with any size enrollment. Under the PLTL model, undergraduate students who have done well in the class previously are recruited and trained as workshop leaders "peer leaders" " who guide the efforts of a group of six to eight students. These peer-led groups meet weekly (separate from the lecture and the instructor) to work together on problems that are carefully structured to help the students build conceptual understanding and problem-solving skills. There are no answer keys for either the students or the peer-leaders; the emphasis is on learning to find, evaluate, and build confidence in answers. Simultaneously, the workshops and the peer leaders provide a supportive environment that helps each student participate actively in the process of learning science. Thus, PLTL offers a mix of active-learning opportunities for students and a new role for undergraduate peer leaders that is appropriate for their stage of development; PLTL has been used successfully in courses in chemistry, biology, physics, math, computer science, and engineering. In practice, the weekly workshop replaces traditional recitation sections led by graduate teaching assistants or faculty. Although most peer leaders are undergraduates, many graduate students with

appropriate training have also worked effectively and enthusiastically in that role.

Why Use Peer-led Team Learning?

PLTL increases student engagement, motivation and performance. Studies comparing groups with and without workshops reveal that participation in workshops leads to higher percentage of students earning grades of A, B or C. Workshop leaders themselves reap significant ongoing benefits from their roles. Leading workshops reinforces the breadth and depth of their own learning, helps them develop personal qualities such as confidence and perseverance, and fosters a variety of presentation and team related skills. Gafney, L. and Varma-Nelson, P. (2008) Peer-Led Team Learning: Evaluation, Dissemination and Institutionalization of a College level Initiative, Dordrecht, The Netherlands, Springer.

- Peer-Led Team Learning offers a number of educational opportunities:
- Solving problems in workshop allows students to assess their own understanding of key course concepts
- The supportive, small-group format encourages questions and discussions that lead to conceptual understanding
- Students learn through explaining concepts to other students
- Many students are more willing to discuss their questions with other students than with a professor
- Students learn to work in teams and to communicate effectively
- Peer leaders learn teaching and group management skills and gain self-confidence

How to Implement Peer-led Team Learning in Your Courses?

1. It is essential that the workshops are closely integrated with the course and all its elements.
2. Faculty teaching these courses must be actively involved with the workshops and with the peer leaders.
3. Peer leaders are students who have taken the course, who have good communication skills, and who are well-trained and supervised in facilitating small-group collaborative-learning sessions.

4. Workshop problems must be appropriately challenging and designed for use in collaborative group learning settings.
5. Organizational arrangements must ensure adequate and appropriate rooms for conducting workshop sessions.

Teaching with Visualizations

What are Visualizations?

Visualizations can present massive amounts of information to help scientists identify relevant patterns and processes in nature. Data visualization techniques range from simple pie charts or x-y scatter plots to colorful contour plots and 3-D images that can be manipulated and viewed from a variety of orientations and with a variety of color schemes. Spreadsheets like Excel have good basic graphing capabilities which are in essence visualizations.

Typically, visualizations for multidimensional data sets allow the users to:

- Select a particular subset of a data set in space and/or time;
- Create 3-D and contour plots;
- View data from different orientations;
- Create and view animations of data at different rates;
- Customize the color enhancement of images to highlight features of particular interest;

Visualizations typically fall into one of the categories below:

- Many interactive web based data sites are available that allow visitors to select and view different science data.
- Visualization software allows one to generate images and animations from mathematical functions or from your own data or data sets of your choice.
- Visualizations of output from mathematical or statistical models is one of the best ways to convey model behavior for large complex models, e.g. for visualization of results from a general circulation model of the ocean or atmosphere.

How to Enhance Teaching Effectiveness?

- Involve the student in planning
- Begin with what the student knows
- Move from simple to complex
- Accommodate the student's preferred learning style
- Sort goals by learning domain
- Make material meaningful
- Allow immediate application of knowledge
- Plan for periodic rests
- Tell your students how they are progressing
- Reward desired learning with praise

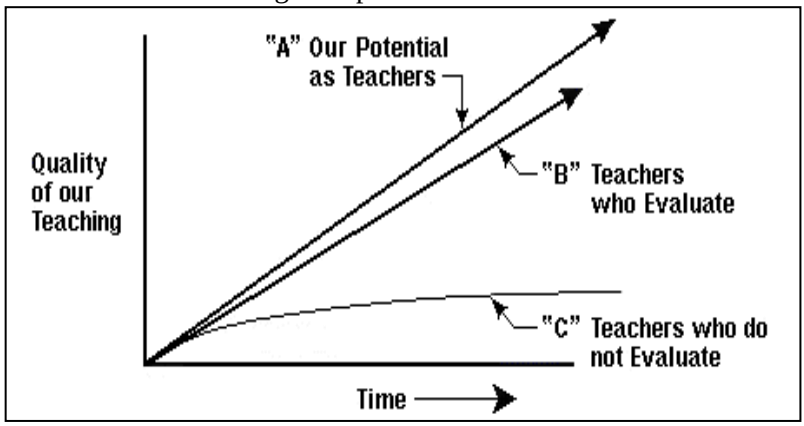

Figure 8 : The Effect of Evaluation on Our Teaching

Evaluating Your Own Teaching

Regardless of how good or how poor we are as teachers, we all have the potential to get better over time (see the arrow in Figure 8). Yet some teachers continually improve and approach their potential (see arrow) while others experience a modest improvement early in their career and then seem

to level off in quality or sometimes even decline (see arrow). Why? I would argue that the primary difference between those who do and those who do not improve, is that only the former gather information about their teaching and make an effort to improve some aspect of it -- every time they teach.

Techniques of Evaluating of Your Own Teaching:

1. Self-monitoring
2. Audiotape and Videotape Recordings (Micro-teaching)
3. Information from Students (Questioners, interview)
4. Students' test results.
5. Outside observer

Good Teaching: The Top Ten Requirements

One. Good teaching is as much about passion as it is about reason. It's about not only motivating students to learn, but teaching them how to learn. and doing so in a manner that is relevant, meaningful, and memorable.

Two. Good teaching is about substance and treating students as consumers of knowledge. It's about doing your best to keep on top of your field., It is also about bridging the gap between theory and practice.

Three. Good teaching is about listening, questioning, being responsive, and remembering that each student and class is different. It's about eliciting responses and developing the oral communication skills of the quiet students

Four. Good teaching is about not always having a fixed agenda and being rigid, but being flexible, fluid, experimenting, and having the confidence to react and adjust to changing circumstances.

Five. Good teaching is also about style. Effective teaching is not about being locked with both hands glued to a podium or having your eyes fixated on a slide projector while you drone on.

Six. Good teaching is about humor. It's often about making innocuous jokes, mostly at your own expense, so that the ice breaks and students learn in a more relaxed atmosphere.

Seven. Good teaching is about caring, nurturing, and developing minds and talents

Eight. Good teaching is supported by strong and visionary leadership from full professors to part-time instructors and is reflected in what is said, but more importantly by what is done.
Nine. Good teaching is about mentoring between senior and junior faculty, teamwork.
Ten. Good teachers practice their craft not for the money or because they have to, but because they truly enjoy it and because they want to.

How will the Students Learn Best?
Students learn best when they…

- Participate actively
- Work together to learn
- Construct knowledge
- Have time to practice
- Feel calm and safe
- Reflect/self-assess/set goals
- Respond constructively to challenges
- Connect what they are learning to the world
- Can make choices
- Can talk to their teachers and each other
- Get timely and meaningful feedback

Students learn best when their teachers…

- Listen to student input
- Know and apply current research
- Collaborate and communicate effectively
- "Triage" curriculum
- Manage or restructure time
- Use multiple strategies based on content and student needs
- Create a positive, respectful learning environment
- Demonstrate they are learners who construct knowledge
- Make connections to students
- Use knowledge of students as learners and as people

- Create meaningful, rigorous, relevant and increasingly complex work
- Demonstrate mutual respect
- Use varied assessments to make decisions about what and how they teach
- Assume multiple roles
- Set high standards and expectations for all

Conciusion and Suggestions

It seems apparent that feedback which is constructive and meaningful may lead to successful teaching and learning as well as to personal satisfaction. Teachers and students who receive relevant information concerning their performance or achievements are more likely to be successful as they engage in the teaching-learning process. Thus, it is important that feedback be provided in a systematic way.

Teaching-Learning is a complex phenomenon. It is called selling and buying process. There have two parties' seller (teacher) and buyer (student). If the vendor wants to sell but the purchaser doesn't like to take, vendor can't put up for sale. Even, if the buyer wants to buy but vendor don't like to sell, then this transaction will fail. So, both of the parties should have the common interest to learn. Moreover, there have no known limits of learning. The learning time is from mother's womb to Tombs. The teacher should learn more than his/her students. There have no known limits of learning. The man who thinks he knows the best is nothing but a fool *(Goutom Buddo).* The learning is more important than teaching. As because you have to learn the matter first as you are going to teach in class. Learning has three domains: Cognitive domain (related with Knowledge), Psychomotor domain (related with skill), and Affective domain (related with feelings). Thus education is Change in Knowledge (Head), Change in Skill (Hand), and Change in Attitude/Feelings (Heart). So, education means change in 3H.

Educators must remember that learning occurs within each individual as a continual process throughout life. People learn at different speeds, so it is natural for them to be anxious or nervous when faced with a learning

situation. Positive reinforcement by the instructor can enhance learning, as can proper timing of the instruction. The effective **"**Teaching–Learning is a 3 Way Communication Process" way-1 message will go from teacher to students, way-2 the students will ask the relevant question to his/her teachers, way-3 the teachers will give the exact and specific answer to that questions raised in the students mind.

Many studies show that learning is enhanced when students become actively involved in the learning process. Instructional strategies that engage students in the learning process stimulate critical thinking and a greater awareness of other perspectives. Although there are times when lecturing is the most appropriate method for disseminating information, current thinking in school teaching and learning suggests that the use of a variety of instructional strategies can positively enhance student learning. Obviously, teaching strategies should be carefully matched to the teaching objectives of a particular lesson

The term 'Collaborative Learning' is often used as a synonym for cooperative learning when, in fact, it is a separate strategy that encompasses a broader range of group interactions such as developing learning communities, stimulating student/faculty discussions, and encouraging electronic exchanges (Bruffee, 1993). Both approaches stress the importance of faculty and student involvement in the learning process.

Today, educators realize that computer literacy is an important part of a student's education. Integrating technology into a course curriculum is proving the valuable for enhancing and extending the learning experience for faculty and students. The Computer Based Instruction (CBI), the Computer Aided Learning (CAL) is the new ways to teach the students in class. In a fully Computer-Assisted Instruction(CAI) program, the computer takes over from the teacher in providing the learner with drill, practice, and revision, as well as testing and diagnosis.

So, there have no specific or best method of teaching in the class. As an effective teacher we have to know the entire methodologies fine and choose the appropriate one on the basic of the teaching leaning atmospheres. So, theacher is the best method of teaching if s/he knows all the methods well.

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