CROSS DISCIPLINARY PEER OBSERVATIONS FOR CLASSROOM BASED LEARNING ACTIVITIES

[#]Adeel Khalid, Bernice Nuhfer-Halten, Craig Chin, John Sweigart, Beth Stutzmann

Southern Polytechnic State University, [#]Corresponding Author (akhalid2@spsu.edu)

ABSTRACT:

The teaching styles vary across disciplines. Some styles may be effective in certain disciplines and not in others. In this project, instructors observe the teaching styles of their peers in their disciplines and outside their disciplines. The idea is to determine the effective teaching techniques, as seen from an observer's or a student's point of view, that are used in various disciplines. The goal is to determine whether these techniques can then be applied to other disciplines. The disciplines involved in this research include arts, music, languages, law, and various fields of engineering including mechanical, systems, aerospace, and electrical. This on-going research will determine whether the teaching techniques used in a given discipline, can then be applied to other disciplines with the same level of effectiveness. The techniques include but are not limited to hands on activities and group discussions.

To conduct the study, the instructors in each discipline observe their peers in other disciplines. The idea is not to critique each other's teaching styles, but instead to observe and analyze whether a particular style is applicable in another discipline. Some of the techniques observed in peer observations include:

- Ice breakers or Warm-up activities
- Emphasis on real world examples, providing context
- Emphasis on key highlights, giving overviews
- Student-centered activities, e.g., presentations, group work
- Relaxation Response, e.g., breathing exercises, meditation
- Reinforcement
- Historic and cultural significance of theory?
- Re-entry work
- Lessons in punctuality, e.g., quizzes over homework during 1st 5 min. of class
- In-class experiments
- Humor

These and several other techniques used by professors across disciplines are discussed.

AN AEROSPACE ENGINEER'S OBSERVATIONS IN A LAW CLASS

In a law class, the following activities were observed by an aerospace systems engineering professor.

Ice Breaker:

Ice breakers are important to get student buy-in. The professor walked in and casually started a conversation about the presence of computers outside the classroom. A simple comment helps emotionally connect students to the campus. By the time she walked over to her desk, almost all the students in the class were paying attention.

Sign-in Sheet
A sign-in sheet was passed around. The use of sign-in sheet can convey the message that the professor cares about the student's presence in the class and wants to reward the students who are making an effort to learn the material.

Professor Solicits Student Responses
Instead of giving all the information to the students, the professor asked for student's opinions. Students were asked to read the material ahead of time and the professor went over the high points. While discussing the high points, the professor solicited students thoughts, ideas, understandings or misunderstandings. Because of this activity, students were constantly involved in the class.

Professor Knows the Material Well
The professor did not use a sheet to copy the notes to the board. But instead she remembered all the material she wanted to cover in the class. One of the ways to accomplish this is to remember the highlights or the headings, and then fill in the blanks during the class. Student responses were used to put the final material together on the board.

Safe Environment for the Students
The professor created a safe environment for the students. She encouraged questions and appreciated all of them. This created a safe environment for the students where they felt comfortable in asking more questions. The discussion ensued. A two-way or a multi-directional controlled discussion seemed like a valuable pedagogical technique.

Emphasis on Important Points
Instead of overwhelming students with lots of material, the professor emphasized on the few important points that the students needed to remember. These points were definitions, rules or principles. Once understood, these could be applied to relevant situations to solve the corresponding problems. The professor made sure that the 'high-points' were repeated multiple times. She repeated them using different verbiage to ensure that students understood their importance.

Real World Examples
The professor gave real world examples to convey how the principles and definitions discussed applied to real world. She discussed several valuable examples of real law cases from her experiences. Students also brought up cases that they had experienced that related to the topic of discussion. They asked questions about the topic relating to the cases. Analogies like these help reinforce the material. Students are likely to remember the material if they have experienced something that relates or hear about a real world example from someone else's experience.

Super Bowl
This Monday class was held right after the Super Bowl weekend and the professor's favorite team had won. The professor was excited about that. She announced a super bowl for the class. The class was divided into two groups. Students were asked questions that were related to the topic of discussion. If a group got the answer right, they got one point and if they missed it, the other team got the point. Students started slow but quickly caught on and were actively participating towards the end. This was a fun way to teach the course material while bringing the current affairs in context and involving students in a game.

AN AEROSPACE ENGINEER'S OBSERVATIONS OF A MUSIC CLASS

Class Attendance:
Attendance was taken at the beginning of the class. Apparently the professor remembers everyone by name.

Music in the Class:
Shortly after the class started, the door was shut and loud music started playing. It felt like being in a concert but no one was dancing. Instead all the students were taking notes. Students listened intently. They were asked to identify the instruments, notes, repetition patterns, and unusual rhythms. There is no better way to learn any material than immersing students in the real world application. It invokes their visual, auditory, tactile and other senses. So learning happens not just by one way listening to the instructor, but by the simultaneous use of multiple senses. While the music was being played, the professor pointed out the things to listen to. These corresponded to the theory they were learning in the class. It was an immersive environment. It was equivalent of an aerospace professor taking his class to an airshow or an aerospace museum and discussing aircraft design. Or it corresponded to the concept of an integrated laboratory and lecture based learning in STEM disciplines. Several case studies have shown that students learn and retain better in immersive learning environments [x].

Student Presentations:
It turned out that the music being played was brought in by a student in the class. They had chosen a track from medieval period – which was the topic of discussion. Students brought music on media and played it in the beginning of the class for a few minutes. The student then presented the technical aspects of the music including its history, genre, culture etc. They were then asked a few questions by the professor. So student did not only have to bring the material to the class, but also present it and then answer a few questions. This helped transfer some of the responsibility for learning and teaching from the instructor to the students.

Cups for Participation:
All students were encouraged to participate actively in the class. The professor brought plastic cups of three different colors. During the course of the class, the professor asked several yes/no type questions and students were asked to raise their cup in response. The green cup corresponded to 'yes' (or liked), red for 'no' (or did not like) and yellow for no opinion. This little exercise ensured that everyone in the class participated without being pressured. This technique works well to keep the students focused specially in a large class, where students sitting in the back may have the tendency of getting distracted or distracting others or both.

Professor Excitement:
It is said that 'Excitement is Contagious' – the statement is certainly true in a classroom setting. The professor seemed very excited about the subject matter. She even seemed excited about the fact that the test was over and that the students did not have to worry about it. She asked all of them to give high-fives to their neighbors to the left and to the right. This small break broke the monotony and created a sense of belongingness to everyone present in the class. It also acted as a 'mind break' so students could now re-focus on the topic of discussion in the class.

Students Create the Power Points:
The professor did not show any Power Point slides during the class. Instead she asked students to write all the notes in class. Students were asked to prepare Power Point slides later. She gave a lesson on effective notes taking strategies. She wrote material on the board and asked students to convert it into Power Point slides and submit them to her. The idea was not because she wanted the Power Points for her, but because

she wanted the students to get in the habit of taking notes in class and then reviewing them after the class. By asking them to put the notes in an electronic format, the professor ensured that everyone took all the class notes, the notes were safe for students for later review. By student submission of the notes, she could gauge if there were any students not participating in the class. This exercise also provided for students a good repository of all the important notes in the class.

Breathing Exercises:
Any time the professor noticed that there was a need for a little break during the lecture, she paused and changed the subject for a few moments. She emphasized how breathing exercises are important for musicians. All the students were asked to take a few deep breaths and then the class ensued. Similar exercises can be done in all disciplines and in most classes.

Candy Questions:
Students were constantly encouraged to actively participate in the class. A few times during the class, they were asked 'Candy Questions.' These were either questions from previous classes or questions that were discussed in the class a few lectures ago. Apparently, the word candy excited most of the students. They wanted to participate and get the candy – even if they had to guess the answers. This was an effective method to motivate students to participate actively.

Inductive Style of Teaching:
The professor often asked a question, and instead of answering it, led the students to the answer by gradually asking other related questions. The inquiry based learning [x] method was used, which is an effective method for obtaining general, observation based information. It helps to guide students through critical thinking, awareness, evaluation of what they observe, and the drawing of logical conclusions and explanations. This class reminded the author of a drama class, where the professor enacted a single person drama during the class period to teach students about the science and arts of drama.

Relations to Culture and History:
The professor gave a detailed relationship of the medieval music to culture, religion, and history. Adding the cultural and historical aspect helps students relate the subject matter to their own prior experiences. It therefore helps in long term learning and retention. It also helps students understand the need, the origin, and the reason of existence of an entity.

Use of Multi-Media:
Professor used internet to show pictures and more importantly music related video. These pictures and videos included the musical notes. It helped convey the importance of the material covered in class. Professor also brought a pictorial book that she passed around. The book contained pictures of instruments, their history, and their cultural significance.

Preparedness:
Throughout the class, it appeared that the professor was well prepared. She has planned the entire class period and had thought about all the details of how it would be conducted. In general, a professor spends a significant amount of time in preparing for the class is likely to conduct an effective class. The professor did not look at any of her notes while writing on the board. She wrote over five slides worth of material. All of it was well prepared and presented.

Controlling the Class:
Every once in a while, there is a student who would distract other or disrupt the continuity of the class. The professor had a strong sense of presence. She knew how to deal with difficult students. She politely and assertively asked one student to be disciplined, and it had a positive effect on the entire class. Dealing

with difficult students without affecting the class environment could be challenging. The professor handled it well and quickly moved on with the rest of the class.

Significant Material in One Session:
One of the complaints often heard from STEM professors is that they have too much material to cover in a semester and not enough time to do it. From observing the Music class, the author felt that a significant amount of material was covered in one session, and a number of active learning techniques were used to facilitate learning from multiple facets. The trick is to cover the material in a way that will help the students to retain and use it long after the semester is over.

AN AEROSPACE ENGINEER'S OBSERVATIONS IN A MATHEMATICS CLASS

Give students a chance to re-do:
It is not uncommon for students to receive their graded assignments back, look at their earned grade and put the papers away. In the mathematics (Calculus 1) class, the quizzes and exams were graded and returned to the students. Students had the option of correcting their mistakes and resubmitting their work for an additional 2.5 points. This technique gave them a motivation to review the mistakes they made and correct them. Students get a chance to learn the material and correct their mistakes that they would otherwise overlook. Their motivation to do this extra work was a few additional points, that almost all of them were willing to work for.

Checklists (Notes):
In aviation, all pilots are required to use checklists. The Federal Aviation Administration (FAA) has learnt from experience that it is not worth taking a risk to have pilots memorize procedures and then forget an important step. All pilots are required to use their notes. The mathematics professor used her notes to write problems on the board. Although, a mistake may not be as critical as in aviation, this practice ensures that all students get the error free content while they are learning.

Students solve problems in groups:
The professor gave students problems to solve in class based on the material that was taught in the previous class. Students were encouraged to work in groups of 2-3 people. They shared their work and solved numerical problems together. Several students took the role of teachers. They explained material to each other. Researchers have argued that students learn better when they teach each other. If they did not understand the material, they asked students in other groups for help. The professor encouraged groups to interact with each other and help solve the problems. If students did not understand the problem, the professor was there to help them out. She walked around the class to check and make sure that every group was actively engaged in problem solving. She moved around the room to see if students had questions and checked their work to ensure that they were making progress. Students also shared their work with others to get feedback. If a student or a group got stuck, the professor asked another group to help. She also gave hints, without giving away the answer. This created an environment of camaraderie in the classroom. Students learned together and from each other and the instructor. Most students seemed excited about helping their peers. There were however some students who minded their own business even though they were turned towards each other to work in groups.

Students solved problems on the board:
In order to utilize the available time most efficiently, the professor asked one or two students to write a problem on the board that they had successfully solved. This gave the other students, who could not finish solving the problem, a chance to understand the process. The professor reviewed the student's work and corrected it as they wrote on the board. Mathematics (Calculus) requires working the problem by hand.

Students need to see the process of evolution of mathematical equations or derivation of steps to understand the material. This technique also gave students, who volunteered, a boost of confidence. Students who volunteered got words of encouragements from the instructor. The instructor went over the solved problem and explained to the rest of the class how the problem was solved. Everyone was given a chance to take notes and determine their own mistakes. Students were encouraged to solve several problems. In mathematics, the proverb 'Practice makes one perfect' is certainly true.

Solicit Questions:
Students are often shy and would not ask questions, unless given a chance. The professor paused several times during her lecture / presentation and asked if there were any questions. While reviewing student's work, if a student made a mistake or had a question, she addressed it to the entire class to ensure that everyone understood the material and could avoid the potential error.

Instructor Solved problems on the Board:
Instructor challenged the students to solve a difficulty problem on the board. If she did not get any volunteers, she solved a few sample problems on the board. To understand mathematics, students need to see the process. Computer, projector, internet, or slides were not used during the lecture. Problems were solved step by step on the board. These were in addition to the problems that volunteer students had solved. After showing the process, the instructor put more problems on the board and challenged students to solve them.

A Lesson in Punctuality:
The best way to preach something is to practice it. The professor started and ended the class right on time. The presence of a clock in the room would help the professor stick to the time. She collected all the homework at the beginning of the class. Students learnt that if they did not do the work on time, they would lose credit.

After Class Help:
The professor announced that the class was officially over at the end of the class time. But the she remained available to answer any questions that student had after the class and stayed until all the questions were answered. She stuck around to answer further questions or help students out in case they needed more help.

Witty Jokes:
Throughout the lecture, the professor made several little witty jokes, which helped retain student's attention. Little sentences like 'make friends with the product rule,' and 'Calculus is fun for grownups,' were commonly used during the class. When a student working on the board made a sign error, the professor jokingly remarked 'plus one million or minus one million – not a big difference.' After the class period ended and students continued to solve problems, the professor remarked 'you are having a really good time – you do not want to stop!' When announcing a quiz, she said, 'you are all probably wondering: when can I show her how good I am at this…' Little jokes cracked a few students up and kept the class atmosphere friendly.

AN AEROSPACE ENGINEER'S OBSERVATIONS OF AN ELECTRONICS CLASS

PowerPoint Presentations:
The professor used Power Point presentations throughout the class to supplement his lectures. The presentations were used in conjunction with problem solving and explanation of material on the white board. This adds value for students to attend the classes. It also gives students all the class notes in a well-

documented format if they miss something during the class session. Although the initial development of all the Power Point slides can be tedious for the instructor, but once developed, they can easily be maintained and updated for future use. Power Point, however, have certain limitations. In engineering and mathematics problem solving, a concept is often better conveyed when students see the process of evolution of an equation or a numerical problem. The ideal way to do that is to actively solve a problem in class so students can understand how a similar problem can be solved step by step. Just showing a solved problem on a Power Point slide may not convey the process of solving often complex problems that engineering students face.

Real World Applications:
Engineering is an applied subject. The professor used several real world examples e.g. the use of telephones, internet etc. while talking about the bandwidth and how it can be expanded. The instructor emphasized the importance of the topic of discussion and detailed its practical significance. Students often learn and retain material better because of the real world examples that they can relate to. This may even motivate students to pursue further inquiry into a certain area, which might not happen if only the theory part is taught during a class.

Asking Questions:
Several times during the class the professor gave students opportunities to ask questions. If he noticed that there were no questions, he started the interaction by asking questions. This created a friendly environment in the classroom where students felt at ease in their conversations with the professor. A healthy, friendly, and open environment is likely to facilitate better learning than an environment where only one way interaction takes place.

AN AEROSPACE ENGINEER'S OBSERVATIONS OF PHYSICS CLASS

Logistics:
Majority of the students who take the physics class are either freshmen or sophomores. Almost all of them aspire to become engineers. So students in all engineering disciplines start out by taking physics classes, which makes the size of the physics classes much larger than the other classes observed in this study. Large classes pose special challenges, which a small class instructor may not have to deal with. The physics class observed had over 75 students enrolled. Almost all of them were present on the day of the observation, which was a healthy sign. The class was held in a large lecture hall. The professor would typically need a microphone to communicate in a hall that large. But it was observed that students were well behaved and disciplined – which may be an indication of the strong sense of presence of the instructor. The instructor did not need to use the microphone and was yet clearly heard all the way in the back of the class.

Answer Solicitation:
The instructor put a problem from the previous lecture on the board and solicited answers. Without judging, she put all the answers on the board. She got three different types of replies. Instead of giving the right answer at that point, she asked for votes for each reply. She then gave students some time to discuss the problem amongst their neighbors and explain what they thought. Research has shown [ref] that students occasionally learn better when they hear from each other as opposed to constantly hearing from the (same) instructor. After giving them a couple of minutes, the instructor asked for votes again for the three options. In this pole, almost everyone agreed on the right answer. In the author's opinion, this was an effective technique of getting everyone to understand the problem, reason and discuss with each other and rationalize the correct answer. It also got everyone engaged in the class from the very beginning. By the time the instructor was done discussing the problem, everyone in the class was focused and attentive.

The instructor kept all the students engaged by constantly asking questions.

No Notes for the Instructor:

The instructor did not use her notes to write on the white-board during the lecture. It appeared that the instructor was well prepared on the topic of her discussion. Even the subject matter experts teach better when they review the material before the classes. Having a good grasp of material helps but being current on it also reflects the instructor's will to perform well. Students can sense when an instructor is well prepared. A well prepared instructor is likely to be more engaging than the one who scrambles through their notes during the class.

Emphasis on Historical Significance:
The instructor emphasized the historical significance of the subject matter. That helps generate interest in students. When the instructor talked about the centripetal force, she clarified that the word is composed on two Greek words meaning 'center seeking'. A little history lesson will help remind students the direction of the force and when it is applicable.

Use of Props:
The professor brought several props to demonstrate live experiments during the class. She used a bucket filled with water and a stick attached with a string to demonstrate centripetal force in action. She claimed that if the bucket is rotated at a fast enough speed in a vertical circle, the water will not fall even when the bucket is facing down at the top of the circle. She explained this with a force diagram. Experiments like this may only take a few extra minutes from the class time but they help students understand and retain the concepts. They also help break the monotony in the class. Students get better engaged during and after the experiments. The professor also solicited help from students to conduct the experiments.

Real world examples:
In addition to the use of props, the professor gave several examples of real world cases when centripetal force affects us. She discussed the example of washer-dryer, which work because of centripetal force. A detailed problem was solved to show that a car in a turn on a ramp does not slide due to the angle of the ramp, even though a centripetal force is acting on it. She also explained that the car would slide if it went around the curve at a faster speed. She went on to explain why there are reduced speed limits around the curves. She solved the complete example problem on the board to determine the speed limit beyond which a car would skid. Friction force was also calculated in class. After listening to this example application, a student may drive around a curve and be able to explain to their peers why a reduced speed is needed, when centripetal and frictional forces are taken into account. It would also help them understand, why from a physics standpoint, it is important to slow down around the curve. The professor used different colors of markers to highlight or emphasize the important points. She highlighted the key concepts. In another example, she explained why small cars driving on a highway next to the large and heavy 18-wheeler truck get sucked towards the truck. Several other real world examples were used throughout the lecture. The author could clearly observe the level of curiosity increase amongst the students when such examples were discussed.

A problem with mistakes:
The instructor put a problem on the board and asked students to help solve it. There was an error in the solution. In her experience, students made that same error in the previous semesters. She even mentioned that it was a problem from the previous year's exam. She then asked the students to try to find out the error. She later explained why students typically fell in the trap and committed the same error. This was again an effective way to get the point across. Just telling students that they will make a mistake may not

be sufficient. Having them make that mistake and then giving them the right answer is potentially going to help students experience, learn, and remember. Also it helps clarify to a lot of students exactly what error they are prone to making.

Recitation:
In addition to the regular class session, the instructor conducts recitations in the after-hours. These are supposedly informal sessions where the instructor provides help to students by solving even more problems and discussing the course contents in a smaller group setting. Problem solving is a key to physics (and engineering) education. Giving students the extra help indicates to the students that the professor is interested in seeing her students learn and succeed.

AN AEROSPACE ENGINEER'S OBSERVATIONS OF A LANGUAGE CLASS

Current Affairs:

The professor in the Spanish class started the discussion with the current affairs pertaining to the Latin countries. Students were encouraged to review the online Spanish newspapers and come prepared to discuss the current affairs. Additionally, she discussed the related activities on campus. A Fulbright Foreign Language Teaching Assistant was visiting campus from Argentina. She encouraged all the students in the class to attend his presentation. He was also going to showcase an international film from Argentina (in Spanish), which the professor had organized. Such synergistic activities on campus, coordinated by the professor, help stimulate students' interest in the subject matter.

Sense of Presence:
The professor was aware of all the classroom activities. She acknowledged the presence of the guest (observer) for the purpose of the project. That made the observer and the students comfortable and it created a relaxed and amiable environment in the classroom.

Circular Seating Arrangement:
In all the observations, this was the first class where the seats were not arranged in rows or bolted to the ground. The professor encouraged everyone to sit in a semi-circle – thus facing each other and creating an environment to encourage student participation. This also helped the professor become part of the group. It changed the role of the professor from being a lecturer to a facilitator.

Student input incorporated:
In regards to the assignment submission deadlines, the instructor solicited student feedback. In general, having a firm deadline helps students complete their work. But if students are overwhelmed with the number of assignments, and have other jobs or family responsibilities, they often choose not to complete the homework and therefore suffer in the course. By asking them for their input in terms of the submission deadlines, students understand that the professor wants them to learn the material and cares about them. Establishing a student-professor relationship of mutual respect and understanding may help motivate them to put in the extra work required to learn the material.

Student Interaction:
The class had lots of student interactions. Students were constantly engaged because of their continuous interaction with the professor and fellow students. Almost all the material involved some kind of student involvement. If the professor discussed the use of past tense in a sentence, every student was asked to say a sentence that had a past tense involved. The professor made the class lively by adding little witty jokes during discussions. In the entire class session, students were observed talking, collaborating, and

contributing. For a few activities, they were paired with each other to discuss certain topics and then report their findings. All the students in the class were engaged. The professor went in circle to ask questions from everyone in the class. Having a small class certainly helped with that activity.

Supplemental Material:
In addition to the class notes and the text book, students were referred to several supplemental materials including related online books, articles, Youtube videos, facebook etc. The professor showed a few Youtube clips of the related topic. She had a class facebook account. All students were required to friend with the professor on the class facebook account. Important announcements, links, and references were posted on the account. This ensured that students were getting all the latest course related information, even when they were involved in unrelated social activities.

Individual Attention:
Language classes are mostly electives. Students enroll because they are interested in learning the language. The professor spoke Spanish during most of the class session. This approach attracted and retained their attention and forced the students to try to understand what was going on during the class. Students were asked to respond to questions in Spanish. It also created a certain level of peer pressure. The class period seemed like a constant dialog between the professor and the students. The professor had a constant eye contact with all the students and gave every single student individual attention. The professor later confessed that she did not believe in any board work (writing on the blackboard). Students learnt by an immersive environment of speaking and practicing.

Tests and Assignments:
The professor claimed that the chances of academic misconduct are minimized in her class because students were not evaluated by traditional testing methods. She tests students with one-on-one oral interviews. In addition, their comprehension is tested by having the students listen to speech and respond to written questions based on the speech. They will understand the material if they prepare all the extensive self-graded online activities. For the assignment, the professor asked students to write a paragraph about job interview. She gave them questions to address and answer in the paragraph. This was a good way to prepare them for a possible real world scenario where a student might be seeking a job in a Spanish speaking business environment. This approach has been referred to as 'learning by assessment'.

AN AEROSPACE ENGINEER'S OBSERVATIONS OF AN ARTS APPRECIATION CLASS

Second Chance:
In the book 'What the best college teachers do,' Ken Bain notes that in his research, he found that the most effective college professors give students multiple chances to excel. Even towards the end of the semester, if a student has not been doing well, a good professor would give them a chance by telling them that they could still make an A in the class if they did XYZ. It was observed in the arts appreciation, which is an optional class, that the students who wanted to improve their grade were given another chance to work on the test. Those who could not take the test at the designated time were allowed to submit it at a later time. Some people may argue that it would be unfair to the students who are diligent and want to finish their work in time. But the counter argument is that students who have other commitments may end up not doing the classwork at all and thus failing the class if they are not given another chance to succeed. Strong students are going to do well in either case. If a professor can bring the not so strong students up, and get them to complete the work, then the professor has probably done a good service for the entire class.

Group Work:
Students were asked to form small groups and discuss for a few minutes the Picasso's work that they had

selected. As part of their homework, they were asked to answer the following questions regarding their selected work of art.

- "Are we to paint what's on the face, what's inside the face, or what's behind it?"

During the group discussion session, the professor actively walked around the room to see whether students were working. She listened to a few conversations and gave her point of view. During the group discussion session, although students were working in small teams, the professor had the ownership of the entire classroom space. After the discussion session, a few students were asked to share their thoughts with everyone else in the class. When there were no volunteers, the professor picked on the students.

Museum Art:
The art at the local museums was discussed. As part of the assignment, students were asked to visit the local art museums, and then share their experiences. Professor pulled up pictures of the art pieces on the screen. Students were also asked questions about the art pieces at the museum. After visiting the museum, students were asked to put together reports summarizing their findings. To ensure that everyone visited the museum, the professor required that they took their picture at the museum. She asked students to read a paper before the following week related to art at the High Museum in Atlanta. As part of their report, they were also required to relate the art with the principles of design. This exercise gives students the sense of importance and significance of the subject matter. It is an applied method to help them internalize the principles discussed in the class. This active learning approach also helps students retain the material for long term.

History and Culture:
The professor emphasized the historical importance of the art. She talked about how and why art came to the U.S. from Europe. She showed a map of where the ancient art came from. She discussed how art was sometimes discovered accidently in the caves while people were digging for other purposes. Other cultural connections were drawn. Such cultural and historical connections help students realize the importance of arts. Pictures of the art being discussed were shown. She showed the picture of the Venus of Willendorf and discussed how it was discovered in the glaciers of Alps mountains. She showed pictures of the art from ancient Egypt and emphasized how art had existed since the beginning on civilization. It helps students appreciate art and its significance in the social and cultural context.

Engagement:
To actively engage them, students were asked to draw on a piece of paper, their mental images of a deer, bull, and a bird. They were not shown pictures of these animals while they were drawing. To be able to draw these figures, they needed to think about what the animals looked like. They had to draw the sketches from memory without any visual reference. Some of the sketches drawn were funnier than others. The exams, homework and other papers were returned to students while they were engaged in drawing the images. This helped save some valuable instruction time for more productive activities. The professor then showed the ancient cave drawings of similar animals. She discussed how the cave men drew these based on their mental pictures of the animals. Some of the animals were large and could not have been brought into the caves. This exercise helped the students appreciate those paintings and acknowledge why it was important to preserve them. The class session was interactive. The professor spent most of her time asking and answering questions throughout the class instead of giving all the information. In this manner, critical thinking was encouraged. Students were acknowledged for their backgrounds or for what they knew e.g. mathematics, biologists, engineers, architects etc.

Importance of the Subject:
The professor discussed the importance of preserving art. She related arts to the Rosetta stone and why it was important to preserve it. A student is likely to get interested in a subject matter if the professor is

interested in the subject and emphasizes its importance. She also drew connections between art work and astronomy and its various theories. She emphasized how it was important to preserve all the theories and work done by ancient artists because that would impact where art could go in the future. To lighten the mood, she would introduce little jokes related to astronomy suggesting that if the students were sky gazing in Atlanta, they should be careful because what they see might be a Delta airlines aircraft as opposed to their favorite star in the sky.

AN AEROSPACE ENGINEER'S OBSERVATIONS OF AN ENGINEERING MATERIALS CLASS

Use of Multimedia
Engineering education is enhanced significantly by the use of multi-media. In addition to writing mathematical equations, derivations, and problems on the white board, the professor used the Power Point slides, pictures, and oral presentation to deliver the lecture. Since different students respond to different stimuli, using a variety of instruments helps gain attention of most of the students. It also helps the professor the repeat the important points from different points of views, which as a result further help in student understanding of the material.

Announcements available on Slides
The important announcements and dates were made available on the slides, which are available to students on the class website. Although, the dates are available to students at other locations e.g. the syllabus, homework or project sheets etc. making them available on the slides gives them another location to see them and provides an additional possibility that students will see them and not miss a deadline. This however may cause additional work for the professor. A change in date may require updates at several locations, which may lead to the possibility of confusion.

Laboratory as part of the class
Most engineering courses are applied in nature. But not all of them emphasize enough on the application aspects of the theory. When a course is taught in conjunction with the corresponding laboratory it gives the students a real sense of importance of the material inculcated. It helps them appreciate the value of the theory discussed in class. It helps them relate the mathematics with its application. The same professor who taught the engineering materials course was responsible for teaching the laboratory course. Students got one extra credit for the added work load.
Things should know or immediately find out
To highlight the important points, the professor projected a slide entitled 'things you should learn from this module.' This list gives students a good reference point. They can refer back to it to ensure that they have met the learning objective of a given module or a chapter. It also helps review the material quickly. The slide had items that students were expected to know for the exam. Before the exams, students can review the list to check whether they have learnt the material expected to be learnt in a given module. This approach is also beneficial for long term retention of material.

Puzzle of the day
The professor showed one slide that was unrelated to the material covered in the class. The slide had a riddle. Students were given a few minutes to determine the answer. When no one could solve it, the professor asked students to think about it and give the answer the next time they met. This was a way to pique the curiosity of the most of the students. Most students got excited and felt challenged.

Casual Discussions
The professor maintained a casual atmosphere throughout the class session. Students felt at ease to ask questions. The significant portion of the lecture was spent in discussion with students. The professor gave examples and solicited student examples from their experiences.

Real World Examples
A large number of students appreciate the material when real world examples are used or demonstrated in conjunction with the course material. When discussing the 'dislocation of materials', the professor gave examples of metals, ceramics, polymers etc. and showed pictures of how they dislocated differently. He also related the material with other courses that the students might have taken e.g. when discussing 'work hardening', he emphasized how it related to material science.

Several Witty Jokes

Several witty jokes were used throughout the class to keep the students engaged.

> *As the professor saw students drifting or getting restless, he would say 'close your eyes as I go to the next slide – because you are going to see something totally wonderful.'*
>
> *When discussing 'cold working' (a mechanical process to shape materials e.g. forming, forging etc.), he related to working in the cold weather and how hard it was*
>
> *When discussing the structure of the materials, he pointed out FCC and then gave several possible definitions of what that might stand for e.g. Federal Communication Commission and waited for students to correct him (He was referring to Face Centered Cubic)*
>
> *When talking about 'slip plane,' he joked the plane that you can slip on (he was referring to the plane along which material internal structure can slip when deformed)*
>
> *Towards the end of the class, when he saw students closing their note books, he politely mentioned – we still have 60 (gave a pause) seconds. This cracked a few students up*

AN AEROSPACE ENGINEER'S OBSERVATIONS OF AN ENGINEERING MATERIALS CLASS (2)

Due to the high demand of the Engineering Materials class, two separate sections of the course are taught by two different professors. The following observations are from the second professor's class. Since the material and the syllabus were similar, a lot of techniques used by the first professor were also employed by the second professor and vice versa.

Several opportunities to demonstrate learning
Students were given several opportunities to demonstrate that they had learnt the material. On the day of the observation, there was a 20 minute quiz at the beginning of the class. This was one of the five quizzes given throughout the semester. Additionally, students got homework, three midterm exams, one final exam and the laboratory assignments. This method gave students plenty of opportunity to catch up if they missed one assessment or did not perform up to their expectation level.

Small class size
Small class sizes have their advantages. The professor was able to monitor all the students at all times. Students listened quietly but observed the lecture with interest and asked questions.

Real work experience
Professor solicited work experience from students and also gave examples from his experience. He used a combination of Power Point presentations and black board to teach the class. He also mixed in the cultural and historical significance of the material at hand. When explaining Polymers, he broke the word down to

Poly(many) and mers(repeat units) and then showed pictures of example repeat units that make up the structure of various materials. He also detailed the applications of different types of polymers. He demonstrated his knowledge and command over the material. An effective professor is the one who knows the material inside out and is good at delivering it.

Teaching by Examples
The professor introduced the concept of Co-Polymers which is formed by combining the good properties of two separate polymers. He explained the idea by giving the example of sticky spaghetti. Important points to remember were also emphasized. He also related the concept with the material covered in previous classes e.g. he defined viscosity, which is taught in more detail in fluid dynamics classes, when discussing thermoplastics. He gave example of a TV show and its relevance with viscosity.

A LANGUAGE PROF'S OBSERVATION OF AN AEROSPACE ENGINEER'S CLASS

The procedure used is to check what is observed in the class at intervals of every five minutes. The behaviors observed are the following:

Warm up
The first activity in every class exists to pave the way into the class. In can be something as simple as a conversation with the professor, music, the introduction of a manipulative, etc.

Instructor talk vs. Student talk
If the purpose of teaching is to provide students with the incentive to "own" the material, i.e., to internalize it, then there should be less instructor talk than student talk. If the class is one in which material is introduced, then there may be more instructor talk, with opportunity for students to participate, depending on whether the presentation is inductive (students arrive at a generalization alter using new material) or deductive (instructors give rules or laws, and then provide examples).

Instructor active vs. instructor passive
If the class is a presentation, and the instructor simply talks with no additional systems of delivery, i.e. visual, audio, story-telling, or kinetic activities, then the instructor is passive, a talking head. If, however, the instructor provides all sorts of vehicles for the delivery of the material, it will appeal to the students' varying learning styles, and the instructor is deemed to be active in this effort to reach more learners.

Students attentive or attending vs. Students distracted

This refers to student engagement. What are students doing at each 5 minute interval? Are they asking questions, taking notes, actively listening? Or, on the other hand, are they checking email, talking about things other than what is going on in the class, not focused?

Overview, Prime, Drill, Check.
Following Constance Knop's system of executing a successful class activity

a. Overview — did the instructor explain what will be taking place?
b. Prime — (as in priming a pump) Did the instructor lay the foundation for the activity by connecting it to previously presented and learned material?
c. Drill — did the instructor execute the activity successfully? Were the instructions clear?

d. Check--Was there a check for learning with re-entry of the material in another format? (Or did the instructor say "Do you understand?" – Without checking to see if the learners actually do understand.

Mechanical-Meaningful-Communicative

This is a continuum that moves from mechanical to meaningful to communicative (for want of a better word)

a. Mechanical — did the professor simply ask the students to learn verbatim, to parrot the material back?
b. Meaningful—Did the instructor leave room for the student to show s/he knows the material beyond the simple repetition of it, to apply the material to a context suggested by the instructor?
c. Communicative—Is the student able to apply the material to new contexts not presented by the instructor?

Nuhfer-Halten **Rubric for Observing Teaching**

	:05	:10	:15	:20	:25	:30	:35	:40	:45	:50
Warm-Up										
Instructor Talk										
Student Talk										
Instructor Active										
Instructor Passive										
Student Attentive										
Student Distracted										
Overview										
Prime										
Drill										
Check										
Mechanical										
Meaningful										
Communicative										
Reinforcement										
Errors Correction										
Supportive Material										
Comments										

Reinforcement

What does the instructor do when a student answers his/her question correctly? What sort of reinforcement is used? Is there a hierarchy for degrees of correctness?

Errors correction

Which errors should be corrected? How should they be corrected?

Are errors bad, or should they be analyzed to determine if the student should change his/her learning strategy? Hint: errors analysis is very useful for improving learning.
What does an instructor do when a student answers a question incorrectly? What strategy does the instructor use to insure that the student experiences success? That is, does the instructor go to another student for a correct answer, then return to the first student and give him another opportunity to respond to a re-worded question, in order to instill success in the first student?

Supportive materials
What sort of supportive materials and strategies are used to reinforce learning? Visuals, manipulatives, audio materials, kinetic activities, etc.

AN ELECTRICAL ENGINEER'S OBSERVATIONS OF A MUSIC APPRECIATION CLASS

Warm-up Activity (Student presentation of a piece of music)

- A student played an audio clip of a piece of music that he selected.
- The student provided a narrative of different musical features that he observed while the piece was playing.
- Student engagement appeared to be approximately 100% during this exercise.

Professor-led discussion

- This warm-up activity was followed by a question and answered-based discussion that appeared to review a topic taught previously.
- Rather than going over the topic on her own, the question and answer format encouraged student participation in the review and also provided an informal assessment of student understanding of the topic.
- If students appeared to have difficulty answering a specific question, hints were provided (instructional scaffolding technique).
- Student participation was about 70%
    - Some students were actively engaged throughout, i.e. answering questions.
    - Some students were attentive, i.e. focusing on the professor, but never answered any questions.
    - Some students could be seen performing other activities during this period of the class.

Professor-led Presentation of a New Topic

- A new topic was presented after the review session.
- The professor wrote various facts pertaining to the topic on the blackboard, while students took notes.
- Questions were asked at various points during this presentation and answers from students were solicited.
- Student participation was about 100% (all students appeared to be taking notes)

Multimedia Presentation

- Immediately following the presentation, a demonstration on the piano and the playing of an audio clip with a visual component was performed.
- This would assist student learning for students with different learning styles.

General Observations

- The enthusiasm of professor for the topic was palpable and I believe this assisted with student engagement.

AN ELECTRICAL ENGINEER'S OBSERVATIONS OF A CALCULUS CLASS

Warm-up Activity

- Warm-up activity required students to complete a problem based on the topic covered in the previous class (find the extrema of the function f(x) = 1 – 9x – 6x2 – x3).
- The solution of the problem was divided into steps.
- The students were given approximately 5 minutes to complete each step.
- After 5 minutes the professor solicited the students for the solution to the step, which she wrote on the board.
- If any of student's response was incorrect, then the professor would gently guide the class to the correct response.
- The professor also walked around the class during this activity to assist individual students with their queries/misconceptions.
- The final step required the students to graph the function in the regions surrounding the extrema (good for visual learners).
- The overall time for the warm-up exercise was 20 minutes.
- Student participation was 100%.
- Essentially this activity employed instructional scaffolding.

Professor-led Presentation of a New Topic

- A new topic was presented orally after the warm-up activity.
- The professor wrote salient points pertaining to the topic on the blackboard, while students took notes
- The professor would at times make statements based on incorrect assumptions to see if the students would correct her (a method to evaluate student understanding of the topic).
- Student participation was about 100% (all students appeared to be taking notes)

General Observations

- The method of delivery of the professor was enthusiastic and she utilized humor (this seemed to encourage student engagement).

A MECHANICAL ENGINEER'S OBSERVATIONS OF AN ARTS APPRECIATION CLASS

In an Art Appreciation class, the following was observed by a Mechanical Engineering Technology professor.

Continuity

The instructor reviewed the sequence of topic coverage and listed the topics that would be on the following exam. This particular lecture was on early 20th century American art and included a review of previously covered work on that topic plus some review of previous material on European art for contrast.

Presentation

Instructor asked a lot of questions of the students and was successful in evoking participation. She

frequently mentioned where specific works are currently on display, especially the works that can be seen locally (at the High Museum in Atlanta).

Directing/assessing/monitoring
Instructor gave students many opportunities to think independently about the subject. Instructor was extremely encouraging regarding participation, entertaining even questions which did not seem to make much sense.

Managing
Although there was a significant degree of participation, no disruptions were observed.
Students were asked to discuss a question in small groups. Apparently, this discussion was often about homework which had been returned. (This observer thinks that is a very good way to get students to explain things to each other and, since they have the graded work in front of them with the instructor's comments, they are not likely to teach each other something that is too far off the mark.) In this particular session, the groups were to discuss a quote by Picasso instead of a homework assignment.

A MECHANICAL ENGINEER'S OBSERVATIONS OF A MUSIC CLASS

In a Music Appreciation class, the following was observed by a Mechanical Engineering Technology professor.

This class session began with students getting a chance to see their results on a graded exam. The instructor called several students forward at a time. She seemed to know the students by name, and sometimes major, although this was a fairly large class. She kept control of the exams although it looked chaotic up there. Very good rapport between the instructor and students was observed. A feature of her grading system is that the lowest test grade is discarded and the highest one counted twice.

Two pieces of music that students had brought in were played. In the first case, the student explained why he liked the particular piece of music. As the music played, the instructor pointed out how it started calmly and built excitement as it went. She pointed out what particular instruments drove the excitement and how they did that. The student who brought in the second piece of music was a musician and quite knowledgeable. In this case, the instructor carried on a dialogue with the student and asked the other students to listen for what key it was in (how many sharps, rather than the note designation, as this is "not a music theory class"). I thought this was a very good example of adjusting to the level of the student. During all of this, there was much student participation and joy and focus. Once again, this observer thought that chaos was about to erupt, but in reality there was a very high level of beneficial participation.

Next, the subject of the current lecture, the Baroque Period, was introduced. The lecture, which was mostly run as a lively discussion, included a little biographical information about J.S. Bach. Then the period was contrasted with the Renaissance, which had been discussed in the preceding lectures. Snippets of music recorded with various period and modern instruments were supplemented by the instructor playing piano as she explained aspects of the music, and contrasted the piano with the harpsichord. Humor was interspersed throughout. You-tube videos were incorporated. The instructor was aware of what instruments some members of the class played and used this to strengthen the connections between all the students and the material being taught.

While most of the class is carried out as a lively discussion, there were short intervals of pure lecture. The instructor would throw candy to students who correctly answered questions. When the discussion would get too lively, or it was time for a pure lecture portion, the instructor quickly settled the class down, somehow.

This observer has never attended a more enjoyable class. The pace seemed fast and the students seemed energized by the pace and by the lively personality of the instructor.

A MECHANICAL ENGINEER'S OBSERVATIONS OF A CALCULUS CLASS

In a Calculus I class, the following was observed by a Mechanical Engineering Technology professor.

On this day a test was returned. The professor discussed grade distribution and let students in a certain grade range know how much work would be required in the remaining weeks of the semester. Students can turn in corrections to test for some additional credit. They are encouraged to work together on the exam corrections.

Continuity
The professor told the students what topics would be covered in the next few weeks and reviewed what they already knew. After revealing something that followed logically from the previous discussion, she asked if anyone was "shocked to the core." Many light hearted comments such as this contributed to obvious good rapport with the students. As she discussed derivatives, she referred back to particle motion. I thought that it was unusual that the application had preceded the math, which is good for the type of learners we have at SPSU.

Presentation
The professor used the white board rather than the computer screen for the most part. Theorems were written out on the white board and graphical solutions were done in "real time," which I think provides much better pacing than other methods. Some discussion was interspersed throughout.

Directing/assessing/monitoring
The professor stopped and had the students do some short computations individually on paper. On some of these occasions, she would have the students pair up and compare notes after they had worked individually. I observed one student sitting near me who only became engaged with the material when he had to discuss it with another student. One problem the student had to work on required factoring, of which she said, "We did factoring before--almost like I knew it would come up again." She also gave a hint on a negative exponent which she said she knew would give the students trouble. As students worked on these problems, she walked around and looked for problems they were having, although the room was crowded so she couldn't get to everybody.

Managing
Throughout, good rapport with the students was evident. No disruptions were observed. After class, students were invited to stay and work on the exam corrections.

A MECHANICAL ENGINEER'S OBSERVATIONS OF A SYSTEMS ENGINEERING CLASS

In an Aircraft Design and Performance class offered by Systems Engineering, the following was observed by a Mechanical Engineering Technology professor.

The class had been on a Lockheed Tour, so the professor answered some questions from that.
The professor had graded an exam. He gave average score, high, low, and standard deviation, but waited until end of class to return the exams (a good strategy). He used this opportunity to explain the concept of standard deviation without numbers or formulas. I think this is an important concept and students often

get confused by the math. Using something that is important to students personally, their grades, and purposely avoiding the formulas are good strategies for teaching this concept. There was quite a bit of interaction with students in this explanation.

The professor pointed out that one student had solved a particular test problem in a way that indicated he had memorized a formula rather than applying concepts he should have known. I can so relate.

There were ten students present and all seemed to be engaged and most participating.
The current lecture was on drag reduction through minimizing wetted area and vortex control. He did a good explanation, using whiteboard, of keeping cross-sectional area constant. This is accomplished on Boeing 747 by the fuselage bump—a good example that uses something with which every student is familiar.

Continuity
The professor pointed out how the material from this lecture and related YouTube sites could be used in their projects. The project is apparently an aircraft design.

Presentation
The professor used the whiteboard rather than the computer screen for the most part, but showed a YouTube video. He mentioned that there are many YouTube videos on aircraft design. Very interactive presentation, with student being asked to speculate on various aspects of aircraft design. Lecture was very conversational in style.

A MUSIC PROFESSOR'S OBSERVATION OF AN AEROSPACE ENGINEERING CLASS

Ice-Breaker
Class was well-prepared and well-paced. Within the first ten minute section, the professor discussed assignments; handed back tests; took a consensus with students and agreed the next test would be given the following week (respect for student input; students greatly appreciated this). Being a very personable professor, a light discussion about an upcoming field-trip ensued. Finally, the professor asked, "Any questions before we start?"

Student-Led Teaching and Learning
The next ten minute section began with the professor clarifying objectives which related to prior lesson knowledge. A designated student went to the front of the room and reviewed what was leaned in class the previous week. The professor took this opportunity to ask this student questions about her knowledge and understanding with the subject matter. When this student could not answer correctly about a formula, the teacher asked another student who was able to relay the correct information. This technique took the pressure off the 'designated' student and she was able to write down the correct formula at this time.

Professor-Led Teaching and Expectations
A model of a plane was displayed on the overhead projector and a discussion ensued about its design and color. The professor also drew an example of a plane on the whiteboard to point out specific features to which the students and professor carried on a dialogue. This created a segue-way into the lecture where the professor informed the students that they must begin their (end-of-semester-project) airplane sketches; what was required of such sketches; and during this time, the professor wrote a list of expectations on the board for this assignment.

New Concept

A candy question followed but the students could not answer it. The professor gave the students the answer and also wrote it on the board for students to write down the information. The greatest amount of time (twenty minutes) was dedicated to learning about this new concept.

Learning Atmosphere
Although this class was a professor led dialogue with student input, the students were provided a safe and comfortable atmosphere to learn and share their knowledge. The professor used well-timed and smooth transitions within topics. Students were encouraged to participate from professor's questions.

Professor Knowledge
The professor is very knowledgeable with the subject material and did not need to refer to notes or a textbook, allowing him to freely walk around the front of the room and interact with the students.

A MUSIC PROFESSOR'S OBSERVATION OF A DATA COMMUNICATIONS CLASS

The professor began class by stating the objectives for what was being taught that particular day. The first half of class time was a professor led dialogue teaching a new concept and the second half of class was used for group assignments.

New Concept
Power points from the book's publisher were used. While these were displayed on the overhead projector, the professor explained and wrote information on the opposite whiteboard. During the explanation process, the professor would ask the students questions and try to have them answer. One of the publisher's power points had an error to which the professor took the opportunity to have his students find the mistake. He and the class re-worked the answer on the whiteboard together.

Learning Atmosphere
This was a small and quiet class; probably typical of an engineering class with a professor-led discussion. The second half of the class was livelier when the students were encouraged to work together in groups. Although provided a safe and comfortable atmosphere, the students were more concerned with writing notes than answering questions and actively participating.

Professor Knowledge
The professor is very knowledgeable with the subject material and did not need to refer to notes or a textbook, allowing him to freely walk around the front of the room and interact with the students.

A MUSIC PROFESSOR'S OBSERVATION OF A FOREIGN LANGUAGE CLASS

This was a very interactive and student focused class where students used name cards. Students sat in a crescent-shape where they were able to see one another and the professor. This seating arrangement aided and encouraged class discussion.

Ice Breaker
The professor and class discussed assignments and homework (or lack thereof) together. Due to the students being behind with their work, the professor announced that class would be cancelled for students to use this time and "catch up." A two-way discussion ensued again, with the professor asking students if they were in need of more structure with due dates and deadlines. There was humor and a mutual respect demonstrated.

New Cultural Concepts
Class officially began with the use of technology: incorporating facebook and a music video. When the video concluded, the professor asked students questions in Spanish and aided students responses (in Spanish) when needed. Another short video was played, teaching students a cultural lesson on how to make Cuban coffee. (It would have been wonderful to have been able to make some in class.) This use of technology made the class very enjoyable and this could be seen on the students' smiling faces.

Student Centered Learning
The next section in class focused on current events which the students were assigned to share with the class. Discussed in Spanish, the class interacted either speaking or listening. The professor, acting as a facilitator, aided student vocabulary with correct pronunciation and correct use of verbs which the students were encouraged to verbally repeat.

As an activity, students were paired together to speak with one another in Spanish; encouraging proper usage of the language and vocabulary.

The final part of the class focused on an upcoming exam. Students were provided information on what the test entailed and how many points were associated with the different sections of the test.

Learning Atmosphere

This was an enjoyable and enthusiastic class which was professor-led with questions and humor, ensuing that students were constantly communicating in Spanish. Students were happy to be in class and participating.

A MUSIC PROFESSOR'S OBSERVATION OF A CONSTRUCTION LAW CLASS

This was an informative class that began with a lecture; explaining legal terms; and court procedures. As the professor wrote the terms on the whiteboard and gave explanation, students were encouraged to ask questions while taking notes.

Professor Knowledge
The professor did not refer to notes or a textbook which allowed her to move freely at the front of the room. She used "fill in the blank" questions to solicit student participation.

Professor-Led Teaching & Student Centered Learning
Forty minutes of instruction ensued and then the students were divided into two groups where they had to arrive at reasons to either go to trial or mediate a situation about a concrete driveway that was fairly new but broken. It was interesting to hear the questions asked by opposing groups and directed at one another. During this time, the professor role-played as the disgruntled owner of the broken driveway. This activity had the students apply the new body of knowledge that was presented earlier and allowed the professor to assess student understanding.

Class objectives were well planned and a smooth transition between lecture and activity occurred. The material was logically sequenced and the professor affirmed and praised students' correct answers and participation.

A MUSIC PROFESSOR'S OBSERVATION OF A MATH CLASS

Learning Atmosphere
The professor was very excited and animated; she was constantly moving around the front of the room; smiling; and obviously passionate about her subject. She also mentioned her office hours for students that needed extra help allowing students to know that this professor cared about them.

Professor-Led Teaching
Class began with the reason for why calculus was important and how 'it' was able to provide answers. Handouts were given to the students and then the professor wrote out the objective on the chalkboard and discussed it.

As the professor wrote a math equation on the board, students worked on the problem in their notes. During this time, the professor constantly engaged the class by asking many questions and complimented the students when an answer was suggested.

The professor's enthusiasm for calculus and solicitation for student participation also indicated a confidence in her students.

CONCLUSIONS

The objective of this project is to give an opportunity to the faculty members in different disciplines on a Polytechnic university to observe their peers in various disciplines for innovative classroom based learning activities. The observations were done throughout the semester. The idea was to give a chance to faculty members to explore if there are techniques used by other professors in or outside of their own disciplines, analyze those techniques, reflect on their effectiveness, and possibly adapt them for their own use in their respective disciplines. A number of these techniques discussed in this paper can be used by professors across disciplines. In this on-going project, the idea is to expand this exercise and give professors from other disciplines a chance to observe and adapt the effective teaching methodologies for improved teaching and learning in higher education.

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