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**The Document of Innovations in
Teaching and Learning
At the University of the Sciences in Philadelphia**

The Teaching and Learning Center of the University of the Sciences in Philadelphia is proud to produce the sixth annual Document of Innovations. Previous editions of the Document of Innovations have been recognized as one of the best ways to know how faculty are making changes in their teaching. The innovations are indexed according to categories including: assessment and evaluating students, ideas that transcend disciplines, reflection on learning, student research, learning-centered teaching, using technology, working smarter not harder and various types of teaching- learning transactions. The types of teaching-learning transactions that are featured include: active learning, collaborative learning, distance learning, service-learning, and simulations. A few sustained innovations that continue to be implemented are showcased as well as new ideas.

The overall goal of this document is to improve teaching and learning. Many faculty are trying teaching innovations, as evidenced by the complete set of Document of Innovations published to date. A compilation of all the teaching innovations into a book allows others to learn about these ideas and adapt them. This document provides faculty ideas that have worked with our students. This document is disseminated throughout the campus and to interested people outside the University to give increased recognition to individual faculty who strive to improve their teaching as well as others who enable students to learn more. Hopefully, this document will help faculty to collaborate on new ideas and will inspire others to try new methods to improve their teaching and learning.

All of the innovators welcome feedback on their ideas. If you use or adapt an innovation, please give the author credit and tell the original innovator how it worked.

To submit a description of an innovation for next year's edition, please use the submission form in the back of this document. Please submit it electronically.

Phyllis Blumberg, Ph.D.
Director of the Teaching and Learning Center
June 2005

Title of Innovation: To Hold A Class When You Can Not Be There

Name of Innovator: Tarlok Singh Aurora

Telephone Number: 215 596 8911 email address: t.aurora@usip.edu

Department: Mathematics, Physics and Statistics and Computer Science

Type of students: Sophomores

Type of course or activity where implemented: required, core curriculum

Leahy innovation submission: No

Course or activity where implemented: Physics II Spring 2005

Describe rationale or goals of innovative educational activity:

Faculty sometimes can not be in class because of an anticipated need to travel to another location to participate in conferences or give seminars. Due to scheduling conflicts, it may be difficult to find a substitute instructor for the class. Under these conditions, a less desirable option is to simply cancel the class. It would be more productive for learning and teaching to make some assignments that students could work on during this class time, in the absence of the instructor. Another goal was to enable the students become self-learners and team workers. With these goals in mind, an assignment was developed to engage the students in self-learning while the instructor could not be there in class.

Describe the innovation and its implementation:

Due to a need to travel to a conference, an assignment was developed to enable students learn on their own in class. Students were informed that an assignment would be posted on the Blackboard and asked to meet in class to study together on the assignment on Monday. The completed assignment was due no later than the next class period (Wednesday). It was also made clear that the material covered by the assignment was important for the further study of the optics topics. Class cancellation and time constraints would have made it more difficult to teach the material in greater depth. Students liked the idea since they were going to be on campus for the scheduled class time anyway and could finish the assignment in class in 50 minutes.

The assignment involved reading five selected pages from two new chapters in optics (next in the sequence in syllabus) that were going to be discussed next in class. Five descriptive questions from these two new chapters and a quiz from a previous chapter were posted on the Blackboard. The questions were selected carefully in order to enable students learn the new conceptual material that had not yet been covered in class. The intent was to have the students learn basic concepts from these two chapters that were going to be needed in the further (and more mathematical) development of the optics topics.

On the day the completed assignment was due, thirteen students submitted a correctly completed group assignment, with the names of the participants. One student submitted the assignment by email because he was unable to join the group in class, for some reason. This was the most admirable part: 13 out of 14 sophomore students met in a scheduled class in the absence of the instructor, studied as a group without supervision and in addition did the assignment correctly. This was not done for extra credit. This assignment was counted as one of the ten scheduled homework assignments, worth a total of 18% of final course grade. The assignment was quickly reviewed and because the students seemed to have understood the basic concepts, these concepts were used to build the remainder of the chapter upon. Because the following and final examination contained all problems, none of these concepts were directly included on the final.

Describe Outcome:

1. This approach enabled holding a class when the instructor could not be there.
2. It placed the responsibility for learning on students.
3. Students worked as group, and one or more students lead the group.
4. All students participated in the assignment.
5. For the instructor, it enabled covering some less complicated topics, thereby providing more time to go over complex material in class.
6. It built a collaborative teaching/learning environment between students and instructor.
7. Instructor developed more faith in students' ability and willingness to do the work if approached kindly and with proper guidance.

Reflect on what's working and why it is working:

This approach has been used only once for a specific purpose, and worked well (somewhat surprisingly).

Describe student reaction to the innovation:

Students liked this approach because they were able to finish the assignment in a short time in a collaborative environment.

Will innovation be sustained within the course?: Yes
If yes, will you do anything differently?

Will you implement this innovation in other courses? Yes.

What advice would you give to other people adapting this innovation?

For larger class sizes, the students could be split into smaller groups for the assignments.

Title of Innovation: Learning Logs

Name of Innovators: Phyllis Blumberg, BJ Cunningham, Barbara Byrne

Departments: Teaching and Learning Center, Pharmacy Administration, Academic Affairs

Telephone Numbers: 215-895-1167, 215,596-8572, 215-596-8865

Email Addresses: p.blumbe@usip.edu; w.cunnin@usip.edu; b.byrne@usip.edu

Type of Students: 1st year Pharmacy students

Type of course or activity where implemented: required

Leahy Innovation submission: No

Course or activity where implemented: PP181

Describe rationale or goals of innovative educational activity:

Students could select to write learning logs as part of their grade. The goals of the learning log were to ask students to reflect on their learning and their learning process both in this course and in the other course they were taking. Writing is a way of clarifying one's thinking and serves as a vehicle to help students engage in metacognition of their own learning. The learning logs assist students to understand why this course is required and to understand why the content of this course is covered. Frequent writing helps students to learn to write efficiently and get over writer's block.

Describe the innovation and its implementation:

Each week students can write a specific 1 page (typed and double spaced) learning log that addresses different aspects of the learning in this course or the other courses they were taking. Students can select which logs they wanted to write about. Directions for each learning log include specific questions that need to be addressed. Examples of specific learning logs include reactions to a document that addresses responsibilities of college students, why is this course required, taking stock of how they are doing, how their study habits have changed since high school, how they have changed since high school, and advice to incoming students in this course.

Describe outcomes, especially learning outcomes, and impact of the innovation:

About ½ of the students wrote superficial logs or answers that seemed to parrot back what was said in class or in the syllabus without making it relevant to their own lives. The rest wrote really meaningful, honest, very insightful and very reflective logs. We have observed that the quality of an answer, in terms of its quality of reflection and insight is a measure of student engagement on this course or perhaps even in all courses at USP. Sometimes these logs contained something that needed to be followed up, such as making a call to the student's advisor or to ask the student to come in and talk to the instructor about a concern they raised in a log.

Reflect on what's working and why it is working:

It is essential to give students, especially beginning USP students very specific guidelines and questions to address on learning logs otherwise students may not know what to do and the logs are likely to be superficial and non-specific. Giving students different topics each week allows students to think about different topics each week. All of these topics should help students relate to what they are talking about in class and help them make meaning out this content in terms of their own lives.

Describe student reaction to the innovation:

Most students who wrote learning logs liked doing them. Some said it was an easy assignment for them because they like to write or are naturally reflective. Some students felt it was a good way to

learn. It was hard to judge the reactions of the students who did not take these assignments seriously.

Will innovation be sustained within the course?: Yes
If yes, will you do anything differently? Describe:

Give students fewer options. Not all topics worked as well as others. We plan to rewrite the assignments and eliminate some. In the future we will require a better log to get credit.

Will you implement this innovation in other courses? No
Describe:

No, no teaching any other relevant courses

What advice would you give to other people adapting this innovation?

Ask another faculty to read over the assignments for clarity or pilot test assignments before using them with students. Some times we write assignments that are not as clear to the students.

Title of Innovation: Using Personal Response Devices (Clickers) in the Classroom

Name of Innovator: Bernard J. Brunner

Telephone Number: 215-596-8898 Email Address: b.brunne@usip.edu

Department: Mathematics, Physics, Computer Science and Statistics

Type of Students: Second Year - Different Majors

Type of course or activity where implemented: required

Leahy Innovation submission: No

Course or activity where implemented: Introductory Physics I & II

Describe rationale or goals of innovative educational activity:

The goal is to enhance student learning by increasing both student participation and classroom discussion.

Describe the innovation and its implementation:

The hardware to receive signals from individual students and the software to process the signals is installed on the classroom computer. Students purchase the keypad from the bookstore and register the device on line.

Questions on the material are presented to the class. Questions are multiple choice, true-false, or yes-no, and are designed to check the understanding of concepts or the ability to apply concepts in solving basic problems. Students respond using their keypads and the results can be shown as the number of students giving each response or as a histogram. When a significant number of students disagree on the answer, the question can then be discussed in their preassigned groups to see if a consensus can be reached. After discussion the question is posed again and responses may be elicited from each individual or a single response from the group may be given by a group spokesperson.

The discussion groups are chosen by the instructor to be nearly heterogeneous. Students are required to sit with their groups during class.

Describe outcomes, especially learning outcomes, and impact of the innovation:

I use a national test on the knowledge of concepts in mechanics as pre- and post-tests. Students scores on the two tests are compared using a measure called 'g-score' or 'normalized gain' which is the ratio of change in score to the maximum possible change ($\text{change}/(100 - \text{Score } 1)$). I've used this measure about seven times since 2000 and the average g-scores for the classes have ranged from 0.27 to 0.33. During Summer 2005 Session 1, after three semesters of using the Personal Response Devices, the g-score average jumped to 0.40.

In grouping g-scores by student grades in the courses on three occasions, the A students twice had average scores in the 0.55 range and this jumped to 0.76 during Summer I 2005.

Reflect on what's working and why it is working:

The use of the keypads adds to the other techniques that I have used in the past: Just in Time Teaching (JiTT) and group quizzes. Probably the most important factor is generating good discussion within the groups. This is enhanced by the use of the keypads since each student is held accountable for participation.

Describe student reaction to the innovation:

In the first semester of usage many students indicated that they thought it was a good idea, but more than half of the class disliked it. The reasons they disliked the Personal Response System were one or both of the following: extra cost to the students and various technical problems with the initial usage wasted class time. In the spring term the responses were much more favorable. For example: "I like the use of key pads

because it allows us to see our mistakes and its comforting to see that I am not the only one wrong. I personally like it.”

Will innovation be sustained within the course?: Yes
If yes, will you do anything differently? Describe:

I will work at upgrading the questions used with the Personal Response System so that more discussion is involved.

Will you implement this innovation in other courses?: Yes
Describe:

Only if I teach other classes with enrollments exceeding 15 to 20 students. This technique may also be useful in the laboratory setting, but will require time to implement.

What advice would you give to other people adapting this innovation?

For many science or math courses discussions have not been traditionally used, so promoting useful discussions is a challenge for instructors. Don't give up if the first attempts don't show the desired results.

Sustained Innovation

Title of Innovation: Math Limericks for Fun and Profit

Name of Innovator: Marion D. Cohen

Telephone Number: 215-732-7723 **e mail address:** mathwoman199436@aol.com

Department: Mathematics, Physics, Statistics and Computer Science

Type of Students: Any type-lately, freshmen and sophomores

Type of course or activity where implemented: elective

Leahy Innovation submission: No

Course or activity where implemented: MA101, MA102, STAT310

Describe rationale or goals of innovative educational activity:

As the title implies, for fun and profit. While providing a positive way to look at some of the material, the limericks say things in ways that the lectures and texts do not, and provide plenty of mnemonic devices.

Describe the innovation and its implementation:

Whatever the course is that I am teaching, I have written limericks for it! (If it's a course that I haven't taught before, I write the limericks as I do the lecture preparations; it's fun and profitable for ME, too! E.g., It helps me to gain new understanding of the material.) I have a set of limericks on Calc II and II, Differential Equations, Partial Differential Equations, Complex Analysis, Vector analysis, Linear Algebra, Abstract Algebra, and son on.) Usually I simply hand out the set of limericks towards the end of the term or even directly after the Final. The limericks are optional, in the sense that they're not required reading. In fact, I usually simply announce to the class that they're on my desk, for the taking, after class. (Many of the students do choose to take, and many do not -- or they forget about it...) Lately I have been actually **READING** the limericks in class -- in particular, to try to prevent some particular misconception. I have been surprised that the students actually laugh! So I have been doing this more and more - also, reciting those limericks if they come to my office asking question about a particular topic.

Here is a sampling of Calculus limericks:

(Power Rule)

It is not my intention to vex.

It is not my intention to hex.

y only intention

is simply to mention:

The derive of x-square is 2x.

(General Power Rule)

On, Dasher! On, Dancer! On, Prancer!

Don't forget the power in the answer.

It gives it might

and makes it right

also a little fancier.

(Product Rule)

Don't forget, f appear TWICE

g will behave likewise

If you make like a dunce

and write them just once.

well, you'll get what you get for half-price.

Describe outcomes, especially learning outcomes, and impact of the innovation:

Who can say? My main purpose in sharing limericks with students is to help them see how much it is possible to love and enjoy math, or any subject or topic. Perhaps the phrase, "supplementary material", says most of what is to be said about this uses of this innovation. (I used them in my graduate courses several years ago and years later several students told me how much they remember and appreciated them.)

Describe any changes that you have made in its implementation:

As I have said, I have increasingly found that it is profitable, and pleasant, to actually read (or recite from memory) the limericks in the classroom (rather than only offering them as optional handouts).

Reflect on why this innovation continues to work:

Again, it develops and sustains a rapport, and positive vibes, as well as marking certain important points in the lectures, and helping to nip misconceptions in the bud.

Describe student reaction to the innovation:

Again, this enjoys them! And they don't make the mistakes that the limericks caution them against!

**Will innovation be sustained within the course?: Yes
If yes, will you do anything differently? Describe:**

Again, I will probably (according to the vibes in the particular classroom) actually use them more in the classroom. Also, I have been putting them on blackboard.

**Will you implement this innovation in other courses? : Yes
Describe:**

If it's a course I haven't taught before, I look forward to writing new limericks! (In fact, right now I'm taking a "seminar" on topology given by Dr. Kumar Shwetketu Virvhadra here at USP, and I'm considering treating myself to writing Topology limericks.

What advice would you give to other people adapting this innovation?

Anyone is welcome to copies of my limericks, for use in class or anything lese; just please reference me. As for advice, if used as supplementary reading, make it optional and in the spirit of fun. And don't TEST on them! (One idea is to have a "closed book/ closed notes/ open LIMERICKS" test! I haven't yet tried it; it's just an idea. I also once, in a graduate course, said that I'd give Extra Credit to anyone who composed a limerick on the subject. A couple of students actually took me up on this!)

Name of Innovation: Next Topic, Sneak Preview, Extra Points
Name of Innovator: Marion D. Cohen
Department: Mathematics, Physics, Computer Science, and Statistics
Telephone Number: 215 596-7520 Email Address: mathwoman199436@aol.com
Type of Students: Any type-lately, freshman and sophomores
Type of course or activity where implemented: elective
Leahy Innovation submission: No
Course or activity where implemented: ST310, MA102

Describe rationale or goals of this innovative educational activity:

To help students to get a "head start" on the "next" topic, or other future topics to be covered in the course -- also (even if that "fails") to help students FEEL familiar with the future material (and to RECOGNIZE it, on some level, when it comes up in the future).

Describe the innovation and its implementation:

Included in every (or almost every) test that I give is, at the end, an "Extra Credit" section, consisting of several (optional) problems. Some of these problems are, as often with Extra Credit, particularly interesting and/or challenging. But the SUB-category WITH WHICH THIS "PRACTICE" IS CONCERNED is the category of problems that pertain to, as mentioned above, FUTURE topics of the course -- in particular, the "next" topic (after the topic(s) covered in the test). In fact, when passing out the test at the beginning of the class, I advise students to work on "those" Extra Credit problems that pertain to future topics. (Of course, I don't word it that way; instead, I tell them the NUMBER of the Extra Credit problem that I want them to put their energies and priorities into -- e.g., Extra Credit Problem X3.)

Here are three examples of such Extra Credit problems:

- (1) In Calculus (MA102), BEFORE we get to anti-differentiation, I give Extra Credit problems such as: Find a function(or two)WHOSE derivative is (,say,) x^2 (or, later on in the course, e^{2x} , or $(\cos x)e^{\sin x}$).
- (2) Also in Calculus, BEFORE we get to Curve-Sketching, I give the Extra Credit problem: Sketch the graphs of five functions $f(x)$, with the following property: $f'(4) = 0$ and $f'(9) = 0$, and FOR ALL OTHER x , $f'(x)$ does NOT equal 0.
- (3) In Statistics, in the test on Confidence Intervals for the Population Mean and Confidence Intervals for the Difference between Two Population Means, I give a problem about constructing a confidence interval for a population PROPORTION. (Along with the problem is written out the procedure for such confidence interval construction -- that is, a VERY short summary of this next topic.)

Describe outcomes, especially learning outcomes, and impact of the innovation:

As expected (by me), not all of the students partake of the extra credit. However, it has been my experience, over the decades in which I've taught at various universities (including, of course, USP), that MOST students so choose. It has also been my experience that most students GET at least SOME of the Extra Credit problems. many students have been ENTHUSIASTIC about "my" Extra Credit problems; one student recently remarked, "I spend most of my time and energy in this course doing the Extra Credit!" (It should probably be said that this is a student who "gets" the core material and doesn't need to spend much time doing the "regular" parts of the test.)

This term, in MA102, what happens on "test days", with respect to the Extra Credit, is: A handful (perhaps one and a half handfuls) of students stay "to the end" and beyond, and really concentrate on that Extra Credit, of some of it. These students seem to enjoy it -- several have SAID that they

enjoy it. (One student in one of my Stat classes wrote me a note on his test paper: "I'm sorry I didn't have time to work on the Extra Credit. The problems do look interesting.")

Reflect on what's working and why it is working:

I believe that, besides having some effect on what students will bring with them when we actually begin the next topic, these Extra Credit problems help to develop a rapport -- or perhaps SEVERAL rapports: between the student and the topic(s), between the student and the teacher, and among the students themselves.

Describe student reaction to the innovation:

I can only SPECULATE on the extent to which it's working; this is something that can't quite be measured. What I know for sure is that SOME students ENJOY it -- also, that it can't hurt ! (I also know that, in general, students do well in my classes -- and don't groan very much, about Extra Credit or anything else!)

Will innovation be sustained within the course? : Yes

If yes, will you do anything differently? Describe:

Probably not. (I usually don't have Extra Credit on Final Exams, or on the test just preceding the Final -- because I want to "wrap things up" and also, I feel that students need all the energy they have for "dealing" with all of their finals, in all of their courses.)

Will you implement this innovation in other courses? : Yes

Describe:

In the same general way as described above. (Of course, the problems themselves will depend upon the course)

What advice would you give to other people adapting this innovation?

I feel that this is not for everyone, meaning not for all students. So I don't insist that students "try" the Extra Credit (although I'm VERY encouraging; I say things like "Aw come on, there's plenty of time left; I think you can do it". And students have sometimes answered this with, "I REALLY have tried the best I can," and then I say "Okay. Good."

Teachers should, I believe, keep in mind that students have individual learning styles, habits, and SCHEDULES; for that reason I don't pressure.

Sustained Innovation

Title of innovation: The Benefits of Cooperative Learning, Peer Modeling and Email: Improving the WPEE Passing Rate of Students Enrolled in the Writing Proficiency Course

Name of innovator: Miriam Diaz-Gilbert

Telephone number: 215-596-8769 **email address:** m.gilber@usip.edu

Department: Humanities

Type of students: ESL

Type of course or activity where implemented: other

Leahy Innovation submission: Yes

Course or activity where implemented: EN 095

Describe rationale or goals of innovative educational activity:

The goal of implementing cooperative learning, peer modeling and the use of email in my summer writing proficiency course was to help my students improve argumentative essay writing skills, critical thinking skills and grammar skills so they could improve their chances to pass the Writing Proficiency exam (WPE). Seven students enrolled in my summer 2002 course; six were ESL students. Of the six, 3 had not been able to graduate as a result of having failed the WPE multiple times, despite collectively receiving 338 hrs. of one-on-one tutoring in the Writing Center. Ten students enrolled in my summer 2003 course; 8 were ESL students, one of whom had not been allowed to graduate. These eight students had collectively received 219 hours of one-on-one tutoring in the writing. Eleven students enrolled in my summer 2004 course; 10 were ESL one of whom had not been allowed to graduate in May 2004. All had collectively received 266 hours of one-on-one tutoring in the writing center.

To address the needs of the students in the most efficient and practical manner that would permit me to teach more effectively and provide the students with an environment conducive to learning, I integrated three learning approaches that would encourage active learning: cooperative learning, peer modeling and the use of email, but without eliminating one-on-one sessions with each student.

Describe the innovation and its implementation:

Guided cooperative group learning provided students the opportunity to brainstorm essay questions with each other in pairs or in groups of 3-4 students, with me as facilitator. Group brainstorming, as opposed to brainstorming one-on-one with only me, allowed students to share, to test their ideas and to learn from each other. Brainstorming with peers can be less intimidating than brainstorming with the instructor, as brainstorming during one-on-one instruction/tutoring can be intimidating to the student. After brainstorming sessions, students wrote their individual essay drafts on computers and submitted them in class or via email for initial evaluation by me for grammar, content, organization, etc.

Peer modeling of student essays allowed them to receive input and comments from each other via discussion, in addition to my written evaluations, which included highlighting of grammar/sentence structure errors to help students keep track error-free sentences, and feedback on content, support, and suggestions for improvement on each draft and revision. Samples of student-produced paragraphs/essays were shared in groups to discuss the strengths and weaknesses of their paragraphs/essays in terms of support and grammar. The exchange and comments received from each other in the discussions provided them with good tips and models for better writing, and helped them to recognize their individual writing strengths and weaknesses.

Using email to send their drafts and revisions, and to receive feedback proved very effective for me as the reader and for the students as writers. Their typed essays were legible, as were my comments and suggestions. Email also provided for a good and organized way to visually track progress, evaluate and receive feedback.

Describe outcomes, especially learning outcomes, and impact of the innovation:

Integrating cooperative learning, peer modeling and the use of email produced remarkable results. Six of the seven students (**86%**) fulfilled the WPE requirement at the end of the 2002 course, including the 3 students who had not been allowed to graduate at the end of their program. Eight of the 10 students (**80%**) fulfilled the WPE requirement at the end of the 2003 course, including the student who had not allowed to graduate. Ten of the 11 students (**90.9%**) fulfilled the writing requirement at the end of the 2004 course. In contrast, in my summer 2001 and 2002 course I used only one-on-one tutoring and the passing rate was **66%** (4/6) and **50%** (2/4), respectively.

Reflect on what's working and why it is working:

The innovation worked because it was designed to address the multiple writing challenges of students with different needs, including the need to graduate, and implemented active teaching and learning methods that allowed for students to cooperatively take charge of their learning.

Describe student reaction to the innovation:

Student reaction was extremely positive and their desire to improve with each essay was clearly evident. They wrote nine essays and revisions. They found the brainstorming sessions productive, student sample essays good models for better writing, and emailing a convenient way to submit essays, as well as an effective way to track their overall progress. Students told me that the methods used in this course to prepare for the WPE were the best they had ever experienced.

**Will innovation be sustained within the course? Yes
If yes, will you do anything differently? Describe**

I can't think of any changes at the moment.

**Will you implement this innovation in other courses? Yes
Describe:**

I have been implementing cooperative learning and peer modeling in my ESL writing courses at USP since 1999, and the use of email since 2001. I will continue to use these methods.

What advice would you give to other people adapting this innovation?

Cooperative learning peer modeling, and email, when used appropriately, benefits both instructor and students.

Title of Innovation: Instructing Pharmacy Students to Assess Patient's Knowledge of Medications on Clerkship

Name of Innovators: Grace Earl, PharmD, Loren Sparano, PharmD

Telephone Numbers: 215-596-8940 **e mail Addresses:** g.earl@usip.edu, l.sparan@usip.edu

Department: Pharmacy Practice

Type of Students: Doctor of Pharmacy, 6th year

Type of course or activity where implemented: professional or advanced

Leahy Innovation submission: No

Course or activity where implemented: Clerkship

Describe rationale or goals of innovative educational activity:

An important outcome of the pharmacy curriculum is to insure that students have the knowledge and skills needed for providing effective patient education. (1) In order to deliver the highest quality of direct patient-care, pharmacy students must be able to take effective medication histories as well as provide accurate and clear instructions to the patient. (2) The pharmacy student also has a responsibility to identify and assess any barriers to education. One of these barriers could be due to the patient's poor understanding or lack of knowledge about their medications (3) A practical method for instructing students to quickly assess the patient's knowledge while taking the medication history was developed.

During clinical clerkship rotations, pharmacy students have an opportunity to refine and develop communication skills during the patient interview. Developing interviewing techniques is a key communication skill that promotes an organized approach to collection and assessment of patient data. Patient knowledge or understanding includes the patient's ability to understand the medications and their uses. Basic questions used for assessment are: "What is the name, dose and frequency of the medication?" "Why has the drug been prescribed?" and "Do you know if the drug is working effectively?"

Describe the innovation and its implementation:

METHODS Barriers to Education

During the first week of the rotation, students are instructed to identify and document any barriers to education that they encounter during patient interactions and must also suggest possible ways to manage these barriers. When the documentation is reviewed, the students participate in a discussion on barriers to education and health literacy. Barriers can be classified according to a number of different domains such as language, sensory, emotional, behavioral, medical, and cognitive.

MED Score

The MED Score was designed to develop the students observation skills and ability to assess the patient's understanding of their medications. The MED Score was refined for use in a research project conducted during a general pharmacy practice residency. Students are instructed to begin the medication history by asking the patient to recite their current medications, dosage, and frequency. Once the student makes this assessment, they can discuss it with their preceptor or other healthcare professionals to identify that the patient has a clear lack of knowledge. The results are documented on the clinical documentation form. For patients with low scores, students are expected to provide written medication lists and encourage patients to bring their prescription bottles in for every visit. These patients also need additional time for counseling.

Describe outcomes, especially learning outcomes, and impact of the innovation:

EXPERIENCE

Medication histories were taken on 25 patients with heart failure at the practice site as part of a research project during a general practice residency. The percentage of correct responses for reciting the drug name

(57.3%), dose (38.6%), and frequency (44%). Of the total of 25 patients, 3 (12%) relied upon a care-giver and 12 (48%) used a written medication list.

During clinical rotations from 2004 to 2005, students completing an ambulatory care rotation at the practice site were instructed in using the MED Score. A pharmacy faculty member observed the students and made assessments of the student's effectiveness in patient interviewing. The effect on student outcomes has been positive. Formative feedback included promoting flow of information from patient to pharmacy student, appropriate use of silence to give patient an opportunity to answer, and alerting student when they are prompting the patient. The MED score was documented on the clinical intervention form and the students provided written medication instructions to patients with low scores. Students were encouraged to utilize follow-up phone calls to contact patients the week following their visit to review the medications instructions. However, students failed to follow-up by phone. Student's were able to identify patients with poor understanding of medications and clearly communicate this to the faculty preceptor as well as nurses and physicians. Documentation of the MED Scores on the clinical intervention form has also improved.

Reflect on what's working and why it is working:

The data collected on MED Scores from the residency project demonstrated that the population of patients evaluated had difficulty in independently reciting their medications. This provides an opportunity for pharmacist involvement in patient education. The MED Score is useful as an effective instructional tool that has improved patient interview skills and documentation skills.

In order to prompt the patient to independently recite their medications, students learn to speak with authority. When initiating the interview, some patients are hesitant to answer. Their response is "The medications haven't changed from the last visit," or "The medications are written on my list," or "The medications are written right in front of you on the chart." Student must be confident in explaining that they must update the medication list in the chart to maintain accuracy.

Describe student reaction to the innovation:

The time allotted to take medications is limited. Students may have 5 to 10 minutes to accurately update the medication record. Using time effectively is a concern for practicing pharmacist as well. Therefore, another advantage to using MED Score is that it allows timely evaluation of the patient's knowledge of their medications as the medication record is updated. Students also learn to adjust their interview technique as they take the medication history. Students are instructed to give the patient an adequate amount of time to respond on their own. Patients make take time to process the question as well as remember their medications. This in itself can be an important assessment if the patient hesitates for a significant amount of time before responding. Once it is clear that patient has difficulty reciting medications the student can alter their interview approach and read from the medication list. The MED score helps the students develop observation skills. Does the patient answer quickly and assuredly? Does the patient pull out a written medication list or refer to prescription bottles? Does the patient rely on a family member or care taker?

Will innovation be sustained within the course?: Yes
If yes, will you do anything differently? Describe:

Will you implement this innovation in other courses? :Yes
Describe:

The MED Score could be adapted for other types of practice rotations. The Center for Advanced Heart Failure Management at Hahnemann cares for patients with heart failure or patients that have had a heart transplant. The first question is easily formulated to specify the diagnosis: What medications are you taking to control your heart failure symptoms? What medications are you taking to prevent your heart transplant rejection? The MED Score method could be useful for pharmacists practicing in other practice areas by expanding the score for separate disease states. For example, a heart failure MED Score of 9 and diabetes MED Score of 9 would indicate that the patient has a good knowledge of medications for these two diagnoses.

Title of Innovation: On-Line Assessment using BLACKBOARD Learning System - Basic Edition (Release 6)

Name of Innovator: Grace Earl, Tamara Case

Telephone Numbers: 215-596-8940, 215-596-8961 Email Addresses: g.earl@usip.edu; t.case@usip.edu

Department: Pharmacy Practice, Information Science

Type of Students: Doctor of Pharmacy

Type of course or activity where implemented: required

Leahy Innovation submission: No

Course or activity where implemented: PP448

Describe rationale or goals of innovative educational activity:

- To create an environment that motivates students to accept responsibility for learning
- To expose students to on-line learning experience via BLACKBOARD Learning System
- To enable students to assess their own learning and modify their behavior to enhance understanding of material

Describe the innovation and its implementation:

Students in the second professional year of the Doctor of Pharmacy program are required to take PP448 Biomedical Literature Evaluation. The course content includes objectives on applying statistics and research design. An on-line assessment was designed as a 10 question, multiple-choice quiz. Students were provided a list of learning objectives, reading assignments, and practice homework questions. Students were provided an opportunity to take additional on-line practice question using BLACKBOARD. Students were offered a 72 hour window to take the on-line quiz. Once the quiz was graded, students were offered an opportunity to view their on-line quiz results with feedback.

There are a number of factors to consider when developing an on-line assessment such as the environment, time window, feedback, and policy on resources. The instructor must decide whether to offer the testing in a closed environment that is supervised. In this setting, you would need to have an equal number of computers to match the number of students. The alternative is an open environment where the student can use their computer of choice and schedule to take the test at their desired time. The BLACKBOARD system enables you to program the time window for taking the test. You can offer a flexible starting time for the test, the opportunity to save and return to complete the test, or forced completion. When you use forced completion, once the student begins they have a specified time to finish each question. Also, they cannot stop and return later to complete the test. When programming the test, you can select the feedback feature and designate whether feedback will be offered immediately at the time the answer is given or delayed until all tests are taken. Finally, you should clearly inform the students regarding your policy on all of the factors above as well as your policy on the use of resources. Inform the students on whether you approve of their use of books or notes during the test.

An important issue for traditional testing and on-line assessment relates to student conduct issues. Reinforce your expectations on issues related to plagiarism and cheating before the test. In an open environment, there are a number of possible ways that students can cheat. A substitute user can log in to take the test. Two users can log-in simultaneously. Also, you can have person-to-person sharing via email, cell phones, and instant messaging. In addition, a truly creative individual could use technology such as digital photography to copy the test questions and share at a later time. Some parameters that you can set to minimize these problems are randomizing the order of the questions, and creating multiple sets of questions. An ineffective method to screen for simultaneous log-in would be to manually verify the date and time that the test was completed. (This appears in the "Gradebook" section of Blackboard.) Finally, there are codes available that can be cut-and-pasted into the answers that will prevent the student from printing the questions and/or answers.

There are some steps that you can take to minimize potential problems with on-line assessment. The potential for equipment failure is possible. Also, because the technology is new, students may not be completely familiar with the process. Before the on-line assessment, students were offered practice questions and were advised to use the same computer that they planned to take the quiz. There can be problems with dial-up service or the computer which can cause the screen to freeze. You should state up-front that in the event of the screen freezing the student should contact the instructor as soon as possible. They should not attempt to take the quiz again.

Describe outcomes, especially learning outcomes, and impact of the innovation:

The main aim of the on-line assessment was to make students responsible for course content on application of statistics and research design. In addition, students gained experience using online technology, which prepares them for on-line licensure testing. Students became aware of their own learning ability and are able to identify solutions when viewing the feedback. Students also appeared to assign a higher level of importance to an on-line quiz than a homework assignment. In past semesters, a homework assignment was offered rather than a quiz.

Reflect on what's working and why it is working:

One observation from the instructor was that students assessed their grade for the quiz and adjusted their study methods to prepare for the next quiz. In past semesters, attendance at pre-quiz reviews was zero. This semester, there was standing-room-only at two pre-quiz review sessions for the final quiz.

A general complaint from some students in past semesters concerns the expense and opinion that the required textbook is not helpful. Students were encouraged to use their textbook and notes during the on-line assessment and this enhanced their reliance and use of these resources.

Describe student reaction to the innovation:

Students were given a paper survey a few weeks after the on-line assessment. Seventy-seven out of 115 students responded to the survey. Most students took the quiz on day 3 of the 72 hour window. Ninety-four percent indicated that the scheduling of the test was convenient. Seventy-one percent used a computer that they usually used for other activities or assignments. The location of the computer was at home (44%), at the Wilson Student Center (28%), in the library (23%) or some other site (5%).

**Will innovation be sustained within the course? :
If yes, will you do anything differently? Describe:**

**Will you implement this innovation in other courses? : Yes
Describe:**

The on-line assessment motivated the students to study as compared with the homework assignment given in the past. It offered students a flexible window of time to take the test. The starting time was negotiable

What advice would you give to other people adapting this innovation?

The on-line assessment motivated the students to study as compared with the homework assignment given in the past. It offered students a flexible window of time to start the test which they viewed favorably. I would encourage others to use the software code to disable the copy/paste feature and printing. However, one major disadvantage is that you are unable to completely insure security of the test question pool and eliminate unauthorized collaboration between students.

Title of Innovation: Dissertation workshop: support for part-time doctoral students
Name of Innovators: Robert Field, and Phyllis Blumberg
Telephone numbers: 215-596-7618-215-895-1167 email addresses: r.field@usip.edu, p.blumbe@usip.edu
Departments: Health Policy and Teaching and Learning Center
Type of Students: advanced doctoral
Type of course or activity where implemented: professional or advanced
Leahy Innovation submission: No
Course or activity where implemented:

Describe rationale or goals of innovative educational activity:

Part-time graduate students who are employed outside the university may have a hard time finishing their dissertations. For many students the earlier class structures forced them to continue making progress through their doctoral program. Once they completed their qualifying examinations, they are more on their own. Without class structure, deadlines and cohort contact students may get stalled. The workshop helps students structure their time, plan reasonable short and long term goals and force themselves to do more work on their dissertations.

Describe the innovation and its implementation:

ABD students are encouraged to register for a one credit course to help them complete their dissertation. This course is independent of their dissertation advisor and committee. The course meets once a week and the students informally present their ideas and progress on their dissertations. The group sessions motivate the students to continue to work on their dissertations. Students also make a time line to graduation outlining all tasks that still need to be completed. The instructor has individual conferences with each student to determine if the timeline is reasonable and assists in motivating the student.

Describe outcomes, especially learning outcomes, and impact of the innovation:

The class and the instructor serve as an emotional foil to the students' dissertation committee and the university's bureaucracy. Students also received practical advice that helped them to move forward on their dissertation. The class served as a support group for doctoral students. Progress made by the students was quite uneven.

Reflect on what's working and why it is working:

The group sessions were helpful. Their peers gave very useful assistance. Students felt motivated to do substantial work on their dissertation in between their class presentations. Some of the weeks the group did not meet and some of the students lost momentum. Because the instructor is not an students' committee, she can serve as a more neutral liaison.

Describe student reaction to the innovation:

Students liked the course and felt it helped motivate them. They enjoyed the peer contact and support. They appreciated how the instructor could have an objective view and offered ways to negotiate the system. Weekly logs of dissertation activities were seen as a motivator for some and busy work for others. The students felt the course should be continued.

Will innovation be sustained within the course?: Yes
If yes, will you do anything differently? Describe:

We tried to do parts of the course in an asynchronous manner. This did not work. Students did not always do their on-line postings and few students responded to each other's postings.

Will you implement this innovation in other courses?: No

Describe:

No other relevant course in this program, other dissertation and thesis programs could adapt this concept.

What advice would you give to other people adapting this innovation?

If there are enough students working on their dissertations, they can be divided into preproposal or those developing their research ideas and those in data collection/analyses stages.

Title of Innovation: Responsible Revision
Name of Innovator: Anne Marie Flanagan
Telephone Number: 215-895-1132 **e mail Address:** a.flanag@usip.edu
Department: Humanities
Type of Students: 2nd year undergraduates
Leahy Innovation submission: No
Course or activity where implemented: Intellectual Heritage

Describe rationale or goals of innovative educational activity:

To teach students the difference between revision and correction. To encourage students to take responsibility for revising their papers. To improve the type of feedback given on papers.

Describe the innovation and its implementation:

Supply adequate marginalia and summary comments on papers. Distribute a list of comments and questions for students to consider as they revise their papers. Do not tell students which comments apply to them.

Describe outcomes, especially learning outcomes, and impact of the innovation:

Responsibility for successful revision is shifted from instructor to students. Thoughtful revision takes place. Instructors can reduce the number of comments on papers

Reflect on what's working and why it is working:

This innovation works because it is learner-centered and focuses on teaching students to take responsibility for revising their papers. Students must reread their entire paper, rather than just looking for the instructor's corrections, and they must exercise their own judgment when deciding which comments and questions apply to them

Describe student reaction to the innovation:

I did not hear any negative reaction, and students were able to revise their papers using this method.

Will innovation be sustained within the course?

If yes, will you do anything differently? Describe:

No, I don't foresee any changes

Will you implement this innovation in other courses? : Yes

Describe:

Yes, since I require papers in all of my courses.

What advice would you give to other people adapting this innovation?

I would advise instructors to explain the purpose and expected outcomes of this practice. I find that students respond positively when they understand the rationale behind our practices.

Title of innovation: Multi-Discipline Strategic Management (course) - MSM

Name of innovators: Harold Glass, Bruce Rosenthal

Telephone numbers: 215-596-7548, 215-596-7439 email addresses: h.glass@usip.edu, b.rosent@usip.edu

Department: MBA in Pharmaceutical Business

Type of Students: MBAs, EMBA's

Type of course or activity where implemented: required

Leahy Innovation submission: Yes

Course or activity where implemented: Various

Describe rationale or goals of innovative educational activity:

Develop a mechanism that allows students to integrate what they have learned in the program's individual classes. Allow students to appreciate that managerial decisions are decisions in one area can have implications for key decisions in other operational areas. Improve written and verbal presentation skills.

Describe the innovation and its implementation:

MSM is a two-semester program where students are asked to construct a hypothetical pharmaceutical company which, in principle, could compete in today's marketplace. The purpose of this course is to integrate what students have learned in the MBA program's individual classes.

Students begin the course by participating in a global simulation of a pharmaceutical company. In the simulation students are exposed to the full range of decisions that decision-makers must make to manage a pharmaceutical company over a multi-year period. During the following two semesters students draw upon the challenges they learned in the simulation to construct their hypothetical company including: a full description of their healthcare and competitive environments, company product(s), company organizational design, along with related management, personnel, financing and strategic issues. Students will also develop a case study, detailing one or more major strategic issues their company will face, and how their company will address the strategic issue(s). At the end of the two semester course, the students defend their case study to a panel of professors.

The hypothetical company will finally be used in the final, and separate, Capstone course where students will show – through an extended series of computer simulations - how their company will compete against other similar companies on a global basis.

Describe outcomes, especially learning outcomes, and impact of the innovation:

- Broadened industry and management knowledge
- Enhanced ability to define and solve problems
- Improved presentation skills

Reflect on what's working and why it is working:

- Students are learning how to work effectively in teams
- Students are learning how to think strategically
- Students are learning how to look at research critically and evaluate sources for their usefulness and validity
- Students are learning about all aspects of business in general and the pharmaceutical business specifically
- Students are learning how to learn – how to teach themselves and teach each other
- Students are creating the case themselves and so take ownership of it, the Faculty Advisor is acting as a guide and helping the students ask the right questions.

Describe student reaction to the innovation:

Students quickly learn that effective management requires integration of skills and substantive knowledge in a multi-disciplinary way. Requiring the students to create a fully functionally company, and deal with a number of strategic challenges to that company, provides a concrete way to facilitate this integration.

Will innovation be sustained within the course? YES

If yes, will you do anything differently? Describe:

We will be integrating the flow of the course with the flow of the entire curriculum to a greater extent so that the students can see how all business functions are inter-related

Will you implement this innovation in other courses? Yes

Describe:

Possible further integration into the other MBA courses in the curriculum. The MSM hypothetical company can be used in the financial-oriented courses for example; as an example in the final Capstone course

What advice would you give to other people adapting this innovation?

The course depends on the students asking the relevant questions and going after the answers themselves; the Faculty Advisors guide and help the students hone their answers. Advice; allow the students to develop their own case study - they get to the point of "ownership" of the project and become very passionate about it.

Title of Innovation: Use of songs in teaching physics

Name of Innovator: Paul Halpern

Telephone Number: 215-596-8913 **e mail address:** p.halper@usip.edu

Department: Mathematics, Physics, Statistics and Computer Science.

Type of Students: Non-majors

Type of course or activity where implemented: required

Leahy Innovation submission: No

Course or activity where implemented: Introductory Physics

Describe rationale or goals of innovative educational activity:

To provide an active way of learning concepts and techniques

Describe the innovation and its implementation:

In electromagnetism, the "right hand rule" is a method to determine the direction of forces and fields. I wrote a song about this, describing how it works, to go along with a demonstration of the method. I asked a group of students to perform the technique during a rendition of the song.

Describe outcomes, especially learning outcomes, and impact of the innovation:

The "right hand" rule seemed much more memorable and interesting for the students. Students seemed to master it better.

Reflect on what's working and why it is working:

It offers students a humorous and visual way to remember the technique.

Describe student reaction to the innovation:

Students seem to learn better when they associate a scientific technique with memorable demonstrations

Will innovation be sustained within the course? Yes

If yes, will you do anything differently? Describe:

No, I would try it the same way since it seemed to be effective.

Sustained Innovation

Title of Innovation: Student Developed Portfolios and Grading by Contract

Name of Innovator: Z. Annette Iglarsh

Telephone number: 215-596-8693 **email Address:** a.iglars@usip.edu

Department: Physical Therapy

Type of Students: Physical Therapy Students in their Third and Last Professional Year

Type of course or activity where implemented: required

Leahy Innovation submission: No previous winner

Course or activity where implemented: PT 667 & PT 668

Describe rationale or goals of innovative educational activity:

1. Originally course was established to help students develop a professional portfolio to improve their employment opportunities and to instill self-determination of the grade achieved in the class
2. The portfolio review was conducted to involve the students in a structured peer review format
3. Student group presentations were critically reviewed by their peers and by me.

Describe the innovation and its implementation:

1. As the job market for Physical Therapists improved, the portfolio became a format to store the students' professional accomplishments and to promote the Niche Business that they developed.
2. The grading format was converted to a more traditional model because the previously submitted projects decreased in quality and the self-grading system did not discriminate among different student performances. I developed very objective grading policies for Reflective Papers, Group Presentations and development and presentation of the Niche Business.
3. I implemented Health Policy issues in a manner that was significant to the students at this point in their careers.
4. I extensively used the 2004 Presidential Election as a vehicle to discuss the issues related to Healthcare and discuss the relationship with all issues of the campaign and to increase the students' responsibility as citizens.
5. I also implemented a more detailed and staged explanation of the portfolio and peer review process.
6. I planned to have the students present their niche business to a panel of practicing physical therapists to get "a real world appraisal" of their work.

Describe outcomes, especially learning outcomes, and impact of the innovation:

1. The students were more attentive to the quality of the assignments and positively commented on the benefit of the extensive peer and professor criticism that they reviewed on their presentations.
2. Many of the students found the discussion of issues outside the professional didactic curriculum exciting and appeared better prepared to become an active professional upon graduation. (This assessment was drawn from multiple class and small group discussions.)
3. The Presidential Election was a great educational tool. Each student followed their preferred candidate and had to work in their candidates' political office for at least one-half of day. They saw the many sides of politics and all students voted as compared to less than 10% in the previous years.
4. The quality of the portfolio improved and the students used the portfolio as a budding professional rather than a reflection of a student activity (an outcome that was not previously achieved in previous years.) All students received job offers and were able to use the portfolios to secure the specific job that they wanted from their multiple offers.

Describe any changes that you have made in its implementation:

See above for content and grading differences

Reflect on why this innovation continues to work:

I presented the material in a context comfortable to the students and built on their knowledge and experiences to bring them the next level of their education, becoming a practicing professional

Describe student reaction to the innovation:

The students responded that they liked the evolution of the niche business and portfolio development; the presentations and resulting constructive criticism; and they felt they were better prepared to enter the profession as an active participant. They did not like the reflection papers, even though it gave me insight into their thought process and the evolution of their thoughts of the course subjects.

The political experience was eye opening and frustrating to most of the students. The business material, introduced in class and developed through student presentations, met with mixed reviews.

Will innovation be sustained within the course?: Yes**If yes, will you do anything differently? Describe:**

- I plan to return to the grade by contract format but provide more detailed structure of the projects and relationship to the grades they select.
- The portfolio project will remain as it was used this year.
- The niche project will be selected at the beginning of the course and the business information presented relative to the student's niche project (adding to the relevancy of the material.)
- The panel presentation of the niche business was not successful since I could not find clinicians that were able to come in and serve as program reviewers. I will seek the PTs earlier in the semester and explain that this could be a recruitment activity for them as well as contributing to the students' education.

Will you implement this innovation in other courses?: Yes**Describe:**

- The course is converted to a single, three credit course in the revised MPT and the DPT curriculum. This limits the student to developing their portfolios to one semester instead of two. Instruction about portfolio development will be presented and explained early, the time line for completions of components of the portfolio will be tighter and individual and group seminars regarding the portfolio and niche businesses will be scheduled earlier in the term.
- I will still use the elections local, state and national to connect the students to the process. I will use the niche businesses to discuss the business topics.

What advice would you give to other people adapting this innovation?

Clear and extensive explanations of all assignments and grading format initially and repeatedly in the first half of the semester. Detailed discussions and example of quality expectations is essential.

Discuss assignments with other professors teaching in the same year of the program so that students will not be given multiple assignments requiring the same format unless the objective of the assignment is significantly different.

Title of Innovation: Use of Blackboard to coordinate multi-section General Chemistry Laboratory

Name of Innovator: Madhu Mahalingam

Telephone Number: 215-596-7549 e mail Address: m.mahali@usip.edu

Department: Chemistry & Biochemistry

Type of Students: First Year

Type of course or activity where implemented: required

Leahy Innovation submission: No

Course or activity where implemented: CH103, CH 104

Describe rationale or goals of innovative educational activity:

The coordinator of General Chemistry labs (18 sections last year) is responsible for the course content, coordination of the instruction and assigning grades. The instructors are both faculty and graduate students (GSIs). The use of Blackboard was implemented to enable the following:

1. Provide a platform for announcements as well as necessary course material from coordinator so that all students irrespective of lab section will be informed.
2. Enable Instructors to communicate directly with individual/groups of students via email as well as post relevant information for their sections.
3. Enable graders to enter their grades directly on Blackboard so students are aware of the grades they are receiving in the class as the assignments are being graded and not wait until they receive a letter grade in the class.

Describe the innovation and its implementation:

Blackboard course shells were created for the entire lab course as well as each individual lab section.

- Coordinator communicates through the master course which has all students from 18 sections enrolled.
- Instructors for each section communicates through course shells for their individual sections
- Graders have restricted access to enter grades only for their specific sections

Describe outcomes, especially learning outcomes, and impact of the innovation:

- Improved coordination of multi-section laboratory.
- Eliminated student complaints that they 'did not know' or 'were not informed'.
- Fewer student's with questions about their lab grade.
- Instructors more connected with their students as they are able to address questions about grades for assignments not graded by them.

Reflect on what's working and why it is working:

Blackboard is an ideal tool for coordinating multi-section courses as it provides a mechanism for communicating with all students (~510 last year)

Describe student reaction to the innovation:

Students feel more informed as they can look at grades throughout the semester as the assignments are being graded and rectify errors as well as be responsible for their learning as they know how much more effort they need to put in the class to achieve the grade they want.

Will innovation be sustained within the course?:

If yes, will you do anything differently? Describe:

Will you implement this innovation in other courses? : Yes

Describe:

Next year I plan to implement the innovation in the same way.

What advice would you give to other people adapting this innovation?

It is important for the coordinator to have access to all the courses (the master course and the different sections).

Roles for instructors and graders must be specifically selected within Blackboard.

Title of Innovation: Evaluation of physical therapy student learning outcomes associated with participation in an experiential learning course

Name of Innovator: Carol Maritz

Telephone number: 215-596-8683 email address: c.maritz@usip.edu

Department: Physical Therapy

Type of Students: Upper level Physical Therapy Students

Type of course or activity where implemented: professional or advanced

Leahy Innovation submission: Yes

Course or activity where implemented: Physical Therapy

Describe rationale or goals of innovative educational activity:

Prior to this project physical therapy students volunteered to participate in the Mercy/USP Pro Bono Physical Therapy Clinic (established in 2002). While faculty agreed that students were benefiting from this participation, it was unclear as to what the particular learning outcomes were. This project was initiated to evaluate the learning outcomes associated with this experience.

Describe the innovation and its implementation:

In order to assess the learning outcomes associated with participation in the pro bono clinic, I created a pro bono elective course. This 3-credit course was offered to all 4th year PT students along with a traditional PT elective course. Twelve students signed up for the pro bono elective and 16 for the traditional course. Students in the pro bono course were required to spend one three-hour time period during the course of the semester in the pro bono clinic treating patients. In addition, the students were also required to attend two one-hour in-class seminars each week. While in the clinic, the students were responsible for direct patient care under supervision of licensed PTs. In the seminar students were required to present patient cases for discussion much like physicians perform grand rounds. All students completed the California Critical Thinking and Disposition Inventory and the General Self-Efficacy Scale prior to the start of the semester and again at its conclusion. Additionally, the students in the pro bono course made weekly journal entries as well as completed the professional behavior assessment (pre and posttest). Focus groups were conducted with the pro bono students at the conclusion of the semester.

Describe outcomes, especially learning outcomes, and impact of the innovation:

There was a statistically significant difference in professional behavior following participation in the pro bono course. Students that participated in the course showed improvement in the areas of self concept, self-directed learning, communication and interpersonal skills. This was also supported by the reflective journals. The overwhelming theme from the journals dealt with the notion that this course provided them with a "safe" hands-on learning opportunity that allowed them to develop confidence in themselves. Many said that although they had the knowledge it wasn't until they felt confident that they truly felt that they had something to offer patients. While there were no statistically significant differences between groups for the California Critical Thinking and Disposition Inventory or the General Self-Efficacy Scale, there was a positive trend for the GSE in those students in the pro bono course.

Reflect on what's working and why it is working:

Pro bono experience works because the students are not graded on their patient interaction or skills. By removing this pressure, the students are able to relax and experiment in a controlled environment. As the students' confidence level improved, they demonstrated an enhanced ability to be self-regulated learners. Self-regulated learners are key to life-long learning which is a PT programmatic learning outcome.

Describe student reaction to the innovation:

The students' feedback on this innovation was extremely positive. In fact, several of the students signed up for a second semester in the pro bono clinic.

**Will innovation be sustained within the course? Yes
If yes, will you do anything differently? Describe**

This course has become the model for the implementation of the pro bono clinic into the PT curriculum

**Will you implement this innovation in other courses? Yes
Describe:**

It is part of the PT curriculum.

What advice would you give to other people adapting this innovation?

It is labor intensive to start but the rewards are tremendous. The students are better learners as a result.

Title of Innovation: Magazines and Journals, More on magazines and Journals, Articles and Audiences

Name of Innovators: Jeanette McVeigh, Phyllis Blumberg

Telephone numbers: 215-895-1197, 215-895-1167 **e mail addresses:** j.mcveig@usip.edu, p.blumbe@usip.edu

Departments: Information Science and Teaching and Learning Center

Type of Students: 3rd year and above pharmacy or health science

Type of course or activity where implemented: elective

Leahy Innovation submission: No

Course or activity where implemented: IS 305

Describe rationale or goals of innovative educational activity:

Develop student's appreciation and understanding of the differing approaches to health information found in magazines versus journals

Describe the innovation and its implementation:

This continuing innovation has evolved based upon student input and performance on assessment. The first class has been revised to allow students to visually analyze the differences between a magazine and a journal. Linked PDF files of front covers and tables of contents open within an html text for students to examine and discuss. The second session also has been changed to differences in larger issues such as advertising, article selection, and editorship. This part has also been expanded to include trade publications. The final section remains an analysis of a clinical journal article compared with that of a magazine article. Emphasis is on audience and article organization. All three sessions use html text linked to examples in PDF format.

Describe outcomes, especially learning outcomes, and impact of the innovation:

Students are visually presented with examples of parts of magazines and journals to examine and discuss. Students relate the examples to their own academic or work experience. Students master the features discussed by providing their own examples of magazines and journals and individual article.

Describe any changes that you have made in its implementation:

As mentioned above, the first session was completely changed to begin the focus of the discussion with larger, physically obvious differences, such as the table of contents and front cover. Students are cued from the beginning that color, size, and words are important analytical tools.

Reflect on why this innovation continues to work:

For some students this is a much needed review. For others, this is the first time they examine a magazine with such detail. In health professions, it is useful for them to know that their patients/clients will be reading this material.

Describe student reaction to the innovation:

Students appreciate the in-depth approach to what is usually covered in one class. They also appreciate the opportunity to look at magazines and understand the place they have in the dissemination of information or misinformation, particularly for patients.

Will innovation be sustained within the course?: Yes
If yes, will you do anything differently? Describe:

I continue to evaluate student performance on assessments and also their comments. I may expand the part dedicated to trade publications, a very confusing subject for students.

Will you implement this innovation in other courses?: Yes
Describe:

I have created similar html readings with linked PDF examples and web sites for a graduate course, BW703 Information Strategies for Biomedical Writers.

What advice would you give to other people adapting this innovation?

Think about how dynamic html can be-linking to websites, documents in other pc formats.

Title of innovation: Integration and Review of Cardiovascular Physiology through group mock panel review of clinical case scenarios

Name of innovator: Diane W. Morel

Telephone Number: 215-895-1123 email address: d.morel@usip.edu

Department: Pharmaceutical Sciences

Type of students: 3rd year

Type of course or activity where implemented: required, professional, large lecture, multiple sections

Leahy award submission: Yes

Course or activity where implemented: PC 301

Describe rationale or goals of innovative educational activity:

Goal of the activity was to (1) engage students early in the block to be thinking about normal and abnormal function, (2) force students to consider both electrical and mechanical properties in considering cardiovascular function, (3) allow students to develop confidence in their ability to apply principles and to interpret clinical information in light of the principles being learned in lecture, and (4) encourage students to interact with one another and use each other and faculty as resources.

Describe the innovation and its implementation:

Students were introduced and divided into working panels to address questions relating to one of three common pathophysiologic conditions in the cardiovascular system right at the start of the 5 week block. The idea was for them to initiate and develop over the course of a block a collaborative, working relationship with one another to discuss, apply, and integrate the principles being learned in class. The assignment was for each group to present a written response to their group's set of questions and then to present it in class as part of a mock "expert panel" discussing cardiovascular issues. Each group of students thus served as an independent "mock expert" for their assigned case questions, a panelist in a group discussion of their assigned case, and an interested party/ listener in the presentation/discussion of other cases. Information used to address questions came from class; class notes, the textbook, and internet/ alternate text sources. Repeated small blocks of time within class were afforded for teams to work together; electronic interactions were also encouraged by providing each student with their group members' email addresses.

Describe outcomes, especially learning outcomes, and impact of the innovation:

The learning outcomes were (1) demonstration of ability to work together as a group in an ongoing manner (over at least the course of a 5 week block) to develop some measure of "expertise" in a focused area and (2) the ability to "walk the walk and talk the talk" in a multi-faceted, science-based open ended inquiry, both in writing and verbally. The impact of the innovation was to encourage students at the end of a long semester in which many struggle to utilize one another as well as their daily classwork to integrate information, to think critically and analytically to solve problems (in this case, clinical scenarios), and to develop confidence in their ability to "pull it all together".

Reflect on what's working and why it is working:

I think it works because it forces students to become proactive in their learning, to recognize each other as well as instructors as learning resources, to take responsibility for some portion of the breadth and depth of their learning, and to critically evaluate their own learning processes in light of their interactions within the small groups as well as within the large class as a whole. It also engages students' oral and written prowess to communicate information to one another and to the large group, and forces them again to be responsible for the "teaching" or sharing of information from the cases with each other.

Describe student reaction to the innovation:

Student reaction varied early on from excitement over bonus points to help their grade from a group project to frustration, either in being forced to work with a group of people they didn't know or trust or in being unsure about how they could possibly be held responsible for information that was not directly presented by the instructor. Student reaction, by survey after the experience and exam, was largely favorable, with the most common suggestion being that each group be required to address all questions.

Will the innovation be sustained: Yes

I hope so, depending on the structure and timing of course and block offering. I anticipate that new case scenarios need to be developed/elaborated to keep the experience "new". I might try to break it up a bit more over the course of the block rather than have the "big event" during the last three lecture hours of the semester to make it more of an integral part of the block. However, the application of principles and integration of information makes most sense as a wrap-up to the block.

Will you implement this in other courses: Yes

If the opportunity exists in other large courses.

What advice would you give to other people adapting this innovation?

Think through the dynamics of interactions in the large group and in how groups are set up, and be strong in the face of what will undoubtedly be resistance to change, or to something new.

Title of innovation: Learning Centered Teaching in a Large Classroom Setting
Name of innovator: Andrew M. Peterson
Telephone number: 215-596-8877 **email address:** a.peters@usip.edu
Department: Pharmacy Practice
Type of students: 4th Year Pharmacy Students
Type of course or activity where implemented: Pharmacy Systems Management
Leahy innovation submission: Winner of the 2005 Leahy Award
Course or activity where implemented:

Describe rationale or goals of innovative educational activity

The goals of this activity are to:

1. Eliminate exams and substitute more authentic assessments
2. Promote teamwork and relate the need for teamwork in class to teamwork in managing a pharmacy

Describe the innovation and its implementation

The innovation is the elimination of examinations and this innovation was implemented in the Pharmacy Management course. Students (120) are randomly assigned to 20 groups of 6. Each group represents an area of pharmacy practice (e.g., Retail, Hospital) and tackles management problems from that perspective. There are no exams in the class. Instead, written, oral and group work comprises the means of assessing student performance. Rubrics are used to assess the written assignments. There are 4 required written and 7 optional written assignments along with 17 group activities, with a 10-12 minute end-of-semester group presentation. The structure of the class and the assessments promote collaboration and teamwork. Using multiple assessment techniques and multiple avenues of learning helps students choose the means of learning that best suits them.

Describe outcomes, especially learning outcomes, and impact of the innovation:

The students reacted positively to the class design. The mid-semester and final self-assessments speak to their perceived satisfaction with the class. In particular, the students usually comment positively on the use of groups to help enhance learning. The quality of the work turned-in by students usually improved as the semester progressed. With many students, though not all, there appeared to be an increase in the critical thinking and analysis in each assignment. The complexity of the information contributed to this, but the student's clearly did make a more concerted effort at integrating and synthesizing the information as it related to their type of pharmacy. Also, the course evaluations were positive about the style of the course as well as the learning opportunities.

Reflect on what's working and why it is working:

The transformation from a lecture-based presentation of material to an interactive, learning-centered environment has been gratifying. The near-weekly assignments help students maintain contact with the material further promoting retention. There was an increase in collaborative learning during each group activity as the semester progressed. The reason why this innovation is working is that the students see this as a departure from the typical exam-based course. They appreciate the ability to choose the level as well as the content of the work. They also appreciate the opportunity to collaborate with other classmates.

Describe student reaction to the innovation:

The students reacted positively to the class. The mid-semester and final self-assessments speak to their perceived satisfaction with the class. The students usually comment positively on the use of groups to enhance learning. The quality of the work turned-in by students improved as the semester progressed.

Will innovation be sustained within the course? Yes

I will continue to review the rubrics and make adjustments as necessary.

Will you implement this innovation in other courses? Yes

I will incorporate the use of groups in other courses and lectures.

What advice would you give to other people adapting this innovation?

Structure the group activities so that individuals must complete work before coming to class to make a better contribution. Consider requiring this aspect of the work to be handed in with the group work. This will minimize the potential for students relying on others to accomplish the work. Also, in the beginning of the semester, have each group develop rules by which it will run and then have the group assess how well they are abiding by the rules.

Title of innovation: Computerized Self Assessment Activities: A Learner Centered Learning Tool for Enhancing Problem Solving Skills

Name of innovator: Cathy Y. Poon

Telephone number: 215-596-8889 email address: c.poon@usip.edu

Department: Pharmacy Practice and Pharmacy Administration

Type of Students: Doctor of Pharmacy

Type of course or activity where implemented: Required and elective

Leahy Innovation submission: Yes

Course or activity where implemented: PP551-4, PP549, PP661-9

Describe rationale or goals of innovative educational activity:

The goals of computerized self assessment activities are to provide a method for students to evaluate their level of knowledge; to improve students' ability to develop problem solving skills; and to utilize an efficient method to deliver individualize learning to a large number of students.

Describe the innovation and its implementation:

Using Blackboard Learning System™, self assessment activities corresponding to lecture materials are created. The activities are presented in a patient case format with a focus on integrating knowledge and improving problem solving skills. Within a patient case, new information is added to mimic clinical practice. Questions are presented sequentially to help students organize information and solve problems systematically. The questions consist of various formats. For questions with an objective answer, the correct answers are identified; whereas sample answers are included for open-ended questions. Rationale for incorrect answers is included under the feedback section. For some questions, a step-by-step method for solving a problem and selecting the best answer is included. Probing questions to prompt students to assess deeper understanding of the material may be added.

Some helpful design features from Blackboard Learning System™ provide the necessary platform for creating learner centered learning activities and are discussed below. More importantly, this technology serves as a mechanism to provide instruction and feedback for a large number of students efficiently.

Activity scheduling allows each activity to be activated for a specific time period. Specific time periods are set for each activity, thus students have some autonomy when to complete an activity and since the program automatically inactivates the activity, deadlines are enforced. Another application of this feature is to minimize students from sharing their work. By posting similar self assessment activities within scheduled time periods, different activities are activated and inactivated without the knowledge of the students. Lastly, by setting due dates for these activities, sequential assessment of students' knowledge of topics is accomplished. This will force students to review small sections of material and/or practice problems before progressing in the course.

With the force completion feature, students must complete an activity once it is started. This is helpful to prevent students from accessing the activity and looking up answers ahead of time.

Providing and displaying feedback for each question is optional. However, including explanations for correct and incorrect answers serves as a mechanism to identify key teaching points and provide feedback to a significant number of students efficiently. For some activities, upon submission of their answers, the students will only receive a final score. After the due date, the answers and feedback are activated and students may review their work and feedback. The benefit of this approach is to prevent sharing of answers among students, which may skew results of the activity. The limitations of this approach are delayed feedback, some students may not take the opportunity to review the activity at a later date, and timing may be restrictive especially for progressive learning. The approach to display feedback immediately upon submission of the answers provides students immediate feedback with opportunity for improvement and confidence building for those who did well.

Prohibit backtracking forces students to answer one question and move forward. This feature is particularly useful in patient cases because it mimics clinical practice and forces students to integrate new information provided. Students also develop problem-solving skills through answering a series of questions. For each subsequent question, by including the correct answer and explanation as to how the answer was derived for the previous question, allows students to progress through the case learning and building concepts each step of the way. More importantly, if students make one mistake, they will not be penalized and become frustrated.

These computerized self assessment activities are integrated into several didactic courses and clinical clerkship experiences. Some of the activities are required, but many are designed for self assessment and are optional.

Describe outcomes, especially learning outcomes, and impact of the innovation:

The following are outcomes of a series of self assessment activities (pre- and post-rotation) for students enrolled in the pediatric clinical clerkships. The results of the pre-rotation assessment serve to identify the areas of weaknesses which direct the students as to what to focus on during the rotation. Throughout the rotation, optional activities are available on Blackboard™, along with patient discussions, to reinforce problem solving skills and integration of knowledge. At the end of the rotation, verbal patient case challenge and written post-rotation activities are used to evaluate students' progress. Out of 15 students (2004-2005), 11 students who completed multiple self assessment activities throughout the rotation scored 15% higher on the final written assessment than those who did not complete any activities.

For students in the pharmacotherapeutics course (P3), two optional pediatric fluid and electrolyte management patient cases were posted on Blackboard™ serving primarily as a self assessment and studying tool. Based on results from Fall 2003, 79/243 (32.5%) students reviewed two cases (group 1), 26/243 (10.7%) reviewed one case (group 2) and 138/243 (56.8%) did not reviewed any cases (group 3) as recorded by Blackboard™. The mean number of questions (out of 8 questions) students answered correctly was 5.13 ± 1.54 (group 1), 4.69 ± 1.35 (group 2), and 4.41 ± 1.50 (group 3).

Reflect on what's working and why it is working:

The self assessment activities serve as a tool for students to review, apply and assess their knowledge. Immediate feedback to identify incorrect answers and directions for solving problems are critical for learning. Students learned from their mistakes without being penalized.

Describe student reaction to the innovation:

Those students who completed the activity stated the process was well organized and helped them develop a systematic method for solving problems. Some students indicated that by completing the self assessment activities, they were more comfortable with the material and their performance on the exam improved.

Will you implement this innovation in other courses? Yes

Describe: For courses I coordinate, self assessment activities would be required. The system designed would include ample activities (with excessive points) for students to earn a maximum number of points toward their final grade. This will emphasize learning and not simply earning points.

What advice would you give to other people adapting this innovation?

I recommend requiring self assessment activities as part of the course and use this method as a way for students to earn credit towards their final grade without penalizing them for making mistakes.

Title of Innovation: Biology in Mathematics Classes: Hardy-Weinberg Theorem - One gene/three alleles Model

Name of Innovator: Lia Vas

Telephone number 215-596-8547 email address: l.vas@usip.edu

Department: Mathematics, Physics, Computer Science and Statistics

Type of students: all freshmen; chemistry, biochemistry, pharmaceutical chemistry, pre-medicine, pre-veterinary medicine or related science majors

Type of course or activity where implemented: required , elective

Leahy Innovation submission: No

Course or activity where implemented MA101, MA202

Describe rationale or goals of innovative educational activity:

This innovation is inspired by the 2002 Leahy award winning innovation by Bendl, Kimchuk, Mostrom and Wolbach. The Hardy-Weinberg theorem is covered in freshmen biology classes in the spring semester and, since 2002, in freshmen mathematics classes in the fall semester. In mathematics classes at USP, students are taught just the form of the theorem that describes the one gene/two alleles case. My innovation is the introduction of the case of one gene/three alleles (applicable to human blood types) to classes. This innovation benefits students in two different ways:

1. In MA101 (Mathematical Analysis I, freshmen core curriculum requirement), I extend the application scope of the Hardy-Weinberg theorem that the students are already familiar with. On a more general level, I illustrate how to modify a known method to fit a more general setting.
2. In MA202 (Mathematical Analysis IV, elective course, attended by mostly science majors), the students revisit the theorem with me, applying it to solve a completely different type of problems than the ones covered in MA101. They see how the same theorem can be used in new and different settings and how two different disciplines are interrelated. From the mathematical point of view, the theorem gives a nice example of how to use the method of Lagrange Multipliers to solve the constrained optimization problem of a function of several variables. Simultaneously, students learn how to approach an optimization problem in genetics.

Describe the innovation and its implementation:

1. For MA101, I prepared a class handout. This handout, currently used in class, can be found at <http://mpcs.usip.edu/faculty/vas/Math101/MA101/Handouts.html> (click on "9. Hardy-Weinberg and Blood Types"). The handout deals mostly with blood types, a typical example of the one gene/three alleles case. From this example the students see how to apply the theorem to any other situation that requires the one gene/three alleles model. The handout starts with a quick review of the Hardy-Weinberg theorem for the one gene/two alleles model and a concise summary of the new concepts. Following are a list of examples with detailed solutions and a list of practice problems with solutions (just the final answers). Most of the examples and practice problems use real-life data (available on the internet). For example, students learn about the world distribution of blood types. Also, websites where they can find out more about the subject are listed.
2. In MA202, I also have a class handout. The handout starts by explaining the idea of the Lagrange Multipliers method (constrained optimization of a multivariable function), followed by examples. The application of the Lagrange Multipliers Method to the Hardy-Weinberg theorem is the last example. It also deals with blood types. The handout is posted at: http://mpcs.usip.edu/faculty/vas/Math202/MA202_Handouts.html (click on "11. Lagrange Multipliers").

Describe outcomes, especially learning outcomes, and impact of the innovation:

The application of the Hardy-Weinberg theorem first to the two-allele and then to the three-allele models illustrates how to extend an idea to a more general setting and how two disciplines interact. Revisiting the theorem in MA202 demonstrates how the same idea or method (in this case the Hardy-Weinberg theorem) can be used to solve different types of problems (optimization in MA202 as opposed to blood type distribution in MA101).

Reflect on what's working and why it is working:

The innovation is successful because it shows students why mathematics is relevant for applications in other fields. As a result they are more motivated to learn mathematics. By carefully selecting the problems for the handouts, I keep the students' attention, maintain their motivation and fulfill the goals I set with this innovation (see above).

Describe student reaction to the innovation:

Having covered the Hardy-Weinberg theorem applied to Blood Types in my MA101 course, I made a short, informal survey among the students, asking them to evaluate the class. The majority of the students ranked the class positive and added that they would like more similar hands-on examples applicable to their majors or other courses that they are taking. Relating mathematics to other disciplines was precisely one of the goals that I set out to achieve with this innovation.

The students generally have a very positive opinion of my MA202 class (see evaluations on my website at <http://mpcs.usip.edu/faculty/vas/index.htm>). I have not conducted any survey on the application of the Hardy-Weinberg theorem in the class, but I have asked the students which was their favorite problem on the exam. A majority chose as their favorite the problem involving Hardy-Weinberg. It is worth mentioning that the students, who did not choose the Hardy-Weinberg problem as their favorite, chose another problem that was dealing with applications of mathematics.

**Will innovation be sustained within the course? Yes
If yes, will you do anything differently? Describe.**

I will do nothing differently except, potentially, expand the scope of the theorem to other genetic models.

**Will you implement this innovation in other courses? Yes
Describe:**

Even if I do not apply this particular theorem, I will certainly include in my courses further applications of mathematics to biology, chemistry or other fields.

What advice would you give to other people adapting this innovation?

Explore applications of what you are teaching to other disciplines. The process is very rewarding and the results are beneficial for students.

Title of Innovation: Bridging Mathematics and Chemistry

Name of Innovator: Lia Vas

Telephone number: 215-596-8547 **email address:** l.vas@usip.edu

Department: Mathematics, Physics, Computer Science and Statistics

Type of students: chemistry, biochemistry, pharm. chemistry, pre-medicine or related

Type of course or activity where implemented: elective

Leahy Learning Innovation submission: Yes

Course or activity where implemented: MA 490

Describe rationale or goals of innovative educational activity:

I created a new, interdisciplinary course during the fall of 2004. The course benefits students in many ways:

1. It gives students a deeper insight into the material learned in certain chemistry courses and better understanding of various techniques used in chemistry and medical imaging.
2. For students interested in continuing their education at a graduate level, it provides them with mathematical techniques used in certain graduate programs in chemistry.
3. It involves the students in the interaction of two different fields. A student interested in a career in science is likely to be a part of a research team consisting of different professionals. The material exposed in the course will enable students to better interact with other members of that team.
4. The course emphasizes research ideas, not just mastering various techniques or methods. The underlying theme behind all course topics (Fourier Transform, Groups and Symmetries and Algebraic Topology) is that it might be easier to solve a certain problem by translating it to a different field, solving it there and then translating the solution back into the original setting. This general principle of problem solving is often used in various fields and will be a useful concept for the students to acquire.

Describe the innovation and its implementation:

The course is innovative both in the choice of topics and the way the material is presented to the students. It unites different areas of mathematics rarely taught together in the same course in either a mathematics or chemistry curriculum. Using material written by chemists, I introduce certain mathematical concepts in a novel way, not usually employed by standard mathematics textbooks. The course consists of the following topics or activities:

1. **Fourier Transform.** Students learn about the Fourier transform and find out why it is used in nuclear magnetic resonance, magnetic resonance imaging and signal processing. Imaging and signal processing illustrate how the same idea can be successfully applied to problems in various different fields, ranging from physics to medicine.
2. **Groups and Symmetries of Molecules.** Group theory is a very powerful mathematical tool used in quantum chemistry and spectroscopy. Students are presented with the idea of using the geometric structure of a molecule to conclude something about its electronic structure. Students also learn the basics of topology and algebraic topology and how group theory is used to obtain information about a space of interest.
3. **Recursive Formulas in Chemistry.** Students learn about basics of programming and will write programs for TI83 calculators and programs in MATLAB that model certain chemical equations. While completing a project, they learn how programming makes it possible for them to understand what happens to certain polyprotic acids.
4. **Visit to the Laboratory for Structural NMR Imaging at the University of Pennsylvania.** Students visit a research group at the Hospital of the University of Pennsylvania, consisting of medical doctors, engineers, physicists, and medical professionals. They observe how the ideas presented in

the course are applied in a real world scientific laboratory and how professionals in different fields work as a team.

Describe outcomes, especially learning outcomes, and impact of the innovation:

Upon completion of the course, students will have a new outlook on problem solving and will adopt the underlying idea of all topics covered in the course (as explained in goal 4 above). The students will have a better understanding of certain topics that are significant for a working chemist and will be ready to use the newly acquired mathematics techniques needed for success in some graduate programs in chemistry. Students will also benefit by adopting an interdisciplinary approach to problems.

Reflect on what's working and why it is working:

The choice of topics works because the course is designed for a chemist; all topics are covered from the viewpoint of a chemist with applications of mathematics to chemistry in mind. Given my pure mathematics background, the help of Dr. Preston Moore, professor of chemistry, in choosing topics to be covered in the course was invaluable. He provided me with excellent references to chemistry literature and his chemistry perspective. Presenting complex mathematical concepts through concrete examples and chemistry applications piqued students' interest and gave context to the new notions they learned making the learning experience successful and satisfactory.

Describe student reaction to the innovation:

The course is currently running for the first time with just one student (4th year chemistry major, mathematics and physics minor). So far, her reaction is very positive. She claims to be really enjoying the course and learning a lot. She is very enthusiastic about the course material and agrees that it is useful to her. As she is taking a spectroscopy course parallel to this one, she claims that she can already see the benefits of my course. Also, the list of the chemistry students interested in taking the course in the future is long.

**Will innovation be sustained within the course? Yes
If yes, will you do anything differently? Describe.**

I will consider covering some other topics relevant to this interdisciplinary approach in addition or in place of existing ones.

**Will you implement this innovation in other courses? Yes
Describe:**

I intend to create similar courses that bridge mathematics and biology, pharmacy and/or some other fields relevant to our students.

What advice would you give to other people adapting this innovation?

Explore the relationship of your field with other fields. The process is very rewarding and the results are beneficial for students.

Title of Innovation: Reformed Calculus Techniques and MATLAB in Calculus Classes

Name of Innovator: Lia Vas

Telephone number: 215-596-8547 email address: l.vas@usip.edu

Department: Mathematics, Physics, Computer Science and Statistics

Type of students: mostly second year students and science majors

Type of course or activity where implemented: MA201 is required for chemistry, biochemistry, bioinformatics and pharmaceutical chemistry; MA202 is elective.

Learning Innovation submission: Yes

Course or activity where implemented: MA201, MA202

Describe rationale or goals of innovative educational activity:

1. To promote learning-centered teaching practices.
2. To make classes more dynamic, learning of mathematics less stressful and students more involved and better motivated.
3. To incorporate other disciplines, relevant to education at USP, into mathematics courses.
4. To introduce students to a computer application for mathematics calculations (MATLAB) and to prepare them for using advanced technology in their careers.

Describe the innovation and its implementation:

"Reformed calculus" is an umbrella term for all changes in traditional classroom teaching of calculus. Changes range from the way material is presented (such as more group work, less lecturing or using an interdisciplinary approach to present curriculum topics) to the use of new technologies. From a passive audience, the students are turned into actively participating, self-directed learners. This innovation unifies three elements:

1. My 2003 Close Contact Calculus (CCC) innovation. The main idea there is that a teacher creates a worksheet for every teaching unit. The worksheet replaces the traditional lecture. A typical worksheet starts with a concise summary of new concepts, followed by a short list of introductory or typical problems. The idea is that the teacher demonstrates the main ideas of the subject, and the students then go over the problems individually, actively discussing them as they go along. The way in which new notions are introduced enables the students to relate them not only to already acquired mathematical knowledge, but also to notions interesting and meaningful to them. In this way, the hazard of mathematics being considered "boring" by the students is avoided and the students' incentive to learn eagerly kept alive.
2. My 2003 innovation titled MATLAB in Calculus Classes. MATLAB is a computer application for mathematical calculations, graphing and numerical analysis. MATLAB was not used at USP before I started teaching MA201 and MA202. From working with students in 2002, it became evident to me that they needed a better numerical and graphing tool than the TI83 calculator they had used in previous courses. Many of the real-life differential equations and integrals cannot be solved by hand. The students are solving such problems using MATLAB. Some of the students were already involved in research with their advisors and were looking for a quick way to do some of the lengthy calculations or to generate graphics on a computer.
3. All changes I have made in MA201 and MA202 classes since 2003. As worksheets are an essential teaching tool for the reformed calculus method, I kept improving them throughout the years: I added new problems, new examples of mathematics applied to chemistry, biochemistry and bioinformatics. Also, I added some problems that parallel a physics class that the students are taking in the same year as my courses. Another extensive change I made is the addition of solutions to all problems of every worksheet in both courses. My students told me that this was especially helpful to them when

they were working on the problems out of class. The complete and current list of worksheets for MA201 and MA202, are at <http://mpcs.usip.edu/faculty/vas/index.htm>

Describe outcomes, especially learning outcomes, and impact of the innovation:

The active learning process in reformed calculus helps the students to acquire a true knowledge built on fundamental understanding. By using MATLAB students develop the skills necessary to cope with research and current technology.

Class medians (90% for MA201 in fall of 2002, 2003 and 2004; 93% for MA202, spring 2003; 95% in MA202, spring 2004) show that the students truly learned the material. I have noticed that in my evaluations students often use terms such as "helpful" "clear", "reasonable" when referring to course material, my pace and problems on exams or assignments. The fact that students find the worksheets helpful and the material clear to them is a proof to me that I am on the right track. Students' description of the course difficulty level as "reasonable" shows that even when asked to do hard problems, students find them not hard but reasonable if the right methods are used to present the material.

Reflect on what's working and why it is working:

When selecting problems for the worksheets, I paid special attention to adjust the level of abstraction to the students. Advanced use of technology and applications of mathematical notions to chemistry, biology and physics helped make the courses a success.

Describe student reaction to the innovation:

Extremely positive. See evaluations and students' comments on my website: <http://mpcs.usip.edu/faculty/vas/index.htm>

**Will innovation be sustained within the course? Yes X
If yes, will you do anything differently? Describe.**

Every semester I am making minor improvements in certain details but I do not see any major changes in the future.

**Will you implement this innovation in other courses? Yes
Describe:**

I am using MATLAB in my Special Topics Course as well. I use some elements of reformed calculus in my freshmen mathematics classes (MA101 and MA102).

What advice would you give to other people adapting this innovation?

Compared to teaching calculus traditionally, one has to put in more time and effort to prepare the worksheets, MATLAB instructions, individualized exams and applied problems, but learning outcomes and students' satisfaction prove that the work pays off.

2005-2006

Document of Innovations Abstract Submission Form

Title of innovation _____

Name of innovator _____

Telephone number _____ email address _____

Department _____ Type of students _____

Type of course or activity where implemented: required ___ elective ___, core curriculum ___, professional or advanced ___ other, describe _____

Leahy Innovation submission: Yes ___ No ___

Course or activity where implemented _____

Describe rationale or goals of innovative educational activity:

Describe the innovation and its implementation:

Describe outcomes, especially learning outcomes, and impact of the innovation:

Reflect on what's working and why it is working:

Describe student reaction to the innovation:

Will innovation be sustained within the course? Yes ___ No ___

If yes, will you do anything differently? Describe

Will you implement this innovation in other courses? Yes ___ No ___

Describe:

What advice would you give to other people adapting this innovation?

Other comments:

Sustained Innovation

Title of innovation _____

Name of innovator _____

Telephone number _____ email address _____

Department _____ Type of students _____

Type of course or activity where implemented: required___ elective____, core curriculum____, professional or advanced ___ other, describe_____

Leahy Innovation submission: Yes___ No___

Course or activity where implemented _____

Describe rationale or goals of innovative educational activity:

Describe the innovation and its implementation:

Describe outcomes, especially learning outcomes, and impact of the innovation:

Describe any changes that you have made in its implementation:

Reflect on why this innovation continues to work:

Describe student reaction to the innovation:

Will innovation be sustained within the course? Yes___ No___

If yes, will you do anything differently? Describe

Will you implement this innovation in other courses? Yes___ No___

Describe:

What advice would you give to other people adapting this innovation?

Other comments: