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A Study of the PLC

An Interactive Qualifying Project Report
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Degree of Bachelor of Science
by

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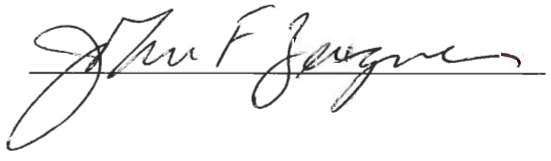

Abstract

The purpose of this study was to determine the value of the WPI Davis Tutorial or later called "Project-Based Learning Community" (PLC) and its effect on first year students at WPI. The study was based on researching other learning communities and forms of pedagogy, then developing a student survey of former Tutorial/PLC students to test perceptions and its benefits. The study supplies new projects, recommendations based on survey and consideration of outside assessment reports. The report concludes with 41 recommendations.

Authorship

This paper was completely and equally authored by Andrew Dupont, Joshua Holwell, James Kondel, Meggan Marcantonio, Ranjith Thomas, and Dave Tran.

Each section was completed by each member of the group and then compiled to form the section contents. Andrew Dupont and Joshua Holwell were responsible for concatenation of the end document. Meggan Marcantonio was responsible for the Methodology of the survey, and the survey questions. Dave Tran was responsible for both the online PLC website, and the online survey for former PLC students. James Kondel and Ranjith Thomas were responsible for studying different available supplements for physics and calculus and eventually creating some of their own supplements due to lack of material.

Executive Summary

As research indicates, the freshman year is of the most importance to a student, yet it has gone without pedagogical change for centuries. The freshman year is of such importance because it is the transition period of social and academic standings. This transition period can be boiled to two points within the freshman education: the student – student relationship, and the student – faculty relationship. The student-faculty relationship has been shown to have a direct effect on a student's GPA, degree attainment, prospective enrollment in graduate studies, all areas of self-assessed intellectual and personal growth, satisfaction with the quality of instruction, and the decision to choose a career in college teaching. The student-student relationship has been shown to have a direct effect on student GPA, graduation with honors, analytical and problem solving skills, preparation for graduate studies, leadership ability, public speaking skills, interpersonal skills, and general knowledge.

The following is a condensed version of recommendations that were drawn from analysis and literary research:

- The freshman year must be redesigned for maximum benefit of the previously mentioned student needs.
    - The first year should consist of small groups of students taught by experienced faculty (Learning Communities).
    - Students should work on topics that allow learning by inquiry in the collaborative ambience.
    - Faculty should engage students within the teacher's interested areas, and then allow interested students to come along side the faculty through more interpersonal learning, not lectures.
- WPI must accept and desire that there is a need to change.
    - Staff must see the need for change in order to want to implement change.
    - Professors must be excited about teaching and cohesive with one another.
    - A visionary leader must be selected to lead the reform and be aware of what changes are being implemented by other successful schools.

Assessment of other Learning communities was also performed. The learning communities that were investigated consisted of University of Massachusetts Dartmouth, Carleton College, Georgia State University, University of New Mexico, Syracuse University, University of Nebraska, Iowa State, University of Michigan, Franklin W. Olin College, Evergreen State College, Wagner College, Temple, and University of Maryland College Park. In these learning communities, the goal was to be able to implement a program were the students would share their learning experience, in gaining knowledge, shared knowing and a responsibility by all, to form a good solid foundation or a springboard to launch them in the right direction for the rest of their years at college. In this form of collaboration, the desired path was to give the students a sense of belonging and understanding that is beyond the typical college student and give the

students the right tools to succeed in college. Learning communities are setup in various ways such as being dependant on what the focus of the community was to integrating various subjects, which has been done so such as the IMPULSE program at Dartmouth or the Project Learning Community at WPI. Most of these programs have been implemented for the incoming freshman to serve as an adjustment or a transition between high school and college which has proven effective where students would form groups outside of the classroom, have a higher level of participation, or feel that they have a better understanding or increased academic ability from the community. These learning communities also tended to increase the social interaction because these students have this shared effort when collaborating on various projects or ideas and support each other in attaining the knowledge and the ability to do well in future years.

Nearly all of the schools investigated have had a positive outcome and gave students a sense of accomplishment and a sense of reassurance that they can handle the college environment. The majority of these learning have accomplished what they set out do, if it's either promoting academic excellence, enhancing a student's intellectual and personal development or developing a supportive and inclusive community of diverse students, faculty and staff.

Learning communities have proven to be an effective way of teaching and avoided the stereotypical monotone lecture that some students fear or labor over when someone mentions the word "college". Learning communities allow the students to become involved in their learning and aid in their own development in various areas such as knowledge, comprehension, application, analysis, synthesis and evaluation that are mentioned in Bloom's taxonomy. The method of teaching done in learning communities are instead of the typical just sitting in a lecture hall and absorbing the information, but to gather knowledge, give insight, question that knowledge and form their own conclusions on what they are being taught on. This process of teaching is one of the major contributing factors in successful teaching and has been implemented in many of these learning communities give another reason why learning communities have been successful as they are now.

These learning communities are evaluated in various ways such as surveys, focus groups, and academic evaluations of the students who have undergone these learning communities. Learning communities have displayed that the teaching style plays a key role in the development and the process of learning. They give the students the ability to think and figure out subject matter on their own through their own process of understanding therefore making their learning experience evolve from the concept of just being taught the information straightforward to the idea of being involved in one's own learning experience.

In an effort to improve the integrated calculus, physics, and humanities theme, significant work was also completed in developing curriculum enhancements which accommodate the structure of the PLC. Our efforts include the review and selection of reading assignments, the development of new group project topics, as well as the development of helpful study aids.

The humanities portion of the PLC concentrates on a wide variety of topics throughout each term. The quick and wide variations in subject matter, although a valuable tool in meeting the educational goals of a general humanities course, often present difficulty for a first year student. To make students more comfortable with this format we have selected a series of small assignments, which aren't necessarily related. Students shall read a selection each night to prepare for an interactive discussion the next day.

Group projects are also an important part of the PLC curriculum. They not only form the foundation of the curriculum, they provide students with an opportunity to build their teamwork and communications skills. Ideally, these projects are to integrate the calculus, physics and humanities portions of the PLC. Unfortunately, some of the past projects have failed to fully meet this ideal goal. Thus, we have proposed many new projects which are aimed towards more successful integration. These projects include topics in the history of electricity, aviation, ancient engineering, and even the use of Lego MindStorms™.

With the recent addition of a PLC section which includes calculus 3 and 4, we have also recognized difficult areas and points of confusion within these courses, especially in calculus 4. To help eliminate this issue we have developed a flowchart which makes determining the convergence of a series, a central concept of the course, significantly easier to understand.

Additionally, to help facilitate further development of the program, improvements have been made to the website, and an informative brochure has been created. The website has been updated to a more professional looking format, which is consistent with the standard WPI website structure. Included in the new website is a self test which provides prospective students aid in making the decision to enter the program based on their view of themselves versus the type of student best suited for a learning community style environment.

To better assess the performance of the PLC at WPI. Assessments performed by an outside assessor were studied. The reports reinforce our own assessment of the learning community. The assessments involved a focus group, a survey comparison of PLC students and control students, and a GPA comparison of PLC and control students.

Results from the focus group results show that almost all students who took part in PLC program had an overwhelmingly positive response about their experiences in the program. According to the students who participated in the focus group, PLC emphasized learning as opposed to performing on a test. Students who participated in PLC welcomed the interactive approach of the program as opposed to the traditional lecture based classes. One of the main objectives of PLC was to link all courses the students were taking while they were in the program.

Students from each PLC section agreed that they developed a better understanding of how issues are interrelated. With regular projects, reading assignments, writing assignments, and other homework, PLC students liked the challenging environment that they worked in. PLC offered students to work in groups, create presentation, observe and

critique each other's presentation, and opportunities to learn from each other. PLC students enjoyed working with their professors, which provided them an opportunity to get to know each other. The students also appreciated the extensive one-on-one time with the professors.

The GPA analysis of PLC students and their control groups did not reveal any significant difference statistically. The GPA analyses suggest that PLC students are not disadvantaged academically by the innovative educational experience and they do not appear significantly different from their control peers. A pre intervention and a post intervention survey were given to AY 01-02 and AY 02-03 PLC students and their control groups to further assess PLC. The analyses done on the pre and post survey results revealed that PLC students successfully achieved almost all goals of PLC. The data from the survey indicate that the group project approach of PLC was key to the success of the program. Compared to the control group, PLC students promote the benefits of interdisciplinary study, promote and help students develop strong communication skills, promote and help students develop good problem solving skills, and encourage positive attitude towards teamwork. The outside assessment reports show positive results from the student focus groups, pre intervention and post intervention survey, and GPA analysis. According to the reports almost all students who participated in PLC program enjoyed the environment.

Another key assessment for the IQP consisted of the opinions of former PLC students. To obtain this information a survey was sent to all former PLC students. First students were asked to compare the different experiences of the PLC to that of experiences in traditional classes and pick the one that they felt helped them more, the PLC, traditional classes, or no difference between the two atmospheres. These questions were focused on issues, like academics and social skills that any student must acquire. For example: improvement of skills in writing, problem solving, teamwork skills, interacting with professors, and making friends. Next students were asked to answer questions in the form of strongly agree, agree, neutral, disagree, or strongly disagree about statements made about the PLC. Questions reflected the aspects of the PLC that set it apart from traditional classes. Our intentions of the survey were to see what aspects of the PLC that the general group felt were the areas of strength and weakness.

The results and recommendations chapter of this report has made an attempt at suggesting further developments that should be looked into in the evolution of the PLC. For this portion of the executive summary we shall attempt to enumerate several key issues for the maintenance of the PLC program and the future of learning communities at WPI.

In our research on learning communities around the country we found several areas that are necessary for a successful program. First there must be local administrative support from within. If there is resistance the freedom and growth of the program is severely limited. Second, the learning community needs to address both academic standards and student affairs. With this model the focus is shifted from just providing information and grading exams, to refining the way in which students learn in an attempt to improve their performance. Next, there needs to be financial support such that the extra materials and

resources the program requires are readily available. An intuitive information system is important for enticing prospective students as well as keeping the university community in general informed with the goings-on therein. Lastly, integrating the students into their own experience will help to produce a favorable response and opinion of the program throughout. This will in turn ease study group formations, college life style transitions and the learning itself.

In order to evaluate the growth of the program and be sure that these goals are being met, there are several issues to explore which illuminate the quality of the result. First of these analyses is to compare the group in the learning community with a control group outside. One way of doing this is to compare GPA's, year-to-year retention and survey results. All of these methods should expose some areas of interest in the discrepancy between traditional classes and the LC in their effects on the student. As a final outcome you can observe annual enrollments and graduation rates of students from both groups. This should further enumerate the quality of the learning community as it relates to student education, performance and satisfaction.

With a satisfactorily performing learning community one can achieve many goals. For the PLC there is a set of goals, which have been defined from the beginning. Since a learning community is the best method for achieving outcomes such as those sought after in the PLC, that is the carrying force in achieving these goals. Some of the goals of the program include forming bridges between courses, improving inter-student relations, developing better study habits and group skills and hopefully provide students a more rewarding and effective learning experience.

It has been observed, as previously explained, that the traditional lecture format is not sufficient for improving any of these areas, or even addressing them. The best a lecture professor can do is to suggest that his pupils strive for higher standards. It is another matter entirely to lend a hand in achieving these standards. Our research has suggested that a change from this environment is needed to begin to improve the learning process.

The project concludes with a series of bulleted recommendations on areas of: Reasons to support and grow a learning community, Things needed for any successful LC program, Implementations for PLC to grow at WPI, and Assessment is key to realizing that the program works.

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Chapter 1: Introduction

The purpose of this study was to determine the value of the WPI learning community or "Project-Based Learning Community" (PLC) and its affect on freshman students at WPI.

The study begins with a background and literature review. In the review, a study of learning communities is performed. Various learning community models are addressed, and many of the countries leading university learning communities are studied. Special attention is paid to the top rated learning communities by US News and Report. The next piece of the review is a study of interactive learning. Types of interactive learning requirements are reviewed to determine what types of students will benefit most from the PLC. The third review section is devoted to researching the needs for reform in current education and how these needs can be fulfilled by a program such as the PLC. The final section of the background and literature review is the history brief of the PLC at WPI.

The background and lit review is followed by Chapter 3, the methodology section, which explains the approach of the student survey and how the results and recommendations of the study were determined.

Chapter 4, the results section, opens with a series of articles that were read and critiqued by the authors of this paper. The purpose of these articles was to find more humanities based material that would more appropriately meet the requirements of the social portion of the WPI education. Following the critiqued articles is a section of proposed projects that were brainstormed by the authors in order to better tie calculus, physics, and humanities together into "real" engineering problems. The results section then introduces a brochure that was written to create awareness of the PLC program for possible incoming freshmen at the WPI spring open house. The PLC website is also included in the results section, as it was designed by the authors. Next in the results section is the summarized results of an outside assessment performed on three generations of PLC students. Finally, the results section contains all the questions and results to the survey of former PLC students.

Chapter 5 contains the analysis and results of each researched portion of the study. Particular attention should be paid to each section's recommendation outline, as well as the Overall Recommendations section. The Overall Recommendations section concatenates the results of each analyzed section, and ties these results together with final recommendation per the future of the PLC at WPI.

Finally, Appendix A contains documents which were used in this study, but could not be traced back to a single source.

Enjoy.

Chapter 2: Background and Literature Review

2.1: Learning Communities

Learning communities are a form of co-registration that enables students' learning experience to not become so isolated but to more actively involve them in their learning. These learning communities' feature cluster groups, usually freshman interest groups, with linked courses and coordinated studies. There are three types of learning communities integrated throughout various undergraduate universities and colleges across the United States. The first type is known as a Student Cohorts/Integrated Seminar, which forms groups of students who enroll in one or two larger lectures that is unassociated with the program. The community and academic connections are made in an additional seminar. The next type of learning community is Linked Courses/Course Clusters were students take two or more related classes that are taught separately but coordinated by a group of faculty. Finally, the Coordinated Study format is taught by teachers who assign team projects centered on a theme or topic (Tinto 1).

Nearly all these learning communities have three things in common. 1) Shared Knowledge, where a shared, coherent curricular experience is formed and promotes higher levels of cognitive complexity since the courses are required to be taken together, which are organized around a theme. 2) Shared Knowing, where students are constructing knowledge together, they become involved both socially and intellectually in ways that promote cognitive development. Also, developing appreciation in the learning experience when enhanced by input from other people in the experience. 3) Shared Responsibility, where students become responsible and mutually dependent on each other in the learning experience so the group does not advance unless each member does his or her part. (Tinto 2)

There are other variations to the learning communities such as "living learning communities" (Tinto 4) where shared courses are combined with shared living and the members of the learning community reside in a reserved part of the residence hall so the students are in linked courses and are living together. "Service learning" (Tinto 4) combines educational activities with service experience to meet critical needs identified by the communities being served.

But in these learning communities, the faculty needs to collaborate to ensure the linked courses provide a coherent shared learning experience. The faculty usually combines academic work with student affairs work. The collaborative efforts of both groups are required since the only persons on campus who have the skills and knowledge needed to teach some of the linked courses is usually on the staff of student affairs.

Vincent Tinto of Syracuse University has done a recent study on learning communities under the auspices of the National Center for Teaching, Learning and Assessment, which explored the impact of learning communities upon the academic and social behavior and persistence of new students in a handful of different institutional settings. Even though

limited in scope, this research produced a number of important insights have been found such as students in learning communities:

- ✓ Tended to form in their own self-supporting group, which extended beyond the classroom. They concurrently spent more time outside of the classroom together than the students not in learning communities.
- ✓ Became more actively involved in the learning experience and spent more time inside and outside of the classroom learning together, forming a bridge between academics and social life.
- ✓ Had higher levels of participation than those not in the learning community.
- ✓ Saw themselves as more academically and socially active and engaged than other students
- ✓ Recounted powerful messages about the value of collaborative learning communities.
  (Tinto 5)

Learning communities are not perfect since some students prefer to work alone and some faculty find collaboration with other faculty or staff difficult but learning communities do enhance the student's learning and persistence, as well as enrich the faculty's professional lives. Many institutions have begun to form learning communities and there is little question as to why. The National Science Foundation Coalition program has funded some of these learning communities in the hope of restructuring engineering education curricula, and the US News and World Report has created a college ranking system of the various learning communities.

Reference:
Tinto , Vincent. "Learning Better Together: The Impact of Learning Communities on Student Success". Chair of the Higher Education Program at Syracuse University and Distinguished University Professor vtinto@syr.edu

2.1.1 NSF Funded Coalitions

The National Science Foundation has supported and funded creation of eight engineering education coalitions to restructure first-year engineering curricula. Within these eight coalitions, some schools have a variety of integrated curricula for their engineering education. The integrated curricula ranges from a couple of courses combined to a cluster of courses that includes non-science courses. There has been a study done, titled "First-Year Integrated Curricula Across Engineering Education Coalition"(Bilgutay, 30), to assess the progress and outcomes of the institutions in the NSF coalitions. The purpose of this study is to present different curricula developed by schools in different coalitions, logistical challenges, and its assessment results for schools interested in developing a first-year integrated curriculum. This study explores mainly four broad categories of questions about integrated curricula. These categories are: motivation for the integrated curriculum, pedagogical models, implementation and logistical issues, and the assessment results. While examining each college, the reason for implementing an integrated curriculum is discussed. The negative impacts that were faced during the program and their solutions were also addressed. Different colleges have

different pedagogical models to fit their institution. Therefore, the pedagogical models are discussed in terms of course structure, time-sharing, topical span, topical coordination, and learning environment. (Refer to Table 1 on page 5 to find a summary of the pedagogical models experimented by colleges that are under study).

Program	Course Structure	Time Sharing	Topical Span	Topical Coordination	Learning Environment
IFYCSEM (Rose-Hulman)	large course block, one 12-credit grade	real-time (flexible time)	math, physics, computer sci., engineering, chemistry	topical alignment, integrated exam	coop learning teams, team projects, required notebook computers for every student
University of Florida	separate courses	fixed time	calculus, physics, chemistry, engineering	pre-arranged topical alignment	moderately structured coop learning, teams, student cohorts, computers in classroom
FYIEC (Texas A&M University-Kingsville)	large course block with separate grades	fixed time with minimal real-time sharing	math, physics, chemistry, engineering, and English	topical alignment, thematic concepts, integrated exam integrated design projects	co-op learning, teams, team projects, computers in classroom, student cohorts
The Ohio State University	course triad	fixed time	engineering, math through diff. eqs., physics, statics, technical report writing	nomenclature coordination, some topical alignment, computer tools introduced once	coop learning, CAI materials
Texas A&M University	large course block, separate grades	fixed time	calculus, physics, engineering, chemistry	topical alignmen integrated exam	co-op learning, teams, team exams
IMPEC (North Carolina State University)	large course block, separate grades	3/4 fixed time and 1/4 time shared	math, science, and engineering, with written and oral communication	integrated lectures, hw assignments, projects, and exams	structured co-op learning, experiential learning, teams
Arizona State University	large course block, separate grades	real-time	math, physics, and engineering, English	integrated lectures, hw assignments, projects, and exams	structured co-op learning, experiential learning, teams
University of Alabama	large course block, separate grades	real-time	math, physics, chemistry, and engineering	integrated lectures, hw assignments, projects, and exams	structured co-op learning, experiential learning, teams
E4 (Drexel University)	large course block, separate grades	fixed time	math, physics, chemistry, biology, engineering, and humanities	homework assignments, faculty team meetings	experiential learning, teams

Table 1:Summary of integrated First-Year Curriculum Experiments (Bilgutay, 30)

The assessment done on the first-year integrated curricula in all the colleges mentioned in Table 1, have a very positive outcome. All the students in the integrated curricula outperformed their counterpart in the traditional classroom in all colleges. The control groups for the program students were matched before the start of the year based on their SAT scores, incoming grade point averages and other factors such as parents' education, etc. All schools followed the performance of the control group and the program students even after they are released into the traditional course structure. Amazingly, in all cases the retention rate and the GPA of the program students were significantly higher than that of the control group. In many cases the difference in GPA varies from 0.2 to 0.5 and the retention rates are 20% or more than that of the students in the traditional classroom. E^4 program at Drexel University started in 1989 expanded its program in 1992 and in 1994 the program was institutionalized to all 500+ entering freshman students due the overwhelming success of the integrated curriculum. (Bilgutay, 30) This program is still in effect today.

Different first-year integrated curricula have been piloted in different schools in the engineering coalitions funded by NSF. The Assessments of these program indicated positive results. The NSF study recommends that schools interested in the integrated program should explore into this field and come up with a curriculum that fits their institution.

There are institutions outside of the NSF Coalitions that have also experimented with the innovative learning communities and often resulted in positive outcomes. Most of these institutions are inspired by the NSF Coalitions itself. One such program was embarked in September of 1998 at University of Massachusetts Dartmouth.

Reference:

Nihat M. Bilgutay; ; Carlos Corleto; John T. Demel; Nizar Al-Holou; Richard Felder; Karen Frair; Jeffrey E. Froyd; Mark Hoit; Jim Morgan. "First-Year Integrated Curricula Across Engineering Education Coalitions", 1998

2.1.2 University of Massachusetts Dartmouth IMPULSE program

In 1995 the engineering and science departments at UMD were suffering from failure and drop rates greater than 40 percent, and the preparedness and motivation of the remaining engineering students was significantly lacking. Faculty established that the roots of the problem existed within the foundation of the current engineering curriculum, the basic physics, calculus, chemistry and English courses. To resolve the clearly apparent problems within these foundation courses, faculty began a curriculum development process, which would assure initial acceptance and success, as well as long-term effectiveness of their resulting program.

The first step in their development process was to take a close look at already established innovative programs. Traditional paper research methods, in addition

to visiting working programs, enabled the UMD faculty to learn of the successes and failures of the current programs. Among the institutions visited were those in the Foundation Coalition, sponsored by the National Science Foundation. It was the innovative programs used by members of the Foundation Coalition which most appealed, and provided much useful information, to the UMD faculty. After reviewing many programs, including Rensselaer Polytechnic Institute's Studio Calculus and Physics programs, the UMD faculty constructed a plan for a fully integrated first year engineering program. This cost effective program utilized hands on, technology assisted, cooperative, learning which integrated all required first year foundation courses.

Often the most difficult aspect of curriculum development is obtaining support, funding, and acceptance within the institution. UMD faculty first tackled this problem by obtaining external support that, in turn, would help establish initial funding in addition to program credibility among administrative forces. Preparing the institute for the radical change was the next hurdle. To reduce fears and resistance, the program was initially set up as a pilot that would be subject to assessment and correction by all involved engineering departments. This, in addition to offering optional involvement to all departments, greatly reduced initial resistance to this dramatic change.

Long term success and effectiveness was also a significant concern. Thus, the program was designed with cost, assessment, faculty cooperation, and size in mind. UMD faculty claims that their studio style classes taught by one instructor and one TA would save the institution an estimated $124,000 a year. Being introduced as a pilot course, assessment was also an important aspect of program development for the long term. Accurate assessment techniques allows for curriculum improvements, as well as establishing performance expectations. The UMD assessment techniques would involve control groups, test scores, high school rank, SAT scores, and even writing samples. Additionally, the pilot course size was to be kept close to the desired final course size to most accurately benefit from the assessment results. Also, it was established that faculty teamwork would greatly determine the success of the program, and was thus critical for the programs success.

The final established course is called Integrated Math, Physics, and Undergraduate Laboratory Science, English and Engineering, or IMPULSE for short. It is a 31-credit 2-semester course structure in which groups of 48 students all take the same courses together. An instructor and TA teach each course, and the course topics closely match those of traditional classes. However, topics from each course are tied together, integrating all subjects. One state of the art classroom is utilized for all courses except for chemistry labs. This classroom contains high-speed computers, measurement devices and software that are utilized for analytical experiments in physics, calculus, and engineering topics. By integrating the courses all topics seem more relevant to the student, especially the calculus courses. By overhauling the calculus courses to include more emphasis on the applications within physics and engineering, students can see first hand

where and how the subject can be used. English courses within the IMPULSE program are similarly integrated with physics, calculus, and engineering, and focus on improving the motivation and ability of engineering students to express their ideas in written and oral form.

Some compromises were necessary in the program for practical reasons. The program includes math, chemistry and physics, and some students find it to be a heavy load. Students in traditional classes only took chemistry and math during their first semester and physics in their second or third semester. Therefore, during the second semester students had an option to drop chemistry if they wanted.

For assessment purposes, two control groups were matched up with the program students from 1997 and 1998. These control groups consisted of freshman students majoring in engineering and were in traditional classes. The assessment of IMPULSE after one year revealed positive results. The retention rate of the engineering students in the program was higher compared to their counterparts in both control groups. The percentage of students passing two semesters of physics on schedule nearly doubled and the percentage of students passing calculus on schedule increased by 40%. Due to the success in IMPULSE physics, many of the methods used in the program were borrowed by the traditional physics courses in UMD. There were no statistically significant improvements in the students who took IMPULSE chemistry. However, this result is impressive since IMPULSE students spend only three hours per week in chemistry compared to the traditional seven hours of course work. From the first year assessment, the IMPULSE produced more and better prepared sophomores, as the university has hoped.

Reference:
N.A. Pendergrass, Raymond N. Laoulache, John P. Dowd, Robert E. Kowalczyk; "Efficient Development and Implementation Of An Integrated First Year Engineering Curriculum", University of Massachusetts Dartmouth

2.1.3 Carleton College

The people at Carleton College decided to create a program for first year students that coalesced three different realms of study. The students in the program studied natural sciences, social sciences and humanities. The goals of the program were to form bridges over the gaps between different subject matters that are actually related. To make that cross-dimensional traffic, they even narrowed their areas of study to the human mind and its workings.

The ninety students in the entire program met once a week for a group session in which the professors could address the most pertinent of material for the curriculum at that point. Numeric surveys entailed that students had a steadier workload, felt they understood more of what was taught, felt that their courses were more interrelated and would be much more likely to recommend their classes to other students. Carleton has recognized the value of crossing boundaries between courses.

2.1.4 Learning Community at Georgia State University

Freshman Learning Communities were first implemented at Georgia State University (GSU) in 1999 with a focus on small group learning, demanding writing, and relating courses to the world outside the classroom. They are conducted in the fall semester and consist of five courses that are planned around a basic theme. Each FLC is limited to 25 incoming freshman. In the second semester students continue with one course related to their specific FLC and four additional courses of their choosing. Each FLC has at least one faculty advisor and several junior or senior student mentors. Students need not worry if the FLC they pick relates to their major because all offered courses go toward fulfilling the general education requirement.

Thirty-four various learning communities are offered for the fall of 2003. These programs range from African and American Culture and History, City Life: Exploring Atlanta, Pre-Med, and Understanding Yourself and Others. In 2002 two Honors LC sections of twenty students each were added, so students could participate in a LC while still meeting requirements to achieve General Honors. Residential Emerging Leaders is a FLC for students who hope to be leaders in the GSU community. All students enrolled in this LC live together in the GSU Village, where two out of their five classes are held. Six additional FLCs are offered in the summer consisting of three courses per community.

Despite each course being taught by an individual professor, each FLC is catered to a specific theme. For example, three of the courses included in the Law & Society community are GSU 1010: New Student Orientation (which all first semester freshman are required to take), Great Questions of Philosophy, and English Composition I. Throughout the semester various topics relating to Ethics are chosen. Not only are readings relating to these topics assigned in Philosophy and English, but a paper is written. Taking material learned in Philosophy the students revise their papers in English and hold a debate in GSU 1010 connecting all three classes. This is just one small example of the program.

The success of the program is rated in various ways. One way of evaluation is questionnaires given to students upon the completion of the program. Also focus groups are held to obtain information not available through a survey. Another important factor is the number of students that enroll in FLCs from year to year. The enrollment rate in FLC shows the demand for the program. Finally, FLC students GPAs and retention rates are compared in Table 2 on the following page.

Retention Rates for Freshman Learning Community (FLC)
Students and Other Freshmen, Fall 1999, Fall 2000 and Fall 2001

Fall 1999	N	PGPA	Term GPA Fall 1999	Cum GPA Fall 2000	Cum GPA Fall 2001	Hours Earned
FLC	295	2.639	2.72	2.7	2.79	61.4
Non-FLC	1465	2.619	2.38	2.61	2.7	58.7
Total	1760					

Fall 1999	N	Retained Spring 2000 N	%	Retained Fall 2000 N	%	Retained Spring 2001 N	%	Retained Fall 2001 N	%
FLC	295	285	96.6	232	78.6	217	73.6	193	65.40%
Non-FLC	1465	1322	90.2	1054	71.9	981	67	891	60.80%
Total	1760	1607	91.3	1286	73.1	1198	68.1	1084	61.60%

Fall 2000	N	PGPA	Term GPA Fall 2000	Cum GPA Fall 2001	Retained Spring 2001 N	%	Retained Fall 2001 N	%
FLC	432	2.693	2.87	2.74	421	97.5	374	86.60%
Non-FLC	1650	2.697	2.47	2.63	1522	92.2	1286	77.90%
Total	2082				1943	93.3	1660	79.70%

Fall 2001	N	FI	Term GPA Fall 2001
FLC	572	2683	2.96
Non-FLC	1570	2697	2.67
Total	2142		

Table 2: Retention Rates for FLC

The chart is presented in Figure 1 of this report that shows students participating in a FLC have a higher average GPA than compared to non-FLC students. The percentage of students who participate in the FLC is higher than non-FLC students when discussing the amount of students that return to GSU every semester.

2.1.5 Learning Community at University of New Mexico

This program runs for all incoming freshman as of the year 2000. The basic idea is to take two classes, each consisting of the same 22 students and integrate them as seamlessly as possible over specific subject matter. One is a "Freshman Seminar" which seems to be the main conjoining piece of this learning community and the other is either freshman English or public speaking in which the students will appropriately present in terms of reports or presentations on what they are learning. The two classes always have a linked theme and the students do projects and reports along this theme. In total there are 20 pairs of linked classes with 41 professors involved. To answer the L.C. websites question about how they assess the success of their program, they say they judge "faculty/student

affairs satisfaction", "rates of course or program completion", "national instruments such as CSEQ, CCSEQ, NSSE or others", analysis of year-to-year retention", "grade point averages", "annual program enrollment", "graduation rates" (which are yet to be ascertained), and "student satisfaction" . They propose to use all of these tests to improve the program from within and to ascertain how well it is being received and performing towards its goals. One notable program they hope to institute is an "instructional diagnostic", basically a focus group to ascertain how the students feel about the program as well as a program of review to help recommend professors whom are well suited to this type of structure and class types.

Reference:
(http://learningcommons.evergreen.edu/dir/progdetails.asp?progid=209), (11/06/03)

2.1.6 Learning Communities at Syracuse University

The Learning Communities at Syracuse University all include a collaborative learning environment, common academic experiences, introduction to university resources, peer mentoring and tutoring, faculty and staff mentoring and involvement, leadership opportunities and development, interaction with a diverse group of students, faculty, and staff, and special programs to acquaint students with campus life.

Syracuse University offers 17 Residential Learning Communities, 4 Non-Residential Learning Communities and 2 Summer Learning Communities. The Residential Learning Communities ranges from major focused learning communities, to character building learning communities, to learning communities based on race. The residential learning communities, for the majority, are offered to all undergraduates, except for the few, which a particular class required such as first year students or junior and seniors. The Non-residential learning communities offer a Higher Education Graduate Program, Human Service and Health Professions Inter-professional Learning Community, Management Junior Core, and Michelangelo Learning Community.

Summer Learning Communities offer summer courses for high school students to give them a taste of college and experience actual areas being considered as majors and future professions. There are several diverse programs offered such as the liberal arts program, which has two chosen courses focused in the arts and sciences. A pre-professional program, which has one chosen course focused in the engineering and computer science, law, management, and communication fields followed up by a complementary course in the liberal arts offerings. The studio arts program allows you to earn six credits in any one of the following: Acting and Musical Theater, Architecture, Art and Design, and Fashion and Textile Design.

The Learning Community Advisory Board provides the social events for all the learning communities, serve as peer mentors, input and support for the learning community program and assist with learning community recruitments.

Reference:
http://lc.syr.edu/, (11/06/03)

2.1.7 Learning Communities at the University of Nebraska

The University of Nebraska describes their learning community program as an extremely effective method of making the college transformation, both academically and socially. Their program integrates both academic and residential aspects of college life to create an atmosphere conducive to the analysis, evaluation, exploration, management and discussion required to successfully establish direction in ones college career. To suit the wide variety of interests and majors, the university offers over 17 unique interest based communities all built on the same basic foundation.

Although the University of Nebraska offers over 17 different learning communities they are all based on the same general structure. Within each community students are required to take at least two classes together, yet it is not uncommon for some communities to require 3 or more per semester. Each of these courses is related to the theme of the community, and satisfies a portion of the universities general education requirements. Additionally, members of each individual community share co-curricular activities, have an open faculty-student connection, and most generally share the same residence halls.

In addition to the standard major related fall session communities, the university offers a 3-week summer community called NU Start. This program allows incoming freshman to earn four credit hours and fulfill their general education requirements before the fall session begins, when the campus atmosphere is more relaxed. Giving incoming freshman this opportunity allows students to explore the campus, ask questions, make connections, discover expectations, learn to manage time, and build teamwork and leadership skills.

When the fall semester begins there are 14 theme based residential communities available. The communities offered are biology, business, digital entrepreneurs, engineering and technology, fashion and textiles, general studies, joint ROTC, law and government, mass media perspective, music, nursing, nutrition and health, teaching and learning, theatre arts, and agriculture. The enrollment for each of the communities ranges from 23 to 80 students, and the chosen area of academic interest dictates in which residence hall the students will live. Arranging the residence halls in this manner ensures that students organize and become active in peer support and teamwork.

Yet, those living off campus are not excluded from the leaning community offerings. A community known as Alpha is provided for those who wish to live at home, or a general university residence hall, and still wishes to experience a universal learning community. This community requires enrollment in 2 thematically related courses in History, Literature, Language, or Religious studies. It provides non-residential and uncertain students with the opportunity to

become involved in a challenging, smaller, educational community, while simultaneously fulfilling their general education requirements with courses that provide a strong academic foundation for the remainder of their academic career. Overall, freshman who have been involved in the learning communities at the University of Nebraska believe they have greatly benefited from the experience. The integration of academic and social life allowed for a greater ability to balance academics and social activities. Additionally, students believed that living with students who share similar interests and courses allows for easier learning through peer communication and informal study groups.

Reference:
(http://www.unl.edu/artsci/students/advising/alpha.html, 7/14/03)

(http://nustart.unl.edu/, 7/14/03)

(http://www.unl.edu/learncom/summary.html, 7/14/03)

2.1.8 Learning Community at Iowa State

Iowa State has no shame to boast about the positive aspects of their Learning Communities, which started in 1995 with only 12 various communities that consisted of nineteen percent of the incoming first year students. They now have forty percent of first year students participating in one or more of its Learning Communities (LC). Students participating in an LC have higher first semester GPAs. Ninety percent of LC students return to Iowa State University for a second year. Forty-one percent of the students that participated in a LC graduated, compared to the twenty-five percent of student that did not participate in a LC. When compared to non-LC students, LC students have a higher level of satisfaction about the overall Iowa State experience.

Learning communities at Iowa State University make a big campus feel smaller. Students are able to meet and befriend fellow students who share their same interests. Study groups, composed of students studying similar or identical majors, can be formed that continue to aid students throughout their college careers. Learning Communities hope to aide students in learning what their major offers. In addition, this experience is supposed to help show the connections between different courses.

Nearly fifty Learning Communities are offered at Iowa State University. Depending on the specific LC, students take two, three, or more classes together during the first semester. The remaining first semester classes taken by a student are in a non-LC environment. The general areas covered by the various LC's are Agriculture, Business, Design, Education, Engineering, Family and Consumer Sciences, Liberal Arts and Sciences. Not all LC are based on majors. For example the Multicultural Learning Community consists of sixty first-year students interested in learning about various cultures. Women only Learning Communities are offered along with LC's for sophomores and other LC's that run for a full year. All LC's come with trained peer mentors and tutors. One-third of the communities are residential LC's. Students live together on a floor with students

participating in their specific LC. A peer mentor or mentors live with students to aide their transaction into college life and LC environment. Communities consist of scheduled study groups, social activities, field trips, and speakers. Students also perform community service and volunteer work. Out of the two thousand students that participate in LC's, only a hundred and fifty students join an additional LC.

In July of 1998 at a President's Council, President Martin Jischke allotted $500,000 a year, over a three-year period from 1998 to 2001 for the betterment of Learning Communities at Iowa State University. The two Vice Presidents of Student Affairs and Undergraduate Programs collaborated to appoint Carly Brook, Director of the Center or Teaching Excellence, and Doug Gruenewald, Assistant Director of Residence for Academic Services in charge of the Learning Community Advisory Committee (LCAC). The LCAC consisted of a Representative from each college, Academic Administration, Faculty, Student Affairs Staff. Four members were also LC coordinators. Sub committees were formed for assessment, curriculum development, peer mentoring, and the Learning Community Institute. A Request for Proposal process was designed to divide the allocated money.

One important thing that was done with the money was updating the website. An easier and more memorable domain name was chosen for the LC's website. Thorough information was organized and displayed for people who wanted to find out information instead of the former brief description of the program. The LCAC also sponsored programs to educate members of the Iowa State University community. A school wide information meeting was also held to update the ISU community. The money also provided resources for assessment and to hold an LC coordinator workshop.

The Learning Community Assessment Subcommittee in the fall of 2000 designed the Iowa State University Undergraduate Education Survey. The test is administered in the form of a pre and post-test to all ISU full-time, first time, freshman living on campus. LC students are given the ISU Learning Community Survey. Control students are given a post-test survey titled ISU First Year Student Survey. Pre-tests were generally the same for all students. LC students were more eager to work in groups and to get to know the professors better. Non-LC students were expecting to spend more time working for pay. The post-test showed that both the LC group and the control group spent the same time in classes but the LC spent more time in group study. The LC group felt more time was also spent talking with advisors and instructors who they felt gave them outstanding support and encouragement. They also spent more time doing community service and leadership activities. LC students also felt the professor had high expectations and that the LC environment helped them to meet goals as a student. They also had a better understanding of the aspects of their major as well as a better knowledge of the university. LC students felt they had more opportunity to participate in organizations, group projects, and to participate or develop a study group. In the areas of communication and critical thinking LC students improved by a greater factor than non-LC students. Besides doing well in classes, which was a positive

aspect of both groups, the LC also had positive experiences; meeting new people, finding people in their own majors, and having a fun time. The most frequent response to the question of negative aspects of the LC was none of them were followed by more group activities. Non-LC students found that it was harder to develop good study habits.

One interesting aspect of the Iowa State University LC is the Learning Community Institute. The Learning Community Institute started as a workshop open to anyone interested. Now in its fourth consecutive year, the Institute is geared towards members of the LC organization. The Institute is a weekend of workshops to help share experiences and learn from each other, while also planning for the future. Another important aspect of the Institute is to discuss assessments of the program and ways to improve the assessing process.

2.1.9 University of Michigan Learning Communities

The Michigan Learning Communities (MLC) helps ease the transition into college. Students establish student-professor relationship while meeting student that have similar interests to them. MLCs create small environments for students in large university communities. Depending on the MLC, student can participate in field trips, speakers, sports, research projects, and have the opportunity to stand out as leaders. MLC are broken down into two categories. Residential MLCs consist of students who live together in a specified hall that consists of in house academic advisors and live-in residential staff. They also have access to a library and computer lab. Non-residential MLCs are located in various places around campus and come with peer advisors, mentors, and faculty instructors. Students participating in a non-residential MLC may also participate in a residential MLC.

All MLCs are focused on establishing a supportive and creative environment. Michigan offers MLCs with more of fewer classes, smaller or larger numbers of participating student, and emphasis on different activities. Some MLC are geared toward women while others cater to minority students. Four year, as well as two and one year LC programs are offered. Programs are offered that cover health and science, writing and communication, learning and practicing German, and community service.

2.1.10 Franklin W. Olin College

Franklin W. Olin College would be the first freestanding undergraduate engineering college in the U.S. in nearly a century, and one of the few new private universities of any kind in decades. The objective of Olin College is to reform the engineering education and to challenge the traditional higher education in general. Olin is going to embark a very project-based curriculum with reforms proposed by the NSF and other accrediting agencies. At Olin three courses will be taught in each term and these three courses will be linked and there will be projects linking all three courses.

National Science Foundation and other accrediting agencies have been urging the reform of engineering education emphasizing team building, communication and entrepreneurship for decades.
Olin offered full tuition for their entering class for all four years. There were 32 available spots in the inaugural class and 664 application poured in for these spots, of which 30 accepted. The acceptance rate for the first year was around 4.5% making Olin the hardest school in America to get in. All of these students who entered Olin were among the top three percent of their class as well as scoring high in the standardized tests having nearly perfect scores. Most of these students were offered full scholarship in other well-known universities and colleges. During the following year Olin accepted 32 more students out of 536 applicants. This group of 32 students plus the original 30 will form the first freshmen class of the Olin College. Half of the 62 students are females and about 30% of the group is minorities. A dozen of these students represented Olin in a NASA competition to design a greenhouse that could operate on Mars. The Olin proposal was named one of six finalists, beating upperclassmen from Cornell and other large well-known universities. Olin has hired faculty from MIT, Cornell, Vanderbilt and other universities and colleges. Many of these faculty members gave up their seniority at other colleges to join Olin to be a part of and to contribute to their new curriculum. Olin has the best students, the best faculty and $500 million for this expensive experiment and they are expecting positive outcomes.

Reference:

N. A. Pendergrass; Robert E. Kowalczyk; John P. Dowd; Raymond N. Laoulache; William Nelles; James A. Golen; Emily Fowler, " Improving First-Year Engineering Education", pg 33-40, Journal of Engineering Education, January 2001

Marcus, Jon., "An Unknown Quantity", http://www.highereducation.org/crosstalk/ct0202/news0602-unknownq.shtml (6/19/02)

2.1.11 Evergreen State College

Evergreen College located in Olympia, Washington was ranked the top school for Learning Communities by the *US World and News Report* (2003) (www.usnews.com). At Evergreen students enroll in one comprehensive program for fall, winter, and spring terms taught by 2, 3, or 4 teachers who plan activities such as labs, fieldtrips, workshops and seminars. Each class is designed to accommodate one or more Planning Units, which will be described later. Programs are for 23- 25 students and offer hands on experience and possible internships as a result of the program. Instead of receiving letter grades, student evaluations that are hand written by faculty go in academic folders along with student's self-evaluations. This allows future employers more information about a student than would be obtained by grades. Summer, weekend, and evening programs for working students are also offered. One interesting aspect of Evergreen is they also offer Graduate programs. You can obtain your Masters of

Environmental Studies, Masters of Public Administration, and Masters in Teaching in the same team taught manner.

Planning units are the different areas in which the programs cover. First year programs are core programs taught by faculty from different disciplines where students study general topics and themes. These programs are designed to get students accustomed to the learning style at Evergreen. All-level courses are offered to students, of any grade level, intermediate programs are offered to students that have sophomore standing and finally advanced classes are offered to upperclassmen.
The first area is Culture, Text, and Language, which study the forming of our social structure. Through studies of past cultures and their practices, students are able to see how society has evolved and influenced our lives. Students also learn how present society shapes their lives. Another area is Environmental Studies is based on three themes: Human Communities and the Environment, Natural History, and Environmental Studies. Students not only learn about environmental issues, but also concentrate on certain areas of interest. Expressive Arts includes study in visual and media arts, music, dance and theatre. Past and present influences are studied to show their affect on expressive art, giving students a chance to work on group projects. Native American and World Indigenous People Programs are offered on-campus as well as reservation based. Programs help strengthen Indian communities by studying indigenous peoples' political, social, economic, and culture issues. One unit called Scientific Inquiry helps students develop the thinking style of scientists from how to collect data to finding a solution. Various aspects such as ethical issues are studied in areas such as physical, science, mathematics, computing, and laboratory biology. Finally, Society, Politics, Behavior, and Change combines anthropology, economics, history, law, political science, and philosophy to see the progress of the world and its problems and issues. It also has students investigate possible practices that will lead to a positive change.

Reference:
http://learningcommons.evergreen.edu/dir/profile.asp?progid=188

http://learningcommons.evergreen.edu/dir/profile.asp?progid=247

2.1.12 Learning Communities at Wagner College

US News and World Report rank Wagner College Learning Communities fourth in the US. Wagner is a four-year college located in New York City. As a part of Wagner Plan each student has to complete three Learning Communities before graduation. These Learning Communities are a requirement for student's graduation. Students at Wagner have to take their first LC during the fall of their first year. The second LC is done during their sophomore or junior year and the final LC is done in their senior year. Both the first year and senior year LC's involve field experiences designed to complement the theme of the LC.

The first year Learning Community consists of three courses which are linked by a single theme and which share a common set of students. Two of these LC courses meet in the classroom. The faculty plans these LC courses with overlapping assignments, common readings and joint problems. The third class in the LC is called the Reflective Tutorial (RFT), which combines classroom work and field experience, providing Wagner students with a unique opportunity to "learn by doing". The Reflective Tutorial consists of two parts, classroom work and field experience. The first or classroom part of the RFT emphasizes writing skills, where students actively link their field experiences directly to course readings both in the RFT and in the LC courses. This part of the RFT is scheduled as a class and is taught by a faculty advisor. The second part of the RFT is the field experience. The field experience provides the unique opportunity to explore first hand what students are learning about in the coursework of the LC. The field experience component of the RFT serves as the student's "textbook" for the classroom learning. Students must complete the second Learning Community during their sophomore or junior year. This Learning Community does not require the Reflective Tutorial and Experiential Learning components. The third Learning Community is required in student's own major. This LC combines a course in the major discipline with a Reflective Tutorial. The field experiences are covered within the Reflective Tutorial, combining appropriate literature and writing assignments that improve the connections between the subject and the field experience. Students develop a more sophisticated understanding of the complexity and depth of their major through intensive fieldwork, problem solving and critique.

By integrating the courses in LC's, Wagner wants its students to discover the connections among many different subjects. By linking courses to real fieldwork in communities and organizations, students will discover the connections between ideas and real world problems. Career success will require students to be broadly educated to see how problems, issues, and ideas fit together in order to solve modern problems in a world with a global economy, the Internet and the need for greater cultural awareness.

Reference:

(http://www.wagner.edu/wagnerplan/fyprog.html)

(http://www.wagner.edu/admitted/academic/fylc.html)

(http://www.wagner.edu/admitted/academic.html)

2.1.13 Temple Learning Community

US News and World Report rank Temple University Learning Community fifth in the US. It has been using learning communities since 1993 and is now in its tenth year. It now offers more than fifty different communities to its students and has a faculty handbook. It was originally funded by Pew Charitable Trusts with the primary goals being: improvement of teaching and learning in the first year

experience, and to create a sense of community in a large commuter student base, along with goals of better first to second year retention.

Since its inception in 1993, the LC's continued to draw in more faculty and Core and major courses into its program. Retention rates for both LC students and across the university improved greatly. In surveys, LC students express a greater sense of community, involvement, and satisfaction than their counterparts.

When the communities began only about 200 students were involved. It has now grown to over 1000 students. The majority of these LC's are linked courses that satisfy Core, college, and or major requirements. These courses tend to be one freshman English, one Math, and one that is major specific. The faculty also receives a monetary incentive to attend planning sessions and meetings. There are three currently defined goals of this LC: Promote the integration of knowledge (cross discipline); Transition students to college level learning, and create connects between students and faculty.

The results of a Social Study done on the students are listed below in Figure 1:

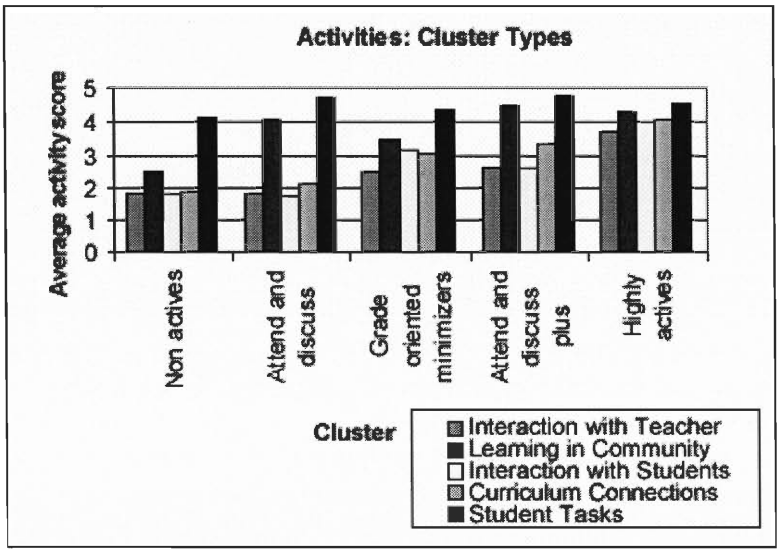


Figure 1: Temple Learning Community Student Activity Cluster Types

The non-actives were those that didn't participate or even attend sometimes. The Attend and Discuss were those that did just that. The Grade Minimizers were those that studied for tests and prepared assignments with other students. The Attend and Discuss Plus were those that are just like group 2 but did better. The Highly Actives were those that participated in everything. From the above graph we see that almost no matter where the students fall, they complete the assigned tasks, but we do not know to what skill they mastered these tasks.

Below in Figure 2, is a rating of helpfulness of the various pieces of a learning community. Again the students were grouped into five clusters.

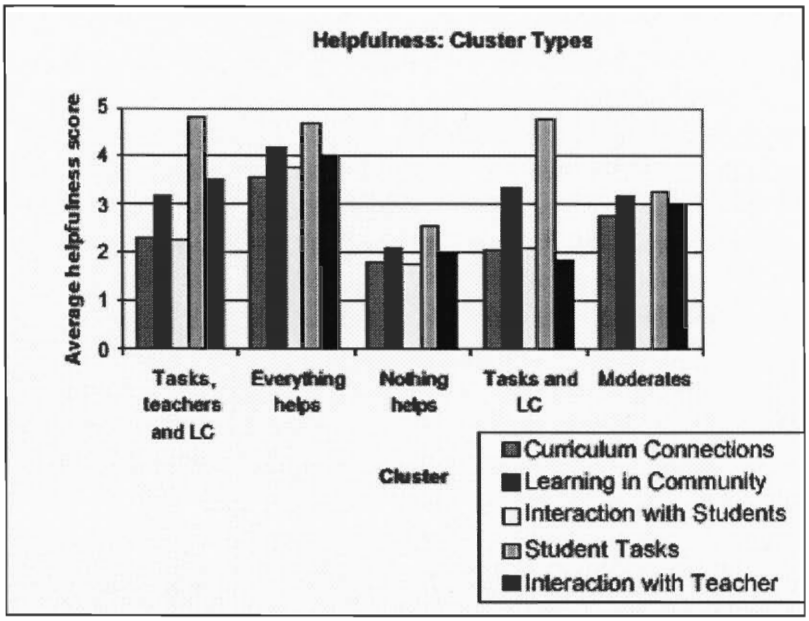


Figure 2: Temple Learning Community Student Helpfulness Cluster Types

Below in Figure 3 is the cross-tabbed data from the above two graphs:

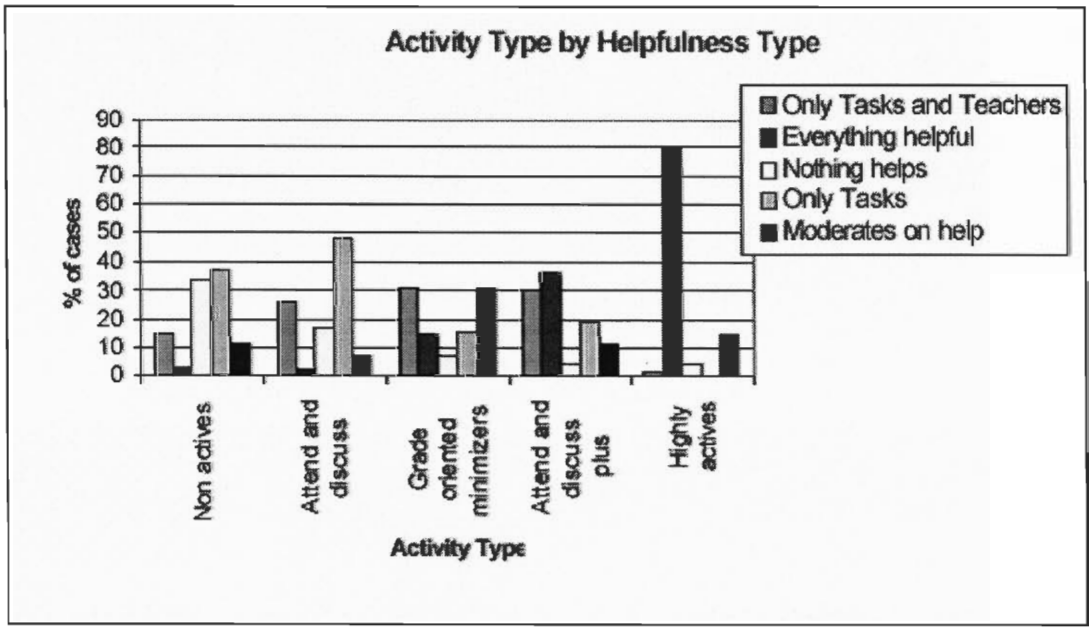


Figure 3: Activity Type Cross-Tabbed by Helpfulness Type

Notice, in Figure 3, how those students that were non-active tend to say that nothing helps while those that were highly active seemed to say that all aspects of the LC was helpful. This shows that a student who is more withdrawn and less participative would tend to find no benefit from an LC or would only benefit from the standard test and homework information regurgitation that is available in a standard class. However, one should note that this does not mean their

performance would be any better in a standard classroom because we are not measuring performance here.

The study also confirmed that majority of the participants in the LC were encouraged to enroll by a faculty member/advisor, or selected the LC to meet academic requirements. The students reported that they regularly attended class, completed assignments, socialized regularly, openly expressed opinions in class, and formed lasting friendships with peers. Students also stated that these were the most helpful in terms of their learning.

Reference:
http://www.temple.edu/LC/ (11/07/03).

2.1.14 Learning Communities at University of Maryland College Park

The learning communities at the University of Maryland at College Park are ranked third in the United States by the US News and World Report (www.usnews.com), and with good cause. With over nine years of learning community experience, and two currently active programs, the unique programs at the University of Maryland at College Park effortlessly stand out among the numerous programs throughout the country.

Early in 1994 an initiative began to develop a program, which would aid in recruitment and retention of academically accomplished Maryland students. This effort resulted in the launch of the College Park Scholars program. The scholars program is a first and second year program, limited to only those who are invited, which integrates academic and residential life to accomplish 4 main goals:

1. To promote academic excellence, integrity, critical thinking, and creativity through the development of interdisciplinary knowledge, skills, and perspectives.
2. To foster the development of a supportive and inclusive community of diverse students, faculty, and staff.
3. To enhance the students' intellectual and personal development through service, experiential learning, and innovative curricular and co-curricular activities both on and off campus.
4. To create an environment that enhances student development as life-long leaders, citizens, and scholars.

Students accepted into the scholars program are involved for their freshmen and sophomore years. To accommodate the wide variety of interests and majors, there are 12 sub-programs available, each focusing on a common interest or major. These sub-programs include Advocates for Children, American Cultures, Arts, Business, Society and the Economy, Earth, Life and Time, Environmental Studies, International Studies, Life Sciences, Media, Self and Society, Public Leadership, Science, Discovery and the Universe and Technology and Society. Students within each sub-program take at least 3 thematically related courses in

addition to a colloquium course, which enhances and integrates work done in the other three courses. For example, students involved in the Science, Technology, and Society program are required to take English 101, any basic science or engineering course, and one basic core course in addition to the colloquium course. The instructors of the colloquium course will actually coordinate assignments with the instructors of the major courses to ensure thematic connections. This basic structure is followed throughout the other disciplines. Additionally, students involved in each discipline share a common residence hall.

What is truly exceptional about the College Park Scholar program is the variety of outside activities in which the students participate. For example, students involved in the Science, Technology, and Society program run workshops for elementary school students, develop Web pages for clients, and work on projects with the Smithsonian, U.S. Patent Office and National Archives. Furthermore, many students are required to become involved in individual internships, which effectively highlight the relationships between technology and society.

The effectiveness of the program is evaluated using many different methods. These methods include graduation rates, student satisfaction, program completion rates, and student retention at the university, retention within the program, GPA analysis, and yearly enrollment rates. Additionally, focus groups, questionnaires, student self evaluation and external review are utilized to help further develop and enhance the program.

Beginning in 2001 a second program was developed at the University of Maryland at College Park. This program, called Beyond the Classroom Living and Learning Program, was developed to aid upperclassmen in obtaining community service, internships, and research opportunities in order to augment professional development and leadership skills through real world experience. Students spend two years in this program, during which period they must participate in one community service activity per year, help organize program activities, and demonstrate progress towards research, internships, or community service learning. Additionally, to help drive academic interest, and to share experiences, students in the program live with those students involved in similar service activities, internships, or research pursuits.

Between the two programs, the learning communities at the University of Maryland at College Park have over 500 currently involved students. In addition, since its early stages of the mid nineties, the number of involved instructors has been rapidly growing and is now nearing 100.

Reference:

(http://learningcommons.evergreen.edu/dir/profile.asp?progid=188, 7/14/03)

(http://www.scholars.umd.edu/courses/, 7/14/03)

(http://www.scholars.umd.edu/sts/cps.html, 7/14/03)

(http://learningcommons.evergreen.edu/dir/progDetails.asp?progid=188,7/14/03)

(http://www.beyondtheclassroom.umd.edu/, 7/14/03)

2.2: Interactive Learning

Interactive learning is a conglomeration of many different facets of intellectual conditioning that have been found to increase the productivity of the receiving student an his or her ability to absorb information. Many teachers attempt to use different devices to get their students not only interested in the subject matter, but also involved in their own educational experience. The PLC incorporates many interactive learning styles with its group projects, low student to teacher ration and goal-oriented curriculum, but there are still many things the PLC can learn from other systems from around the country. The following are several articles about different takes on the importance of interactive learning in the college experience.

2.2.1 On the uses of Liberal education, as Light Entertainment for Bored College Students

This article has a disgusted tone fit for social commentary running throughout. The professor begins by expressing the morose responses he gets from his course evaluation forms. Grey, mundane comments such as "I enjoyed your class" or "Your class was interesting". Quite possibly the most urbane responses imaginable, and I myself have seen it and felt it when the forms come filtering up the classroom to be filled out. So, is this the fault of the drab forms? Does the teacher actually illicit nothing more descriptive than "interesting" or "enjoyable"? Are the students so unimaginative that they cant even experience the environment in a different light than these grossly normal situations?

According to Edmondson it isn't any one of these things directly. Instead it is the fault of our consumer driven society. Ever since the baby boom following World War II there has been a dramatic increase in the number of people affluent and interested enough to attend college. This new societal wave has turned what was once an honor into a marketplace. Just as ads on TV "don't so much endorse the capacities of the product per se as show you what sort of person you will be once you've acquired it" (CITE), colleges now also simply offer another service to make you into a new person. Take the young, unintelligent high school senior and simply by paying for this service, BAM, now you are an intelligent, cultured college graduate. The idea is inherent in our crass materialistic culture and people are so afraid of losing their place on the social ladder that they dare not stray from the pack.

The responses on those forms and the demeanor of the students themselves, reveals an inherent flaw in how we view our intellectual systems as they stand today, merely another service to be taken in like a fast food restaurant or cable TV. Students actually get enraged at teachers when they fail classes, as if they had no control over the outcome of events, as if it were the professor's fault. The nonchalant and wary stance of the student was brewed over time in their affluent economic position, where they are constantly being served to the utmost. No one

is challenging the students to work for what they pay for. That's why they paid for it, so they wouldn't have to work for it.

Even at WPI we see this type of behavior and this article has helped to reveal how pervasive and frightening the attitude is. I consider myself a good student. I go to class every day, speak openly during class discussions, enjoy chatting with my professors in the hallways and treasure every ounce of information I can absorb. Unfortunately there are other students along side of me who do the exact opposite. The general feeling of students today is catered towards the lecture environment, towards not having to defend your understanding of the material face to face with the professor. Today's students have become meek receivers of information, simply watching their professors like they watch he tube.

This educational shortcoming is where the PLC can change the perception of students and actually give them their money's worth. The saddest part of college life is seeing fully able students that are so disengaged from their own experience that they cannot perform. Students who have such poor learning skills they attempt to do all their studying in one long crunch. The PLC takes away all of the normal barriers the students have to shield them from learning and being engaged in their learning as well as providing new learning strategies that will benefit the student for their entire educational career. Direct confrontation from the professor, going to the board to demonstrate what you know, presenting group projects in front of the class, goal quizzes: all of these nuances help to drive the students away from merely being passive observers in their own educational experience. One point is clear: Something is definitely lacking in the psyche of the modern student.

Reference:
Mark Edmundson, "The Use of a Liberal Education: As Lite Entertainment for Bored College Students," in , Harper's Magazine, September, 1997, pp. 39-49.

2.2.2 Teaching with Cases

"For many instructors, teaching with cases is new. Most teacher find it to be one of the most effective and exciting ways to teach. Cases allow instructors to take students to the highest levels of Bloom's Taxonomy. Thus, cases allow us to fully prepare students for the rigors of college learning."

"Case teaching is more difficult and demanding of the teacher."

"You must also be prepared to keep the discussion from straying away for these teaching points, but you cannot control it."

While teaching with cases is an effective method of inducing the "learning furnace", it does place a great deal of preparation time upon the mentor. Also, as stated in the article "Everyone must be an active learner, and operate at higher level of Bloom's Taxonomy." A student who prefers to remain anonymous and socially reserved would find it difficult to participate in such exercises. While

some of these students eventually embrace this learning style, many simply try harder to exclude themselves, and in the process negatively impact the educational ambience.

This article has a few valid points, but seems to be more of a high school lesson plan. The case studies probably would not suit first year WPI students, as most WPI students are already oriented to some predisposed mindsets about the technology and sciences, as well as the degree of work that is required. These lessons might serve a single class of discussion, but not much more.

Generally the cases that were discussed in this article were nearly devoid of insightful and thought provoking conflicts and paradoxes. There were a few meager moral issues, some of which apply to first year college students, but other than that the cases were pretty much useless for discussion or education. To use this method better the only thing needed would be better cases such as the Challenger Space Shuttle Catastrophe, Big Dams etc.

Blooms Taxonomy is basically a method for ascertaining the type of knowledge in a work and then using specific question formats to get evidence of that knowledge back. I've found that any good teacher uses this method without even thinking about it on as simple levels as knowing which questions you are posing your students. There are "reading check" questions like "Who said this statement?", while other questions are open ended and search for independent student connections such as "What is the significance of the storms in King Lear?". This is all basic knowledge for experienced teachers, but of course, still a useful method.

Reference: (See Appendix A)

2.2.3 A Summation of Blooms Taxonomy

Benjamin Bloom created his taxonomy to give teachers a better foothold on what type of information they wish to receive from their students, and thus a better understanding of the responses the teachers receive, as well as, how to quantify responses value. On the following page is a list of different levels of questioning and how they should be used in testing strategies.

Competence	Skills Demonstrated
Knowledge	• observation and recall of information • knowledge of dates, events, places • knowledge of major ideas • mastery of subject matter • *Question* *Cues:* list, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, who, when, where, etc.
Comprehension	• understanding information • grasp meaning • translate knowledge into new context • interpret facts, compare, contrast • order, group, infer causes • predict consequences • *Question* *Cues:* summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend
Application	• use information • use methods, concepts, theories in new situations • solve problems using required skills or knowledge • *Questions* *Cues:* apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover
Analysis	• seeing patterns • organization of parts • recognition of hidden meanings • identification of components • *Question* *Cues:* analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, explain, infer
Synthesis	• use old ideas to create new ones • generalize from given facts

	• relate knowledge from several areas • predict, draw conclusions • *Question* *Cues:* combine, integrate, modify, rearrange, substitute, plan, create, design, invent, what if?, compose, formulate, prepare, generalize, rewrite
Evaluation	• compare and discriminate between ideas • assess value of theories, presentations • make choices based on reasoned argument • verify value of evidence • recognize subjectivity • *Question* *Cues* assess, decide, rank, grade, test, measure, recommend, convince, select, judge, explain, discriminate, support, conclude, compare, summarize

Reference:

Benjamin S. Bloom, Taxonomy of Education Objectives: Handbook 1: Cognitive Domain. New York: Knopf Publisher, 1968.

2.2.4 Humanities for Undergraduate Engineers: A Rich Paradox

This portion of the paper presents a brief summary on the integration of humanities for science and engineering students at the Colorado School of Mines. Freshmen engineering students enrolled in the McBride Honors Program in Public Affairs were offered the introductory seminar titled "Paradoxes of the Human Condition". The challenge for similar courses like this is to equip the graduates to not only be good engineer, but also to be mature and thoughtful persons. This course examines four paradoxes: the heroic paradox, the paradox of freedom and necessity, the paradox of absolute and relative, and the paradox of life and death. The paper further discusses the philosophy, pedagogical basis, and preliminary evaluation given to this course.

The course was developed in 1989 for its initial presentation and several purposes were set forth:

1. To acquaint the student with several of the deepest riddles of the man's existence, through serious and purposeful study of great writings each of which dramatically explores one or more of the above mentioned paradoxes as a central theme.
2. To develop in the student an awareness of the continuing presence of the paradoxes in his personal and professional life.

3. To implant the attitudes of reflection and detachment and to promote the development of self-knowledge
4. To create pressure situation for accelerated skill development in analytical reading, written and oral communication, and time management.

The course was 15 weeks of intense reading, writing, and dialogue on literary and philosophical classics in the Western tradition. It was not lecture based, instead it focused more on interactive discussion. The seminar employs pedagogy of active, and cooperative learning. During the last month of the semester every one of the students writes a 10 to 20 page term paper, which takes the place of a final exam.

To assess the seminar, written evaluations were sought followed by roundtable discussion during students' senior (in some cases junior as well as senior) year. The course was rated as very influential in reinforcing the skills of effective reading and writing. However, students do not think the course was persuasive in improving the oral presentation. Finally, the focus group rated the course as very effective in developing the habit of reflective consideration of competing goals, in provoking the habit of applying the engineering method to non-engineering situations, and in creating an appreciation of the need for a personal value system in the framing of major engineering decision.

It is obscure to think one course can change the entire life of all students. However, the moderators saw the affect of the course on the personal and professional attitude of most of the students who took the course. The students were able to achieve the goals set by the professors. By the end of the course all groups were able to think, speak, and write of the four paradoxes as one, a single unending life-problem.

There is much to be learned from this example. Many of the valuable nuances of this system are already in place in the PLC. Since the educational institution is predominantly catered towards math and the sciences, the curriculum tends to bend that way as well. The course material of the Humanities portion of the PLC attempts to draw connections between the engineering sciences and the ethics that go into every situation. With enough fine-tuning it is possible to maximize the effectiveness of these interconnections and their role in the attitude of the student towards the subject matter of the three, seemingly different courses.

Reference:
Andrews, John K., et al., " Humanities for Undergraduate Engineers: A Rich Paradox", Journal of Engineering Education. Pages: 181-184, July 1993.

2.2.5 William Perry's Master Chart

William Perry's Master Chart emphasizes that the human brain does not stop growing when students reach the first year of college, and that the human brain still goes through changes in ways of thinking throughout the college years. There

are nine positions on Perry's Master Chart starting with simple dualism through complex dualism and relativism to commitment in relativism. Authority applies to the faculty and the professors where the others are the students.

Simple dualism is the belief or understanding that everything in the world is wrong or right, black or white, good or bad, one way or the other. The first position in the master chart is exactly that, which is basic duality. Authority, the ones with the right answers are always right and are not opposed. Position two is multiplicity pre-legitimate, in which there is the understanding that many answers exist, but this idea isn't fully accepted yet and there is opposition against the idea. Authority here starts facing opposition to the belief that the Authority is right, while others are wrong and confused.

By the third position, multiplicity subordinate, we start entering complex dualism, which is when one element is itself dualistically structured. The third position goes a little further than position two in that multiplicity is now believed and trusted. The opposition to the third position is that the Authority will always judge wrong. This is the first instance where the idea that the Authority is wrong and the others are right is introduced. Rejection to the ideas of position two or three leads to retreat, which is just the denial or resistance to the idea of multiplicity.

Position four is the start of relativism, in which is the idea of multiple points of view, interpretations, and frames of reference, which are open to analysis, comparison, and evaluation. The fourth position is the multiplicity correlate or relativism subordinate. Multiplicity correlate is the idea that anyone has a right to his or her own opinions. Relativism subordinate is the idea where the Authority can make judgments in multiplicity, but the others still believe that they think how the authority wants them to think and that their thinking isn't a result of the nature of their knowledge.

Position five enters the relativism correlate, competing or diffuse, in relativism is seen as a way of perceiving, evaluating and analyzing, and not because the authority wants them to think that way. So now the world is divided into a state where the Authority has the answers and concurrently the relativism must now be used. There is no commitment yet to the idea of relativism but the idea is strengthened.
Position six is the beginning of the final phase, commitment in relativism, where the idea of relativism is now believed and used actively. Commitment foreseen is the sixth position where relativism is now perceived as needed as a logical necessity and must be used. Rejection to position four, five or six leads to escape, which is basically a way to avoid the commitment to relativism in any way possible.

The last three positions involved various stages of commitment where simply, in the seventh position, first initial commitment has been started, and the use of relativism has been used to a small degree. The eighth position is where some implications of commitment have realized and the implications of relativism have

been experienced. The last position is where the commitments have been expanded and actually added more personal style to the idea. Another form of rejection is temporizing, which can happen at any time and is just the idea that the other isn't ready for the change.

In general this system is as difficult to apply as it is to understand. Despite this many professors swear by the teachings of Perry. In the most rudimentary format this is a method for identifying different levels of intellectual involvement and understanding in the students, or even for them to achieve self-awareness of their position in educational understanding. A lot of the issues produced by this method involve belief in either relativism or the Authority. This dichotomy is enough to expose the value the student places on certain knowledge sources and their truth content. In short it is possible that many of these ascertations are already being made about the mindset of the students in a given environment. Some students fully utilize the higher levels of the system without even having seen it before. By this I mean not automatically believing the Authority, understanding the relativistic qualities of knowledge and the inherent truth of seemingly irrefutable sources etc. Even so many students will remain at the lowest level being simple vessels of knowledge without attempting to judge the source or the truth content. This lack of information inquisition must be wholly avoided and I believe that is the basic goal of Perry's system.

Reference:
Perry, William Graves. Forms of intellectual and ethical development in the college years; a scheme . New York: Henry Holt Company, 1970. End of Book Chart.

2.2.6 Teaching & Learning: It's a matter of style.

The article starts out with a self test of learning style preferences and then gives a list of definitions to those LS preferences. (Perhaps this is a test we should think about administering to prospective students??)

Learning Style- A persons preferred method of receiving, processing, storing and expressing information. Learning style also includes preferences for rate of learning, social conditions and incentives.

Receiving – The Ability to gather information by using, aural, special and manipulative.
Processing- The ability to incorporate new data into existing knowledge, to classify and categorize, to make connections, to tolerate ambiguity.
Storing- The effectiveness of short and long term memory; the strategies used for memory storage and retrieval.
Expressing- The ability to use different modes for expressing information, e.g., written, oral , or manipulative.
Rate- The preference for a reflective, thoughtful speed or a get-the-information-quickly-and-let's-get-going speed.

Social Conditions- The preference for learning independently or collaboratively; the ability to stay focused on a task despite interpersonal interactions.
Incentives- The motivational factors which encourage learning; e.g., praise, grades, money, perfectionism.

The article then goes through a few ways of categorizing a learner. I have tried to point out the strong points of PLC in this case, but you will have to look for yourself:

Field Dependent vs. Field Independent (Witkin & Goodenough)-

PLC students should tend to be more Field Dependent as those are the communication and interpersonal skills. However, note that engineers as a whole would tend to fall into the Field Independent category. Perhaps this is a claim for PLC to effectively change this.

Field Dependent- this style can organize, analyze and reorganize information. They are more abstract and impersonal, and are better at traditional learning tasks such as reading and factual recall. Radiologists and Surgeons test high in field dependence.

Field Independent- this style can indicate strong interpersonal and communication skills; greater interest in others; is better at working collaboratively; prefers discussion; and invites collaborative problem solving. Internists and psychiatrists were found to be significantly more field independent.

Four Dimension Experimental Inventory (Kolb)-

The good news here is that PLC directly applies to three of the four learning styles listed here. (Maybe even all of them if you really stretch). Again the only "alienated" individual would be the one with the Reflective learning, who would most likely prefer a lecture style of learning. Again, the problem, and perhaps another claim, is that engineers tend to be this way. But, ABET has said that this is an area in which WPI needs to improve its engineers.

Concrete Learner- receives information best by getting involved and participating in experiences; has strong feelings; and relies on his senses, e.g., what is seen or heard.

Abstract Learner- receives information best by carefully analyzing and evaluating ideas or symbols; is rational and relies on logical thinking.

Reflective Learner- processes information best by watching and listening; is careful; takes time to look at all sides of an issue.

Active Learner- processes information best by actively trying things out; wants to see the results of their work in a practical way.

Grasha-Riechmann Learning Styles- I would venture to say that a student with the avoidant style would have that hardest time in the PLC, but that could help them the most. All of the other styles are addressed in certain aspects of the PLC, but would not be addressed in a normal lecture format.

Competitive- Learns material to perform better than others. Wants to be recognized as a "star" and likes to the center of attention. The competitive learner tends to be motivated by rewards of recognition. Prefers teaching methods that are lecture oriented and teacher centered.

Collaborative- Appreciates learning by sharing ideas and talents with others. Likes to work closely with preceptor. Learns best when there is give and take during the learning process. Particularly enjoys discussions and projects where all concerned are trying to reach an agreement about medical issues. Prefers case studies, role plays, small groups, and team projects.

Avoidant- This learner is withdrawn and disengaged during the learning process. Tends to be uninterested in or overwhelmed by the learning process. Not enthusiastic about the educational process or required mental activities. Feeling inadequate about his knowledge and skill, fearing failure, and potentially receiving harsh evaluations contribute to the avoidant style. Indifferent to the preceptor's choice of teaching methods.

Participant- Finds learning enjoyable and takes responsibility for getting the most out of any medical situation. Is energetic and enthusiastic about the learning process and tends to express excitement to preceptor. Eagerly attends and is generally a "good citizen" who takes initiative and responsibility. Appreciates all teaching methods used by the preceptor.

Dependent- Relies on authority, structure, and guidelines for how to function. Wants a preceptor to provide parameters for his behavior. Tends to seek specific answers and direction rather than formulating independent ideas and approaches of patient care. Typically show little intellectual curiosity and learns only what's required. Prefers didactic, lecture oriented, and teacher centered methods.

Independent- Has a strong need to learn for themselves rather than depending on the preceptor. Likes to think for his or her self and is confident in learning abilities. Often goes beyond what is required, to learn what he or she believes is important. Takes initiative and responsibility. As a learner and because of tendency for self-exploration often develops breadth and depth of information in ways that learners with

other preferred styles may not. Prefers independent projects, guided readings, and problem-based learning.

The article has basically set fourth that achieving the highest efficiency in learning a teacher must be able to apply each and every different learning style to the students they apply to. I believe that every student can learn better in a different manner from others. The problem then becomes, how do you teach for every learning style? This I believe to be an impossible task. It is the job of the student to attempt to absorb information as best they can. The solution will vary from student to student and may be as simple as extra study time or help from the instructor after class. There may be no need to get any additional tutelage should the environment of the classroom be sufficiently suitable towards the students learning perspective. In short I think there is merit to students identifying how they learn best, but the instructor cannot be bothered to quibble about these nuances of each student without losing content for other students and opposing basic educational traditions.

Reference:
Donna M. Qualters, "Teach & Learning: It's A Matter of Style!!!" Powerpoint presentation at WPI, January 16, 2003, print out in Appendix A.

2.2.7 Summary of Constance Staley's Writings

Constance Staley is the Professor of Communication, and Director of the Freshman Seminar Program at Colorado University- Colorado Springs. During her career she has written two books titled, Teaching College Success (1990), 50 Ways to Leave Your Lectern (2002). These books are intended for instructors of freshman level undergraduate courses. She hopes to equip teachers with the information and techniques needed to teach a modern classroom.

Staley understands that all students learn differently and the process of learning is not automatic. Instead of teachers getting together and learning from each other, they continue to teach in the traditional lecture format that is no longer catering to students needs. The emphasis is now on quality teaching to generate learning instead of instruction and oration. Students need to learn by doing, which allows them to create or reform patterns, relationships and connections between former and current subject material. Teachers should stimulate thinking, discussion, and group interaction. Attention should be shifted away from just the teacher, to the teacher and students. The control of the discussion should be shared by students as the participation level increases. Finally teachers should be facilitators who guide the class, instead of orators who only lecture the class.
She also feels that teachers should encourage cooperation among students, have high expectations of their students, respect students various ways of learning, give prompt feedback to students, and most importantly emphasize application and experience.

Staley's first book Teaching College Success is a training package for college instructors. Its focus is on faculty development and curriculum structure for

freshman courses and seminars. Staley's goal is to teach instructors various ways of conducting a classroom so all students can learn to their full potential. She feels the classroom must be brought away from the traditional lecture format to an interactive environment that keeps students involved, and encourages them to make connections between the course material.

The book is broken into three parts for teachers and administrators of programs in their various levels. One part contains tips for start-up programs, another has advice for programs that are considering changing their structure, and finally tips for well established programs. The book comes along with training modules, handouts, teaching agendas, exercises, information and history of Teaching College Success seminars, and Power Point presentations

50 Ways to Leave Your Lectern is an updated, more in-depth version of Teaching College Success, which focuses on active learning. Staley begins the book with the explanation, research, and application of active learning and why it is more beneficial than the traditional lecture format. The next eight chapters of the book contain exercises to "Identify your ABC Goals for activity at outset based on Bloom's Affective, Behavioral, and Cognitive Goals" (Staley, p.4). The exercises are organized by goal, group size, time required, materials, physical setting, process, and variation. The exercises are broken down into Icebreakers, First Year Programs, Lecture-Based (large or small), Content-Integrating such as Self-Directed Learning and Collaborative Learning, Communication Skills including Critical and Creative Thinking, Technology Based, Discipline Specific, and Wrap Up Activities. Processing, designing, and assessing techniques on active learning experiences wrap up the book.

Reference: Within Article

2.2.8 Summary and Conclusions

The methods of Staley combine the useful parts of nearly every one of the preceding interactive learning methods. It seems that a healthy mix is the best method to apply to any educational system. Finding the most important foundation on which to rest the majority of the curriculum is the most important part. For the WPI learning community, interacting with the material and the professor has become an increasingly important aspect of the educational experience. Labs that were originally designed to suit this purpose have evolved into high level, hands on experience that the students learn from in the most effective manner. The projects and goals of the PLC each mirror the finest points of the discussion set out above. By bringing together the different subjects on common ground and providing the best recourses and environment for students to learn in, the PLC will undoubtedly provide a new learning mindset for students where they yearn for information and hunt it out on their own. With methods in mind such as Bloom's Taxonomy and Perry's Master Chart there are many connections one can make to the experience and evolution of each PLC student.

After studying all of these different aspects of learning communities there are many conclusions we can draw. In order to be successful the program must be wholly supported by the administration of the institution. This provides enough freedom to instate change and take the necessary steps towards a new educational experience. Second the program must become revered and well known among the students and teachers, as opposed to being a stigma or undesirable position. This transfer can be accomplished with basic communication tools such as brochures and websites as well as word of mouth.

In order to make sure the program is working and to be able to provide evidence as such, assessment systems should be used on every new class of students. There are many ways to tell how well students do with certain situations. Focus group findings, questionnaires, graduation rates and GPA quantifications can be compared to control groups who did not participate. The results should speak for themselves. From the findings at other institutions we can see that Learning Communities provide necessary educational reform that students on-the-whole did not receive in high school. The focus of lower-level educational systems has always been to try to make children behave rather than stressing educational development. Thus students transitioning into the freedom of college life should be provided some guidance and good examples of how to put their new responsibilities and opportunities to their greatest use.

2.3: Reform in Education

"What is needed now is a new model of undergraduate education at research universities that makes the baccalaureate experience an inseparable part of an integrated whole" (Boyer 7). This is a clear call to the need for reform in undergraduate education as stated by an expert who has looked at where we have been, and where we are going.

The freshman year has gone without change for centuries. Students listen and take notes, then are sent off alone to meditate on what was said. They are then required to regurgitate what they were able to comprehend via tests and assignments. If a student was able to perform enough of each of these recitations, then he or she is said to have "mastered" the subject. What the freshman year needs is to be an intellectually integrated one, so that the student will not learn to think of the academic program as a set of disparate and unconnected requirements. (Boyer 19)

The freshman year is of the most importance to a student. It is the transition period of academics and social standing. This is usually the first time that close family support will not be offered and old friends cannot be found. (Boyer 19) In traditional pedagogy the social situation is usually addressed by encouraging students to form study groups and join extra-curricular activities. The academic portion is most often addressed by offering a tutor for a class or a few forced office hours that a professor must hold. Ironically, despite the efforts of the traditional pedagogy, the freshman years of university studies, the most crucial of all, are most often the least satisfactory in terms of curriculum, concept, and pedagogy. (Boyer 19) Thus, the two most important areas of the freshman education are the student-faculty relationship and the student-student relationship.

We will first address the student-faculty relationships. The quality of the educational experience is strongly affected by student-faculty interactions. The more often students converse with professors outside of call, work with them on projects, assist them, visit their homes, has a direct correlation with a student's GPA, degree attainment, whether they enroll in graduate studies, all areas of self-assessed intellectual and personal growth, the students satisfaction with the quality of instruction, and whether or not a student chooses a career in college teaching. (Felder) How is it that all of a student's needs are met in one or two-hour block of teacher attention that is divided among 50 to 500 students?

Some schools provide faculty office hours to provide this student-faculty interaction. But many professors complain that students rarely show up during this time. Students often complain that professors seem to be annoyed by student questions or feel as though the professor just wants to answer a question to an assigned problem but will never entertain a discussion on a topic of student interest. In my own experience, the latter has often killed the desire for discovery in that particular topic which goes directly against what universities are trying to accomplish!

> ...every student at a research university should be able to feel that some faculty member knows and appreciates that student's situation and progress and is ready to help that progress by setting standards to be met and by offering advice, encouragement, and criticism. To be effective, this kind of mentoring relationship

> needs to be created early and maintained when possible throughout a student's program. Such a relationship should go beyond the routine suggestions about choice of courses that many departments consider to be "advising" (Boyer 22)

Astin also indicates that institutional or class size has a direct affect on educational quality: The smaller the better.

> Smaller enrollments and lower student/faculty ratios both correlate with satisfaction with instructional quality, enrollment in graduate school, interest in college teaching careers, and self-reported increases in overall academic development, cultural awareness, writing skills, critical thinking, analytic and problem-solving skills, leadership skills, public speaking ability, and interpersonal skills [pp. 326-329]. The better showing of smaller institutions is undoubtedly due in part to the greater incidence of personal student-faculty contacts at such institutions, suggesting the desirability of trying to increase such contacts at large universities. (Felder)

Again we see the importance of a good student-faculty relationship, and the results that are yielded when one is present.

The other important area of the freshman is the student-student relationship. Astin tells us that as important as the student-faculty relation is, it is still second to the effect that a student's peer group has on his or her academic growth and development. Student interactions have a direct and positively measured effect on: student GPA, whether or not a student graduates with honors, a student's analytical and problem solving skills, preparation for graduate studies, leadership ability, public speaking skills, interpersonal skills, and general knowledge. Interactions can be defined as discussing course content with other students, tutoring other students, participating in sports, and day to day interactions and social life. Student-student interactions also negatively affected feelings of depression and loneliness. How is it that all these student needs are met when students are grouped together for one to two hours, and are then assigned a curricula that demands they go off by themselves and study?

Most schools encourage student-student interaction through an expansive athletic department and physical education program as well as series of social events like dances, clubs, and festivals. One thing to note about all this is that above we defined student interactions as discussing course content, tutoring, sports and day to day interactions. The current institutional model just discussed only involves the latter two of the interactions. The student interaction on course related material is arguably the most important for academic achievement, yet little is being done to further this interaction within current models.

When we compare current institutional models to the needs of undergraduates, and more especially freshmen, what is needed can be summed up in one statement by Earnest Boyer: "Radical change is thus essential to make the freshman year successful, a period of perhaps the fastest growth a student experiences during the college years" (Boyer 20).

This radical change is most often realized in schools through the implementation of student block scheduling, freshmen seminar, and learning communities. The need for this type of reform will be discussed in reference to the above student needs.

The freshman year needs to be redesigned for maximum benefit of the aforementioned student needs. The main point of the first year should be small groups of students that are taught by experienced faculty. The small groups should work on topics that will stimulate and open intellectual horizons and allow opportunities for learning by inquiry in a collaborative environment. Working in small groups will give students the direct contact that they need with the faculty and groups of students who are all learning to be students. (Boyer 20) In the small groups setting students can more effectively use faculty time, and generate better relationships with a few faculty rather than the converse being very little faculty time and just knowing a lot of faculty.

Working in collaborative groups also has many other benefits besides the various necessary relationships. These benefits have been measured by many different tests and surveys. Alexander Astin's findings in this particular area are listed below as paraphrased by Felder:

> Many of the study findings specifically point to the benefits of cooperative learning-students working in teams toward a common goal. Frequency of group work has positive correlations with most areas of satisfaction, all self-ratings, and all areas of self-reported growth except foreign language skills. Tutoring other students-which may be done formally but also occurs in a natural way when teams of students work and study together-has positive correlations with all academic outcomes and with choice of careers in college teaching [p. 387]. As Astin notes, "Classroom research has consistently shown that cooperative learning approaches produce outcomes that are superior to those obtained through traditional competitive approaches, and it may well be that our findings concerning the power of the peer group offer a possible explanation: cooperative learning may be more potent...because it motivates students to become more active and more involved participants in the learning process. This greater involvement could come in at least two different ways. First, students may be motivated to expend more effort if they know that their work is going to be scrutinized by peers; and second, students may learn course material in greater depth if they are involved in helping teach it to fellow students." (Felder)

Collaborative groups are just one area of reform that needs to be addressed. Another would be how courses are handled at the freshman level. As Boyer states "The failure of research universities seems most serious in conferring degrees upon inarticulate students. Every university graduate should understand that no idea is fully formed until it can be communicated, and that the organization required for writing and speaking is part of the thought process that enables one to understand material fully" (Boyer 24) Students need a higher degree of course interconnectedness, which will give more meaning to the reason for good articulation. If students are continually taught in a manner that is disjointed, where one professor assumes that another professor has covered certain material when

indeed he or she has not, students may never comprehend the importance of the basics in which communication is oft the largest part.

As fields of study become more interdisciplinary, the undergraduate education should be encased in interdisciplinary formats. Current departmental structures discourage faculty from engaging or even becoming interested in it. (Boyer 23) Schools must make an effort for reform in how they present a course's relevance to a student's choice of study. If a required course of study has no apparent relevance to what the student is trying to achieve, then the course is often dismissed as "hoop-jumping" to get what the student really wants. To the belief student, the material taught in a required course is useless, even though in the overall picture of what is required of a student to be bestowed an undergraduate degree a required course is required for a relevant reason.

Another reason of better course interconnectedness is that it builds upon and multiplies the feasibility and effectiveness of the aforementioned collaborative groups. Moving from a stimulating freshman seminar with an integrated program back into seemingly unrelated courses would be very dispiriting and disillusioning. (Boyer 21) Schools must not only reform the freshman year, but tailor following courses such that they reinforce the combination style of interconnected courses. Doing so will allow students to see the reasoning behind each requirement of their chosen degree, and thus apply the due effort within that course requirement.

Boyer's recommendations on pages 21 and 22 for reform in the areas of collaborative learning and course interconnectedness are as follows:

1. A student embarking upon a degree program at a research university should be adequately prepared to meet the intellectual challenges of that program; if remediation is necessary, it should be completed before entering the program.
2. All first-year students should have a freshman seminar, limited in size, taught by experienced faculty, and requiring extensive writing, as a normal part of their experience.
3. Every freshman experience needs to include opportunities for learning through collaborative efforts, such as joint projects and mutual critiques of oral and written work.
4. The freshman program should be carefully constructed as an integrated, interdisciplinary, inquiry-based experience by designs such as:

   A. Combining a group of students with a combination of faculty and graduate assistants for a semester or a year of study of a single complicated subject or problem.
   B. Block scheduling students into two or three first-semester courses and integrating those courses so that the professors plan together and offer assignments together.
   C. If possible, integrating those courses with the freshman seminar, so that there is wholeness as well as freshness in the first year.

> D. Taking advantage of time freed by advanced placement to explore areas not studied in high school in order to encourage students to range as freely as possible before selecting a major.

Perhaps the toughest aspect of instituting these proven reforms is a school's reluctance for change. The fact is that course interconnectedness, collaborative learning, and learning communities have proven results that are superior to current modes of pedagogy. For example, a demand on research universities by Boyer states that there must be a symbiotic relationship between all the participants university learning. (Boyer 7) This demand has been answered by numerous Learning Communities throughout the US. "Individual schools and pilot projects have always shown compelling examples of what schools could be, but these "lighthouse" schools are rarely replicated…"(Slavin 1).

Slavin defines three types of schools for us:

> 'Seeds' schools are ones capable of developing and implementing their own reform models, and only need general principles and support. 'Bricks' schools, a much larger category, are ones that would be unlikely to co-develop their own innovations, but are capable of faithfully and effectively implementing well-developed models created elsewhere. 'Sands' schools are ones incapable of either creating their own models or implementing externally developed models. (Slavin 1)

In addition to the school's type, is the school staff's readiness for change. "…school staffs are expected to create their own paths to change" (Slavin 1) If a school's staff doesn't believe a proven reform will work, it is a given that that reform is destined not to work. But if a school's staff believes a proven reform will work, and is not ready for the implementation of that reform, the reform is still destined not to work. School staffs that are cohesive, excited about teaching, led by a visionary leader who involves the entire school staff in the decision, and are aware of trends and ideas implemented elsewhere are 'seeds' schools. (Slavin 3) Proven reforms have the best chance of being implemented and successful at schools with this staff mentality and structure.

The largest problem with instituting the reforms posed by Boyer and Astin is when these reform models are applied to the 'bricks' or 'sands' schools.

> If such schools are unable to create their own curricular and instructional reforms, this of course wastes time, energy, and money, as well as creating disillusionment with the whole reform process. However, there is a less obvious but perhaps more important cost. Schools are often rewarded for appearing to be involved in reform rather than actually changing their practices. They often want the banner on their school that identifies them as a member of a given network of reforming schools. Yet banners are cheap and easy to erect, while real change is expensive and difficult. (Slavin 5)

When schools embark on reforms in the manner depicted above they do two things. One is to show the staff that reform is too tough to implement and that it is easier to just stay

where they are. The second and perhaps most appalling is that an effective and proven reform when implemented in this manner is destroyed. It is destroyed in not only the sense that it didn't work, but it now tarnishes the running track record that this proven reform has built, and thus may not be implemented by schools that truly could and need to implement this reform. The destruction of this reform also has another devastating affect. Because the school was not ready for change when it implemented this proven reform, which the school obviously needed or it wouldn't be trying to implement it, the school has killed the chance that this reform will ever come about at this school because the school will say it tried this reform before and it didn't work.

We have used the same methods of pedagogy for centuries without change, yet almost every other aspect of our lives has gone through reforms in an attempt to better those areas. Whether those reforms were good or bad one thing is true: Those that were ready for change met, embraced, and reaped the rewards of that change. Those that were not ready for change were eventually forced to change or are no longer with us today.

Works Cited, Reform in Education

1 - Boyer, Earnest, "Reinventing Undergraduate Education: A Blueprint For America's Research Universities", *The Boyer Commission on Educating Undergraduates in the Research University,* Published 1998,
Stony Brook State University of New York (April 7, 2001)
http://naples.cc.sunysb.edu/Pres/boyer.nsf

2 - Felder, Richard, "What Matters in College." *Chem. Engr. Education, 27*(4), 194-195 (Fall 1993).
http://www.ncsu.edu/felder-public/Columns/Astin.html

3- Slavin, Robert E., "Sand, Bricks, and Seeds: School Change Strategies and Readiness for Reform", *The Center for Research on the Education of Students Placed at Risk,* John Hopkins University (April 1997).
http://successforall.com/sandbrick.htm

Chapter 3: Methodology

In order to obtain all the knowledge needed for A Study of the PLC, various approaches were taken. First and foremost we needed to see how other colleges conducted their Learning Communities. This was important because we needed to compare our program with these and see where any improvements to WPI's PLC can be made. In order to explore these various Learning Communities a web search was conducted, since the majority of schools websites contained a section on their Learning Communities. From the websites information such as the general type of program (such as residential, leadership, or freshman program), size of program, success of program, and selection of students for program, and faculty or committees in charge of the programs was collected and reviewed.

The next step involved looking at the wider picture of interactive learning and reform in education, since these both compose the fundamental basis of the PLC. Various articles and books were scoured to find our needed information. As a result we obtained a variety of references stating opinions relating to how interactive learning should be conducted and how to reorganize education.

Once all of the background information was collected we looked at ways that we could improve the PLC. By working together with the PLC's humanities professor we reviewed various articles to decide their worth to the program, and if they should be included in the PLC humanities curriculum. All articles were selections from a wide range of books and magazines.

Brainstorming was also a key ingredient when looking for ways to improve the PLC. Together as a group, with our past experience of the PLC and its goal of bi-weekly projects combining humanities, physics, and calculus, we brainstormed to find possible project topics. They goals of our brainstorming session were to find projects that would be appropriate for college freshman, showed connections of the three aforementioned topics, and were general enough topics so that six groups could each work on a different concentration of the topic while still being connected to the topic.

Other improvements such as the creation of the PLC brochure, updating of the PLC website with inclusion of self test, and electronic supplements were all based on our experience of the PLC. As a result of the experience we all had differing view of what the PLC was and the goals it was trying to achieve. By combining our various opinions we were able to get a general view of the PLC from a student's perception. This is very important because we were not a committee writing about the PLC from the perspective of what it is intended to accomplish. Instead we had a first hand look at what the PLC actually did accomplish and the traits that were important to fit in a PLC experience.

As with any good analysis one needs to look at the general census of the opinions of the program to find the points of strength and weakness. One way we did this was to look at the conclusion of an outside assessor, Paula Quinn. Every year in the beginning of C-term Quinn invites a group of student that have just completed the PLC program to a

focus group. At the sessions pre thought questions as well as those generated by Quinn during the session are asked. All the results are video taped and sound recorded. Quinn then takes these recordings and writes up her finding on the PLC. These assessments are important because the are an impartial look at the PLC.

The other key assessment consisted of the opinions of former PLC students. To obtain this information a survey was sent to all former PLC students. The survey questions were asked in two different closed response forms. First students were asked to compare the different experiences of the PLC to that of experiences in traditional classes and pick the one that they felt helped them more, the PLC, traditional classes, or no difference between the two atmospheres. These questions were focused on issues, like academics and social skills that any student must acquire. For example, improvement of skills in writing, problem solving, teamwork skills, interacting with professors, and making friends. Next students were asked to answer question in the form of strongly agree, agree, neutral, disagree, or strongly disagree about statements made about the PLC. Questions reflected the aspects of the PLC that set it apart from traditional classes. Our intentions of the survey was to see what aspects of the PLC that the general group felt were the areas of strength and weakness.

Survey requests were submitted by email to all 120 former PLC students currently enrolled in WPI. In the email students were made aware that we were doing an IQP on the PLC and needed their input, as former PLC student, so we could detect where the strengths and weaknesses fell. In order to complete the survey students followed a link, included in the email, to a separate website. This was done in order to ensure that the recipients were anonymous.

Out of the 120 surveys sent out, forty-five completed survey results were received. In order to evaluate our data we need to figure out how many strongly agree or agree responses are need to consider a certain aspect a success or strong area. You start by assigning number to the selections starting with strongly agree being five, agree is four, and so on down to strongly disagree being one. Now suppose that X many people pick strongly agree, the best scenario, and the rest 45-X people pick the worst case scenario, strongly disagree. The product of the number in each selection and the corresponding numeric value of that selection where summed and averaged over the total number of respondents. In order for the aspect to be a success the average of the responses must be at least four. The number four is chosen since four and five stood for agree and strongly agree respectively, and the average must be in this range to be considered a success. As a result seventy-five percent of the responses must be either agree or strongly disagree in order to be a success. Anything that is not considered a success is looked at as a weak point. For question where a "successful" answers was strongly disagree or disagree, the same approach was taken and seventy-five percent of the results must lie in this range.

Female results were extracted and analyzed separately. The reason for this is to show if the PLC was extra helpful for girls. If the result are positive then maybe it would be of interest for WPI to start an all girls PLC experience.

Chapter 4: Results

The results chapter starts by covering the material that was reviewed by the authors of this project per addition to the current PLC curriculum. The following project proposal section consists of a number of projects that were devised to improve the integrated calculus, physics, and humanities theme.

The next section contains the results of a study done on the currently available electronic supplements for teaching calculus, physics and/or humanities. Due to the nature of the materials available, a set of small examples were created to better display what was desired by the authors.

After the electronic supplements section, a copy of the PLC Awareness brochure is shown. The pamphlet was created by the authors to produce awareness of the PLC to prospective students during the WPI Spring open house.

Following the brochure the PLC website is discussed. The website was created with the intent of drawing a greater student interest, but also included a self test designed to help students determine whether they would be good candidates for the PLC learning style.

A summary of the assessments of the PLC is then included. These assessments were performed by an outside assessor. The assessments cover the inception, as well as the two subsequent years of the PLC. Each assessment consisted of a student survey, grade analysis, and a focus group.

The final section of the results chapter contains the results of the survey completed by the former students of the PLC. The methodology of the survey is outlined in chapter three.

4.1: Curriculum Enhancements

The humanities portion of the PLC has curriculum moments that focus on various areas of study. One way to get the student's minds used to changes in subject matter is to provide small assignments that aren't always related. Every night the students will read a selection from the stockpile of literature provided and come in the next day prepared to discuss. For this portion of the project we shall discuss several of the possible articles for the curriculum next year.

4.1.1 For Richer

This article outlines a growing peril in American society, the loss of the middle class. This faction has been slowly shrinking away to nothing over the past forty years due to many factors outlined here. The biggest problem as a matter of semantics is the rich getting richer. The top one percent, and even the top .1 percent have seen more economic gains than any other group. The lowest decile has even seen a slight decrease! This disturbing trend shows an unsettling connection between the "ruling class" of American society and economic inequality. In short the formation of bureaucrat agencies that chose the

committees which create their salaries, has lead to a profound change in our society. CEOs, politicians and celebrities now have complete control over how much money is made in this country for the super-rich. The choosing of persons who appropriate large salaries and benefits has taken the place of dedicated and generous leaders.

There are multiple quoted figures, but I don't see many of them being too important, spare a brief overview. The life expectancy of the average American is around the same as that of a person from Costa-Rica. Although people of other countries make less on average, they must live better. Which can also be related to the widening gap because the offset in our own GOP is tied directly to the richest of the population. The biggest problem, as I see it, relates to this self-propagating system of committees. The back room handshake has lead to not only the widening gap in executive pay and that of the common worker, but also the political atmosphere to foster this type of behavior.

Although Democrats and Republicans vote more and more towards their partisans the bipolarization of our government is merely skin deep. In fact the motivation of our officials is more and more around one item, money. The different legislations passed since the Golden Age have moved away from social renewal and towards filling the pockets of the wealthy; which hasn't just destroyed the middle class and the prosperity of the common man in America, it has also ruined our hope of getting it back in this atmosphere, a far more terrible sin.

Reference:

Krugman, Paul. "For Richer," *New York Times Magazine,* Sunday, October 12, 2002.

4.1.2 Mozart

This article brings to mind, first and foremost, a quote from the movie "Waking Life", paraphrased as follows. The distance between the primate and the common man is shorter than the distance between the common man and the true genius. I think this is particularly true in the case of Mozart, though I think the scholars have still done a fine job of attempting to understand why he turned out the way he did, even if they cannot agree with one another.

I, myself, agree with the perpetual child motif. But I feel that a certain amount of light on the forms of his character has been left shaded if one does not acknowledge the environment he was nurtured in that perpetuated his many character flaws. At one point in this article the author suggest that Mozart's actions are of him acting as a child since people already see him as one. I think this has a lot to do with how his personality is played out to the outside world.

In short, the conditioning he received from his father created a daunting façade that he could never break through. Just by the fact that "his debts could never be paid in full" meant that he would eternally suffer for the family's benefit. It is said in the article that art itself "seeks the reparation of loss, attempting to reconstruct a fragmented past, to memorialize and resurrect departed love objects…" I think this is very true in Mozart's case. For the purposes of study I put in an old tape of his most popular works while I read the article. After attempting to identify with the situation he was in, as a genius child and as a shameless adult, there is a whole new sound to his music. The genius gives way to a whole breadth of emotion that seemed not to be there before since it was shrouded in the heavy hands of his father's influence. Which pervades not only his character, but also the arrangements themselves.

In closing, the greatest things about Mozart were both fostered and denied of him as a child. The threats of withheld love and enforcement of perpetual youth instilled character flaws in him that attributed to his uniqueness as a child, an adult and a genius. Some may wonder about what Mozart would have been like without such an overbearing youth, but I feel that there would be no Mozart at all without the strict rule of his father in his youth. The most adequate quote about Mozart's abilities, emotions and situation is from Kierkegaard's opening words in Either/Or. "A poet is an unhappy being whose heart is torn by secret sufferings, but whose lips are so strangely formed that when the sighs and the cries escape them, they sound like beautiful music."

Reference:

Solomon, Maynard. *Mozart: A Life.* New York: Harper Collins Publisher, 1995. for Prologue, "The Myth of the Eternal Child." Pp. 3-20.

4.1.3 A Sin of Scale, another look at big dams

I found this article to be nearly devoid of harsh criticism and condemnation. I myself tend to focus on the loss of life and displacement of peoples over the technological accomplishments of big dams. This may be attributed to my personal character, possibly more philosopher than engineer, but nonetheless the tendency is obvious in the writings.

The article talks of many dam building projects from India to Egypt and the Americas. The anecdote at the beginning and the smaller tidbits of factual environmental disruption, save the text from being entirely of a pro-dam tone. I think the most troubling discussion centers around the "Six Companies" building commission started by the Hoover dam project in the nineteen thirties. After this, and several more contemporaneously, the company moved around the world starting dam building projects on every continent except Antarctica. We can be sure they would put one there if the money was around to do so. I think the author gently sidesteps the issue of foreign contractors producing these mammoth structures, even though half of the article is about Willcocks and other Englishmen in India.

To me this is the most important matter for consideration, but unfortunately I do not have statistics as to how many of the foreign dams were funded by loans of foreign money or produced by foreign companies. I'm sure if I called up the World Bank they would be anxious about why I wanted to know. I do, on the other hand, think the author understands the dichotomy of savior and sinner in the production of big dams quite well, even if he gingerly tiptoes around being sensational.

These projects have been revealed to save and take millions of lives over the decades and pervade the outcome of society and the environment in ways we cannot possibly understand at the onset of their construction. Who would have thought that the most wasteful city in the world, Las Vegas, Nevada, would spring out of the desert simply because the technology was there to move water to its swimming pools and exotic aquatic displays? The most important idea I have gotten from Roy or from this article is that we have a very difficult time predicting the ebb and flow of both society and mother natures mighty rivers. There should be the utmost care taken when dealing with the livelihood of millions of people and specie. The earth is an unforgiving medium and should be dealt with inordinate respect and admiration, not the crass, abrasive arms of mankind's industry.

Reference:

Shiva, Vandana. *Water Wars: Privatization, Pollution, and Profit.* Cambridge, MA: South End Press, 2002. for Chapter 2, "The Sin of Scale: The Great Projects." Pp. 46-69.

4.1.4 Origins and Mind, an Integrated Academic Experience for New Students

This article is particularly appropriate for application to the PLC. The people at Carleton College decided to create a program for first year students that coalesced three different realms of study, much like the PLC. Instead of calculus, physics, and humanities, the students studied natural sciences, social sciences and humanities. The goals of the program were quite similar to that of the PLC in forming bridges over the gaps between different subject matters that are actually related. To make their cross-dimensional traffic that much smoother they even narrowed their areas of study to the human mind and its workings.

The only real difference between the PLC and this program was that instead of doing lots of group projects over multiple areas, the entire unit was working towards a few closely cluttered goals. The ninety students in the entire program met once a week for a group session in which the professors could address the most pertinent of material for the curriculum at that point. This doesn't seem to be nearly as effective as each group of students doing projects and presenting them. I'm sure the professors had to fill in the gaps between student achievements and projects they did not participate in, instead of the students doing so. Despite their meager differences the two programs are quite similar in their results. Numeric surveys entailed that students had a steadier workload, felt they understood more of what was taught, felt that their courses were more interrelated and would be much more likely to recommend their classes to other students. Although the questions in the post PLC surveys were different the positive results concur.

In short this article shows how other schools have recognized the value of crossing boundaries between courses. As Wittgenstein's writings in Rules, Grammar and Necessity suggest, there really is no difference in knowledge between math, the sciences and humanities. The only difference is what operators and jargon one uses to connect different objects and articles together. As students start to see how simple grammar relations agree with mathematical operations they will start to get a feel for why there should be no separation of these disciplines in their minds. This should be as clear as the fact that "and" denotes addition and "or" denotes subtraction. One should not simply be thinking of "math problems" when taking calculus nor thinking of "humanities problems" when studying that area. All three disciplines can reveal new strategies for solving the problems in the others. This lack of interrelation has been imbued in students since their first steps into classrooms and there needs to be a program to help reverse the strong flow in the wrong direction and open the student to the vast sea of information that isn't restricted to channels and paths.

Reference:
Roy O. Elveton, et. al., "Origins and Mind: An Integrated Academic Experience for New Students," in Liberal Education, Winter, 2000. pp. 32-39.

4.1.5 Sunday Morning

This work speaks to me of several key themes. The author tells of a deep seeded bond between death and beauty. She says "Death is the mother of beauty". The proof comes from a brief questioning period where she asks, will there be no death in heaven? She asks if the rivers won't pour into the seas, if peaches stay ripe on the tree, basically if there won't be any cyclic change from life to death. She speaks of beauty "[giving] her bounty to the dead". The poem asks questions of the innate connection between the beautiful serenity of nature and life and the finalizing complacency that comes with accepting death. The multiple divine references to Palestine, Jove, sacrifice, heaven contrast with statements such as "… shall the earth <> Seem all of the paradise we shall know?".

The work speaks of innate concepts that few people could ever come to terms with. We feel divinity in nature. We feel a power in the acceptance of death and the finality of coming to the end of our terrestrial existence. We do not, in general, feel the impervious cycling that beauty (nature) and death share. The awesome paradox in "She says, 'But in contentment I still feel <> The need of some imperishable bliss.'" Along with statement that "Death is the mother of beauty" bring to light so many ideas they are impossible to contrive in a better way than using more of her words.

"We live in an old chaos of the sun", we have been living in the dichotomy of beauty and death, with light and day. No one should expect to see the sun rise before it sets. Hence no one can expect to see beauty without death preceding it and following closely on its heels or even hand in hand. She has revealed an innate facet of the human perception of conscious existence as well as the divine aftermath, and even more so an inexplicable part of existence itself. The ever-expanding universe is doomed to collapse on itself and reform the singularity through this concept. The death of the universe, the beauty of the universe, the birth of the universe, the unbounded existence, all culminate in the same awesome event.

Reference:

Stevens, Wallace. "Sunday Morning," in *The Collected Poems of Wallace Stevens.* New York: Alfred A. Knopf, 1954. pp. 66-71.

4.1.6 The End of Welfare

This article explicates the trials and tribulations over welfare during the Clinton administration. The majority of the prose fleshes out the details between dozens of percentages and dollar values. The article poses the question: how did the Clinton administration change welfare? The answer is not directly given but a few pieces of anecdotal evidence attempt to give light to the subject.

No one can deny that during his administration Clinton enacted policies, which decreased the numbers of people dependent on welfare. Unfortunately for some the reason they were no longer on welfare was because they were denied assistance due to violations and small infractions of rules of engagement with the government officials in charge. For example if someone missed a meeting with their welfare representative, they were denied coverage. There were almost never extenuating circumstances necessary to over look that small infraction. (The Price of Citizenship P. 336)

The main problems of the Welfare system are still felt today, despite not being talked about. Maybe we'll hear about them in the next election year, but they will be quickly squelched afterward I'm sure. In short, people who are dependent of welfare rarely save themselves from the oubliette that they find themselves in. Due to the stringent constraints on saving and property ownership, many are forced deeper below the poverty line than they were before. From this article alone, I cannot make any suggestions as to what system changes need to be enacted to make welfare better. But I now have a greater appreciation for the hardships at hand for the poor in this country, the land of opportunity.

Reference:

Katz, Michael B. *The Price of Citizenship* New York: Henry Holt Company, 2001. for "Work, Democracy, and Citizenship," (Epilogue) pp. 341-359. And for chapter 12, "The End of Welfare." Pp. 317-340.

4.1.7 Work, Democracy and Citizenship

This article outlines many of the social problems around welfare and citizenship. After looking at the European philosophy on this topic the author looks at how these ideas relate to the American system. Basically the American system is one of inequality and has been since America fought for its independence. The idea has always been to keep some people at the level of second-class citizens while rich white men remain outside of this boundary. Although it is not as prevalent as it was at the founding of our nation, this system still persists and shall continue to be grandfathered into our system for eons to come.

Another large problem with the American demographic is the increasing numbers of temporary jobs. In 1994 five percent of jobs were part time (The Price of Citizenship P. 349). This number is increasing even today forcing the invisible poor further into the background. Many times the only jobs the underprivileged can get are those that never require the employer to shell out benefits of any kind, nor ensure job security.

In America the name of the game in the welfare system is work. Without contributing to society in a monetary fashion one does not qualify for almost all of our benefits. This seems to work in theory, but along with this system there is still a need to deal with the underprivileged who have never worked before, apart from letting them starve on the street. The combination of these chapters along with "For Richer" creates a terrifying view of the inequality in the distribution of wealth in America.

Reference:
Katz, Michael B. *The Price of Citizenship* New York: Henry Holt Company, 2001. for "Work, Democracy, and Citizenship," (Epilogue) pp. 341-359. And for chapter 12, "The End of Welfare." Pp. 317-340.

4.1.8 The Falling Man

This article undoubtedly struck me harder than most. If there were a sequence of 9/11 articles, I think this one would still, undoubtedly stand out in terms of impact. The eloquent prose and form of the writer leaves little more to be desired in framing the awful tragedy of the events. The main point of the narrative is the search for answers regarding the situation behind the man in the pictures. The subject matter switches frequently from who he could be to the impact of "the jumpers" (Junod, P. 179) on the American media consciousness. Some shunned the graphic photographs as being too terrible to witness. The analogy to pictures of Auschwitz is mentioned. The heaps of bodies and piles of stolen fillings have been on display since their discovery as a willing observance of fact, and few have shunned them for being "too real".

This article opens up two very important and thought provoking debates. Is history supposed to be so perfectly preserved as to force people to bear witness to the events themselves? In my opinion, one would learn much more about the genocide carried out by Nazi Germany by being knee deep in death and foul, human destitution. The second argument is philosophical as well as religious in terms of the true nature of acceptance of life and death. The study of these images and the reality they entail is a gripping process of self-realization for anyone not morbid enough to delve into their inescapable mortality. Though the Falling Man remains the Unknown Soldier of the War on Terrorism, the real questions can still be answered. This article presents an opportunity to change ones world picture through the study of true, pure events.

Reference:

Junod, Tom. "The Falling Man," Esquire Magazine, September, 2003. pp. 177-199.

4.2: Proposed Integrated Humanities Student Projects

The projects constitute a vital portion of the PLC experience. Not only do they form the foundation of the curriculum, they provide the students with an early opportunity to build on their teamwork and presentation skills. Past projects include topics on Galileo's early experiments, world dams, rockets, and the Cuban missile crisis. Ultimately the goal of these projects is to integrate the coursework in physics, humanities, and calculus to create a higher appreciation of the course material. However, many of these past projects have failed at achieving seamless integration, and for this reason the following new projects are proposed.

4.2.1 Lego Mindstorms™ Project

LEGO MindStorms™ is a system which combines motors, sensors, and computer control with LEGO™ blocks to create computer controlled robots and devices. Since their development in the mid eighties, LEGO™ based robotics have easily found their place in the classroom. K through 12 educators have found much value in using LEGO™ based robotics to teach basic sciences through the use of design. However, since their recent commercialization as LEGO MindStorms™, the system has found its place in undergraduate education as well. For example, LEGO MindStorms™ have been used in undergraduate projects such as bacteria travel simulation (http://www.informit.com/isapi/product_id~%...), and an award winning automatic paper money sorter (http://www.berkeley.edu/news/berkeleyan/2001/11/07_lego.html). Additionally, MindStorms have become the basis of industrial systems courses taught by Professor Roger Glassey at U.C. Berkeley (http://www.informit.com/isapi/product_id~%...), and have been evaluated as an economical and flexible method of teaching computer science courses at Villanova (Frank Klassner, Scott D. Anderson). Clearly, LEGO MindStorms™ has their place in undergraduate education as well.

Applied to the PLC, use of LEGO MindStorms™ provides project possibilities that can easily integrate humanities, physics and calculus, while providing a worthwhile educational experience for the student. Students can be given a problem to solve, and then follow a standard design process, utilizing basic principles taught in physics, to design a device which solves the given problem. The humanities aspect can come through the study of robotics, and Artificial Intelligence, and their past, current, and possible future applications.

Reference:

Brian Bagnall, "The Lego Mindstorms Scene," April 19, 2002 (http://www.informit.com/isapi/product_id~%7BBC422A1E-0D18-4A3C-8F19-67174963674F%7D/element_id~%7BBFA01568-125B-45D3-88D1-385E6C523E75%7D/st~%7B9B5B1CBF-1F08-43CB-AAD7AB602ACAB5BB%7D/content/articlex.asp)

David Pescovitz, "Engineering student's 'cool' robot takes top prize in Sun competition," Berkeleyan Online, http://www.berkeley.edu/news/berkeleyan/2001/11/07_lego.html

Frank Klassner and Scott D. Anderson, "LEGO MindStorms: Not Just for K-12 Anymore," Villanova University

4.2.2 Fathers of Electrical Engineering

This project is centered around the many significant figures of electrical engineering's past. Students will research such EE pioneers as Laplace, Fourier, Ohm, Tesla, Westinghouse, Kirchhoff, Faraday, and many others. This project is more suited for B term since students would be learning about the theories and principles of these people in their physics class. The project allows students to dig behind the calculations, formulas, theories and standards, and study the scientists, mathematician, and politics of their development. Additionally, the project would require that students build a circuit or experiment which they would use to physically confirm the developments of their scientist or mathematician under study.

4.2.3 Aviation Project

This project is very broad, and can deal with any aspect of aviation from the Wright brothers to the latest fighter planes. Ideally each group would be assigned an era of aviation technological development, or a specific aspect of aviation, and then be required to evaluate the history, and politics surrounding the period. Additionally, the group would have to study the physical principles behind aviation developments made during that period. For example, a group that is assigned the early 1900's could possibly study the development and failures of the Zeppelin air ships, and the surrounding public enthusiasm. A group assigned to the 90's could study the governments Joint Strike Fighter development competition, and research the physics behind the innovative technologies utilized, such as the lift fan for vertical landing in Lockheed Martins X-35. Furthermore, a group could be assigned specific plane crash incidents and be required to study the causes and results of each crash.

4.2.4 History and Ancient Engineering Project

Ancient engineering is a topic which follows the history of technology theme, and can relate to topics covered in other history of technology courses offered at WPI. In this project groups investigate the design and construction of buildings, structures, or devices from the distant past. One example project would be an investigation of how obelisks were constructed. On this topic, groups could tie in basic physics principles, such as the lever arm, to explain how the structures were constructed. Other possibilities include the study of acoustics in building design and pyramid construction.

4.3: Study of Supplements for Calculus, Physics, and Humanities

It has always been a goal of the PLC to utilize innovative interactive supplements to aid students in learning hard to grasp physics and calculus topics. Unfortunately, up to this time, this goal has never truly been met. When this project began there was little being used that would qualify as an interactive supplement short of calculus Maple labs. Unfortunately, from a student's perspective, even these lab activities are often found to be ineffective. Therefore, we wished to explore the possibility of creating more effective learning aids. An interactive physics application was initially created, as well as a calculus flowchart. However, at the same time, the physics department was thinking similarly, and made the decision to change the introductory physics text to "University Physics." This new text includes the Mastering Physics web based homework and tutoring system, which provides the student with computer based skill builders, self tutoring aids, and concept visualizations. Although many of these features were similar to our developed aids, the Mastering Physics program meshed flawlessly with the text. This is a feature which clearly superseded our efforts in creating physics supplements.

Our efforts in creating physics aids consisted of developing programs which would help students visualize examples which appeared in the physics text. An example of one such program is shown below.

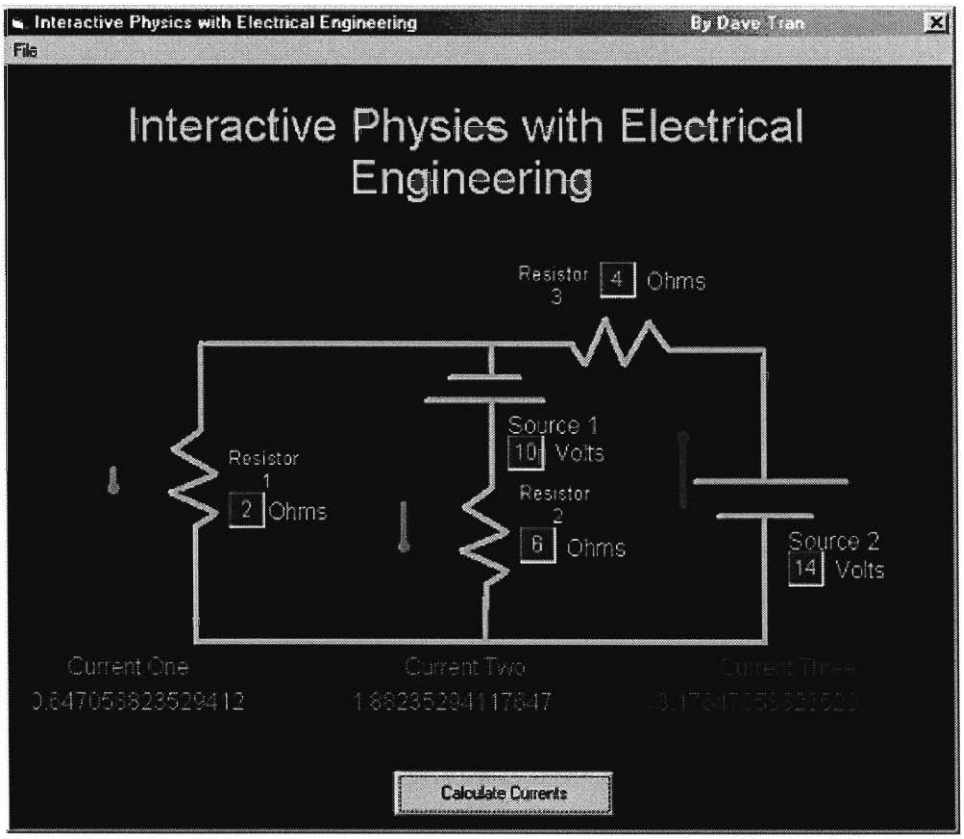


Figure 4: Interactive Physics Supplement Design

This program was modeled after an example which was given in "Physics for Scientists and Engineers." It allows students to change parameters within the example and instantaneously see the effects. This allows for an enhanced overall understanding of the concept without the possibility of becoming lost in a maze of calculations. Similar applications in mechanics were under development when the physics department announced its decision to upgrade the text.

Supplements for the recently introduced calculus 3/4 PLC section were also developed. One concept which is often particularly difficult to grasp, and proves difficult to determine, is whether a series converges or diverges. To make this concept easier to overcome a straightforward flowchart was developed. This flowchart is shown on the next page. It provides the student with a series of steps to follow which allows for easy determination of convergence of any series. This flowchart is shown on the following page:

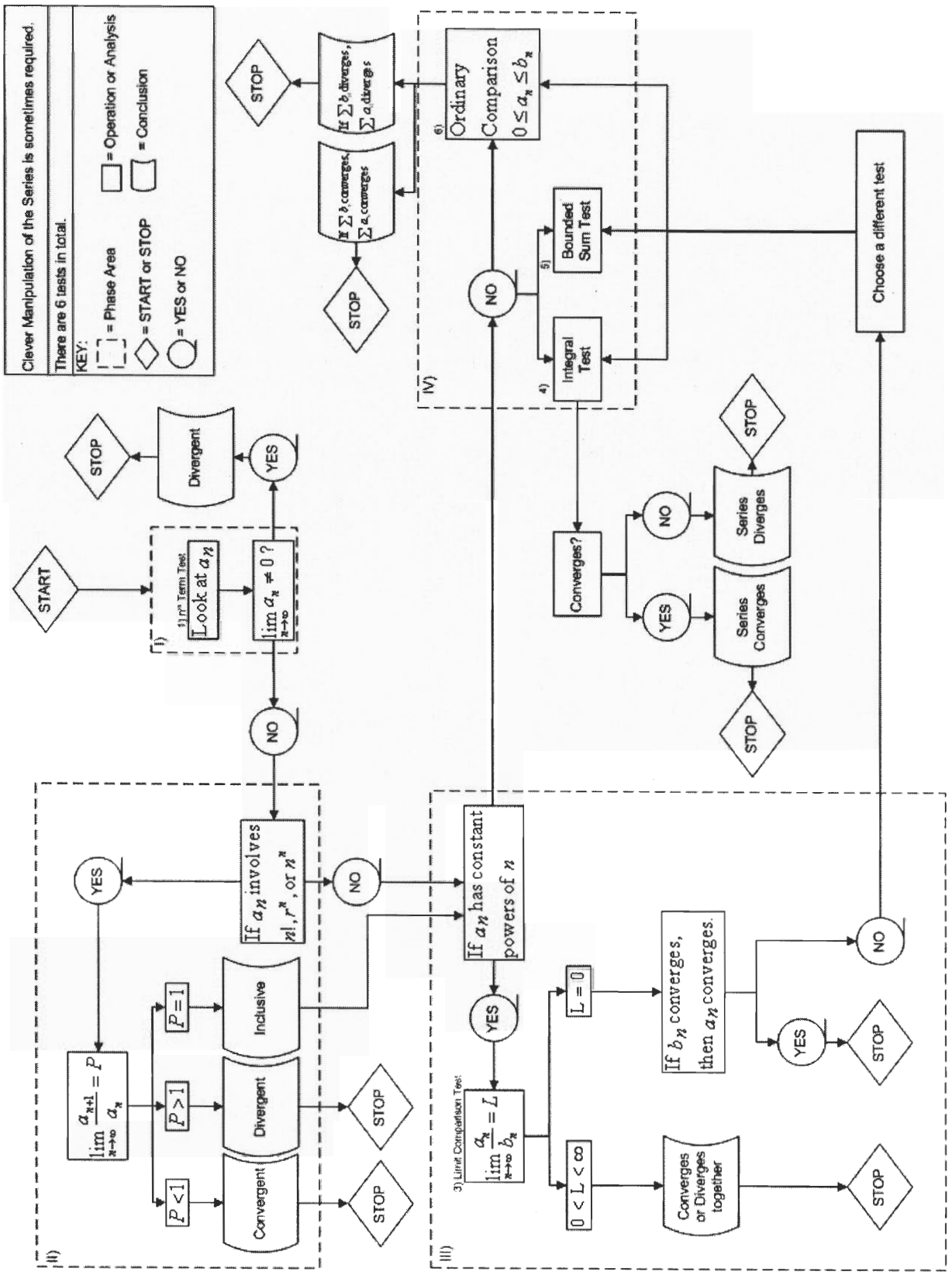


Figure 5: Calculus Convergence Test Flowchart

4.4: PLC Awareness Brochure

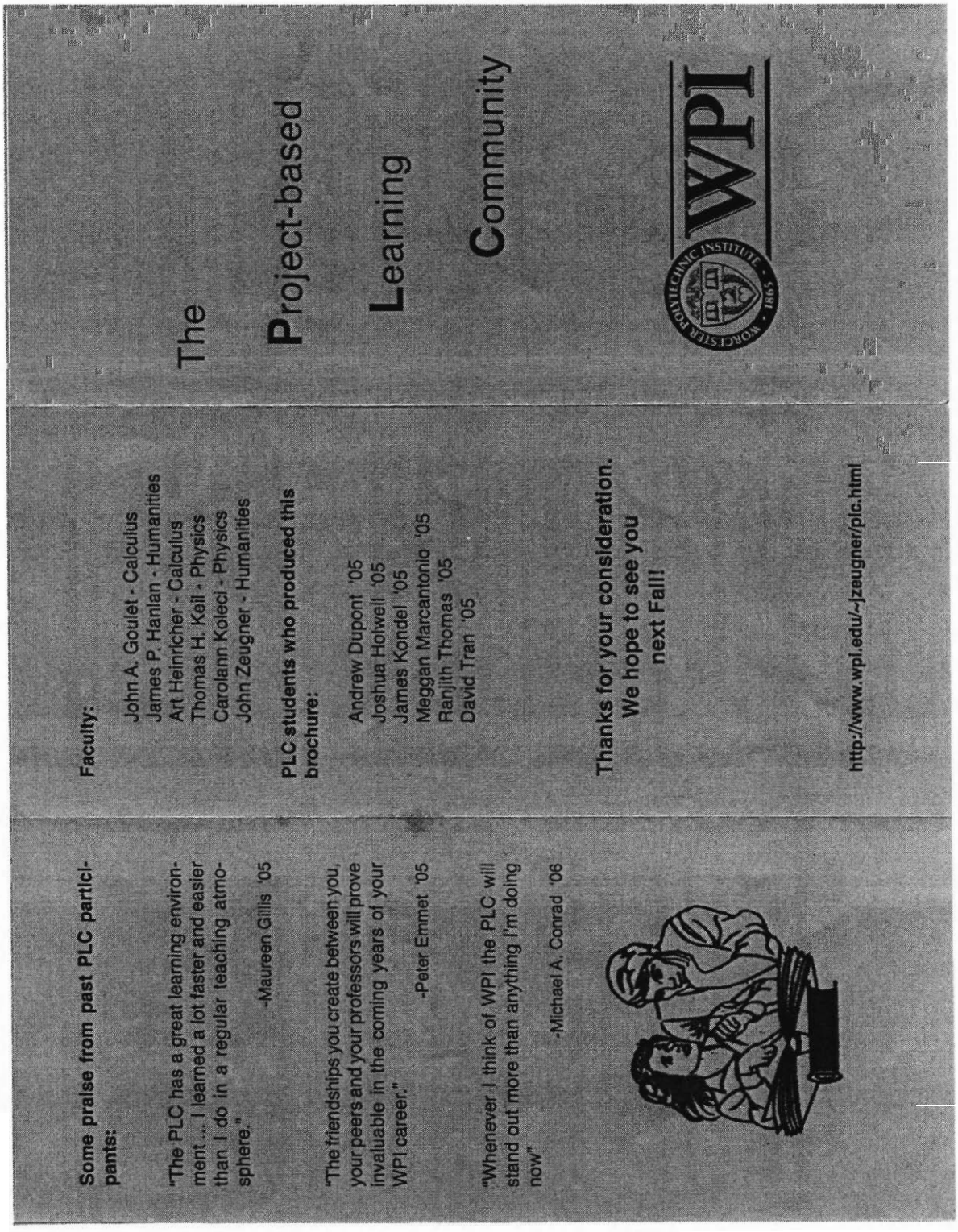


Figure 6: PLC Awareness Brochure Page 1

The **PLC** is just what its name suggests: A community focused on peer assisted learning. The students involved are provided with a special opportunity to explore the relationship between mathematics and science and to appreciate their place in history and society.

Benefits of the PLC include:

- An outstanding student-to-teacher ratio (about 25 to 3).
- Emphasis on group interaction over multiple projects.
- A new social community and meeting place to form lasting relationships with other students.

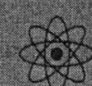
The students complete projects while exploring many areas of study.

Some examples of projects include:

Galileo and his work:
Proving the mechanics of gravity on moving bodies. (Using only the tools Galileo had.)

Exploring the societal implications, mathematical explanations and scientific discoveries on topics such as:

- weapons of mass destruction,
- energy production (hydro -electric, nuclear, and solar),
- natural disasters (earthquakes, plagues, famine, etc.)



All of these projects help students improve their skills:

- writing reports and essays
- preparing presentations using **Power Point**
- working collaboratively in groups

All of these skills will prepare participating students for further projects such as the IQP and MQP as well as aid them in the rest of their WPI experience.

In the **PLC** the Students take three classes per quarter, much like any other student. Each term the participants will take Calculus, Physics and a broad Humanities course designed to interrelate the three disciplines. All of these classes are held in the same room which is equipped with computers, white boards and an ample amount of space.

This environment is notably different than conventional lectures. All of this creates a less stressful environment with more of the learning coming from the students teaching each other. As any instructor would agree, teaching others is the best way to solidify or further your knowledge.

Figure 7: PLC Awareness Brochure Page 2

4.5: PLC Website with Student Self-Test

The PLC has been using a web page to introduce some prospective students to the nature of the program. There are several pages included to help a student decide whether or not they would like to participate. First and foremost is the introductory overview. This section of the web page states some of the goals of the PLC in aiding student development with different learning techniques. Using the structure of the program this page enumerates the differences in the curriculum and environment from the normal WPI experience.

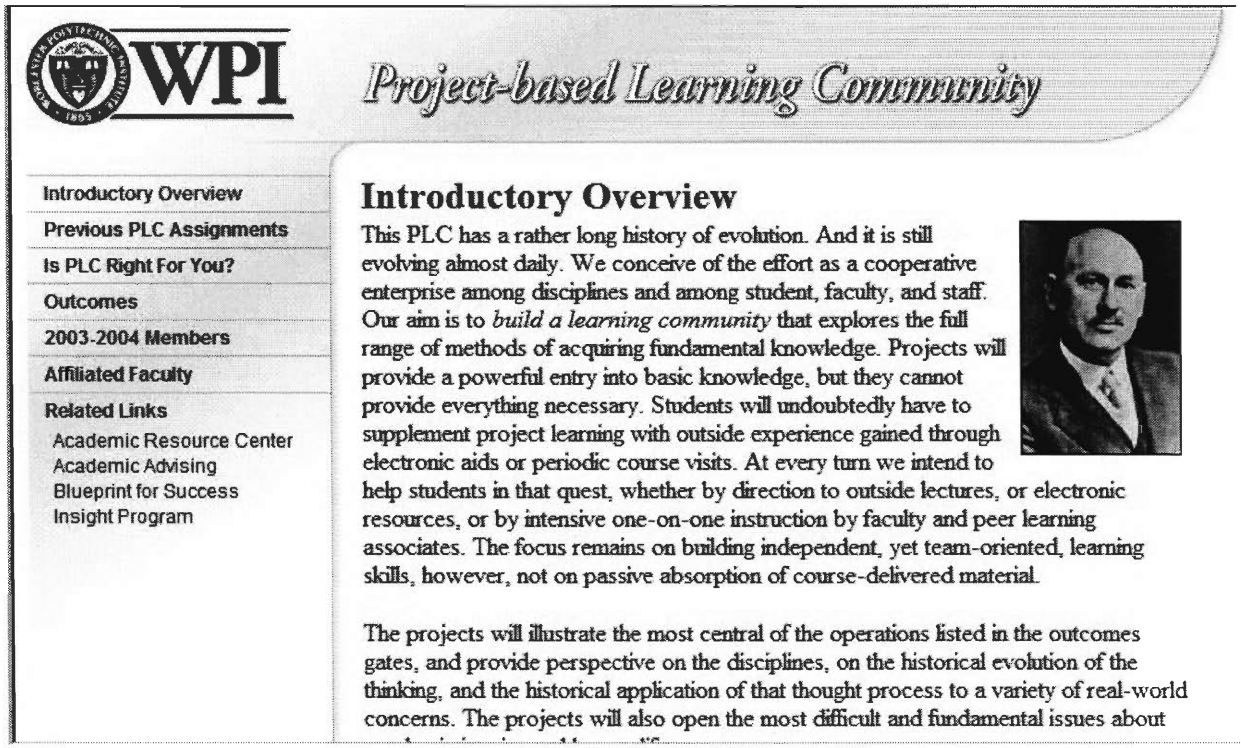


Figure 8: PLC Website Page 1

The next page of the website enumerates several previous PLC projects and other notable facets of the curriculum. This gives the prospective student an idea of the variance in the subject matter as well as the nature of the work itself. A rough curriculum list is presented with major works and outcome gates.

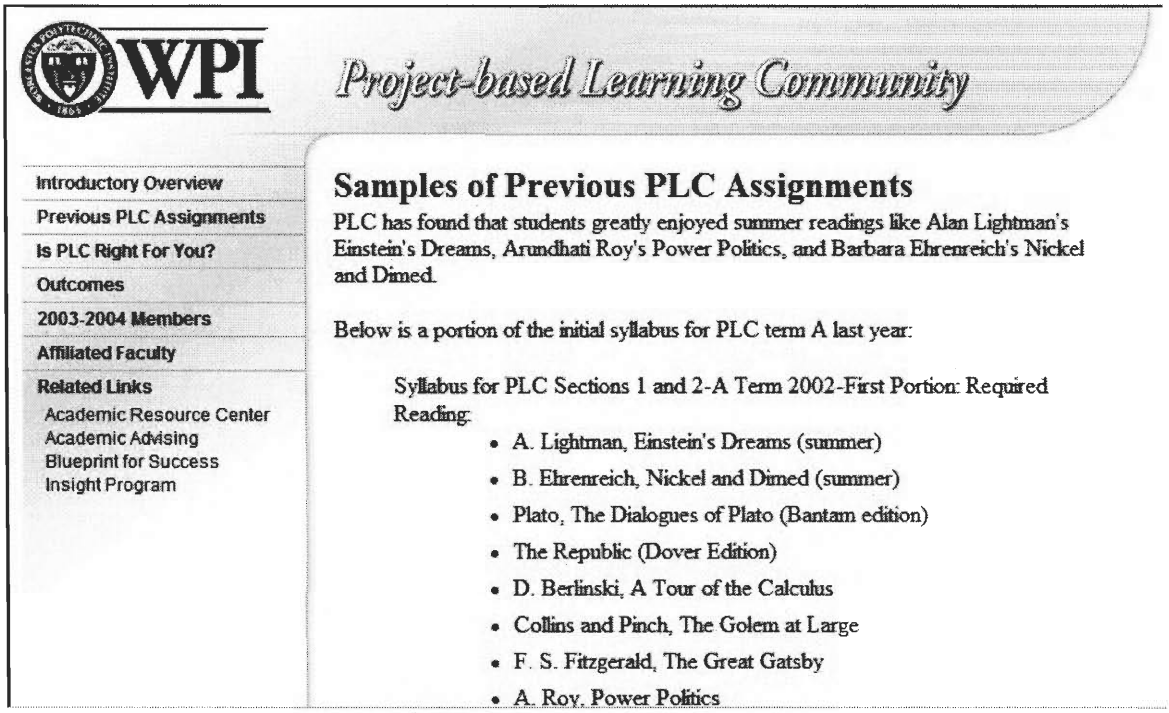


Figure 9: PLC Website Page 2

The third facet of the website is devoted to helping students decide if the PLC is right for them. This questions and material on this page was created at the beginning of this project to attempt to give a student an idea of how well they would like being in the PLC. The test is geared towards illuminating the preference the student has towards several of the goals and outcomes projected for by the PLC.

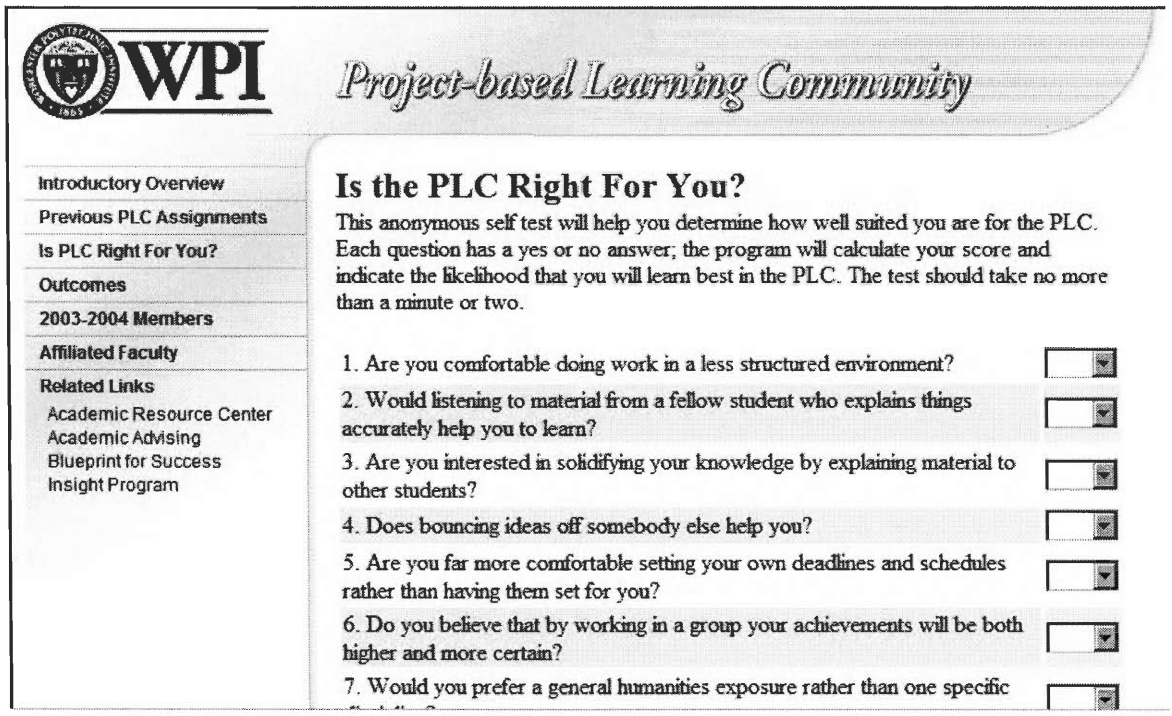


Figure 10: PLC Website Page 3

The fourth page on the website is devoted to explaining the concept of the Outcomes Gates. This process of demonstrating certain achievements is critical to the way the PLC helps students learn how to learn. By setting the goals clearly from week to week, the entire process of learning a subject is broken down to accomplishing smaller steps. After satisfactory completion of these steps, even the student tends to feel ready for the next set of material.

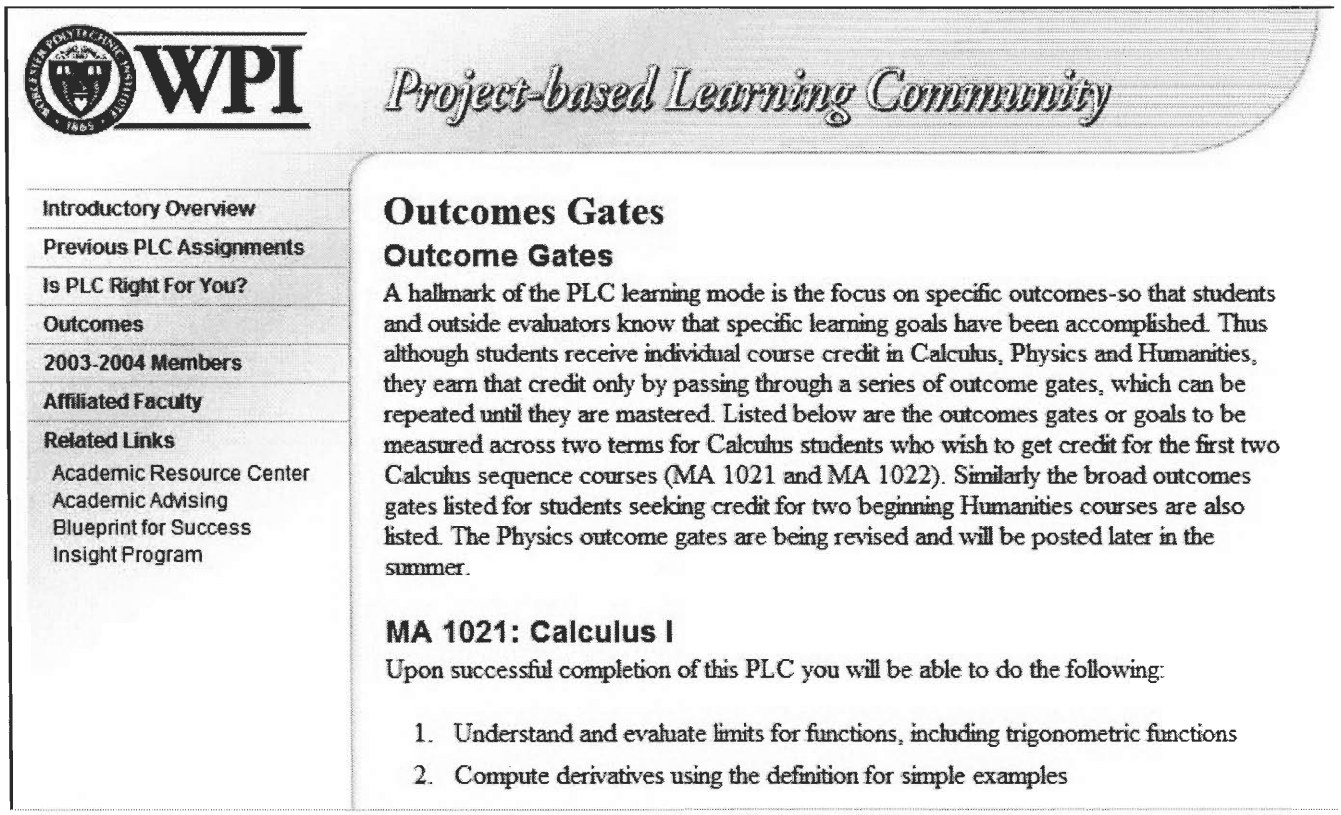


Figure 11: PLC Website Page 4

Next on the website comes a page that is merely designed to tell students how to notify the school that they are interested in the program using the WPI Blueprint for Success. Lastly there is a list of faculty and how to contact them as well as a set of related links for other information surrounding WPI and the PLC.

4.6: Summary of Outside Assessments of the PLC

4.6.1 Description of PLC (previously known as the Davis Tutorial)

The PLC is a program offered to first-year WPI students that blends Physics, Math, and Humanities together in a unified learning experience constructed around group projects, outcomes measures, and internet resources and technologies (principally Maple, SPSS and PowerPoint). This option is offered to students as a way to master fundamental knowledge and simultaneously begin the group project approach to learning that is distinctive to degree requirements at WPI.

All PLC sections had its private room within which they met and worked. The rooms were furnished with tables, chairs, wireless classroom networking, several computers, and white boards. PLC students were also given laptops for their personal use, while they were in PLC.

For membership in the PLC, students are required to enroll in introductory Math, introductory Physics, and Humanities in both A- and B-term. In the Humanities portion of the course, students work in groups on 6 different projects that are designed, whenever possible, to incorporate ideas and concepts from Math and Physics. For each project, students produce a written report and an oral presentation utilizing PowerPoint.

PLC class meetings are characterized by discussions between faculty and students a free exchange of ideas. Students are encouraged to consult with one another on assignments. Calculus quizzes are designed around outcomes "gates," and students are permitted to re-take failed Calculus quizzes and Physics exams. Physics and Calculus homework is not collected.

Aside from Physics lecture, PLC students attend all conferences and class meetings in a private room to which students have access 24 hours per day, 7 days per week. (Quinn, 2)

References:

"Attitude Survey Results: PLC and Control Groups Pre- and Post-Treatment Attitudes and Opinions". AY 2002-2003 Davis Project. Report prepared by Paula Quinn. 03/04/03.

4.6.2 Academic Year 2000-2001

4.6.2.1 Findings of Focus Group Conducted During C-Term 2001

On February 20, 2001 a focus group was held, in the hopes to obtain knowledge that could not be gathered from a pen and pencil survey. Questions were designed to explore two main areas. The first objective was to obtain information about how the students felt about the Davis Tutorial Program at WPI. The second objective was to find out suggestions pertaining to the future of the Tutorial program.
Students of the Tutorial, with the exclusion of the four students who participated in the Insight program, were invited to attend in return for twenty dollars and complete confidentiality. In response six males and two females attended the audio and videotaped focus group. (Quinn, 2)

Paula Quinn reports the students having an "overwhelmingly positive" opinion of the Davis Tutorial. (Quinn, 2) Positive responses were placed in three general categories. The first grouping dealt with academic issues. Students were enthusiastic about the need to obtain all knowledge taught by the course at their desired pace, as long as all material was mastered by the close of the course, instead of struggling to learn enough material to be able to pass one test. Students also enjoyed the relaxed interactive atmosphere of the Tutorial, which they believed helped them to excel. Finally, students seemed to enjoy seeing how different aspects of Calculus, Physics, and Humanities are related. Another category dealt with working with other students. Through group work student felt they learned the skills of communication and project presentation. They also enjoyed being able to learn from not only professors but to be able to look to a fellow student for understanding or explanation. The final category dealt with working with professors. Students appreciated the student-professor relationships that were able to mature due to the nature of the Davis Tutorial. Students now felt motivated in their work and comfortable to approach a professor for help. (Quinn, 3)

Students also voiced their opinions about some negative aspects of the program. Despite the luxury of a relaxed schedule student felt this sometimes worked against them. It was difficult to adjust to the academic freedom now available to them. Some students felt the Tutorial may have encouraged procrastination habits that made it difficult to return to traditional classes. It was commented that this could be due to the individual student, not necessarily the Tutorial. Another complaint dealt with the lack of information explaining the Davis Tutorial prior to the start of school. (Quinn, 3)

Several additional issues were addressed. One issue dealt with the role of the Davis Tutorial teachers as advisors. Students that majors corresponded with those of the tutorial courses enjoyed this aspect, while students that majors differed from calculus, physics, and humanities did not find it as helpful. Students agreed

that if advisors outside of the Tutorial were assigned to the Tutorial students, then they should be aware of the Tutorial and how it is run. (Quinn, 3) Another issue dealt with reasons for students applying for the Davis Tutorial. The overall attraction spouted from the subject material, group work, and the outcomes offered by the program. (Quinn, 4)

Students felt the program should be offered on a voluntary basis, with the exception of one student who as a result of all he learned, felt the program should be school wide. All the other students disagreed saying it would take away from what makes the Davis Tutorial work. Many felt not all students have the drive to be placed in this type of environment, and the professor-student relationship with such a large group.

Additional suggestions included the addition of a chemistry section, the continuation of the program, and allowing the professors who run the Tutorial power to organize its structure. (Quinn, 4)

Reference:
"Exploration of Student Opinions and Attitudes about the 2000-2001 Davis Tutorial Program at Worcester Polytechnic Institute-Report of Findings." Prepared by Paula Quinn. 2/28/01.

4.6.2.2 Grade Analysis

All first year students who were involved in the innovative program and their respective control group were included in analyses for GPA in A-term and B-term for the Academic year 00-01. The experimental and control students' academic performance was also tracked during C-term and D-term to determine whether there were any residual effects of the innovative programming. (Pinet, 13)

Performance of the Davis Tutorial students and the control students were measured for A-term alone, B-term alone, and for the first semester. Academic performance was also compared for C-term, D-term, and the cumulative GPA for the second semester to determine whether there were any residual effects of the Tutorial program. The overall cumulative performance for the 00-01 academic year was also measured between the Tutorial students and their controls. (Pinet, 14)

Mann-Whitney *U*-tests and *t*-tests were used to determine whether any significant differences existed between the Tutorial experimental students and their controls for the introductory Calculus and physics courses in A-term and B-term. Mann-Whitney *U*-tests were used in place of *t*-tests due to unequal sample sizes, where applicable. (Pinet, 15)

For A-term, *t*-test yielded no significant difference between the Tutorial experimental students and the Tutorial control students. The mean GPA of the tutorial students for A-term was 2.9 and the mean GPA of the control students was 2.8. A *t*-test for B-term yielded a close to significant difference between the

Tutorial experimental students (*Mean GPA* = 3.1), and the Tutorial control students (*Mean GPA* = 2.6). (Pinet, 16) *t*-test results determined that there were no significant difference between the Tutorial experimental students (*Mean GPA* = 3.0), and the Tutorial control students (*Mean GPA* = 2.7) for the AB cumulative GPA. (Pinet, 17) A Mann-Whitney *U*-test yielded a close to significant difference between the Tutorial experimental students (*Mean GPA* = 3.1), and the Tutorial control students (*Mean GPA* = 2.5) for C-term. (Pinet, 18) Additionally, the Mann-Whitney *U*-test yielded no significant difference between the Tutorial experimental students (*Mean GPA* = 2.7), and the Tutorial control students (*Mean GPA* = 2.7) in D-term GPA. (Pinet, 19) Using a Mann-Whitney *U*-test, no significant differences were found between the Tutorial experimental students (*Mean GPA* = 2.9), and the Tutorial control students (*Mean GPA* = 2.6) for the cumulative average of grades for C-term and D-terms. (Pinet, 20) Finally, a Mann-Whitney *U*-test yielded no significant differences between the Tutorial experimental students (*Mean GPA* = 3.0), and the Tutorial control students (*Mean GPA* = 2.6) for the academic year 00-01. (Pinet, 21)

The analyses did not indicate statistically significant differences between the Tutorial experimental students and control students in A-term, D-term or the combination of any terms or for academic year GPA. However, the analyses did reveal that during B-term and C-term the Tutorial experimental students evidenced higher GPAs of .5 points higher and .6 points higher respectively, and the results of the t-test were approaching significance. More analyses, using *t*-tests, for the introductory Calculus (MA1020/MA1022) and the introductory Physics (PH1110/PH1120) courses revealed a highly significant difference between the Tutorial experimental students and their controls for Physics (PH1120) in B-term with a final grade of .9 points higher than the control group. It is important to note that in B-term the Tutorial program involved a more integrated teaching curriculum, such that, the humanities, physics and math courses were taught in the same setting with connections being made and highlighted for the historical and social implications and applications. (Pinet, 26)

Reference:
"Grade Effects of Insight, Bridge, and Tutorial Programs (GPA; Calculus, and Physics courses)." AY 2000-2001. Davis Project. Report prepared by: Martha J. Pinet. Date: October 8, 2001.

4.6.2.3 Findings of Focus Group Conducted During B-Term 2001

On October 29, 2001 two focus groups were organized with the purpose of finding out about student's reactions and feelings about the 2000-2001 Davis Project. It also served to inquire how the students responded to survey results that conflicted with intended goals. Participants were chosen from a list of Davis students and invited to the group via email in exchange for twenty dollars and complete confidentiality. Three male and two females attended the first group and one male and two females attended the second group. (Quinn, 2)

Students commented on how they learned better in a community environment over the lecture format. One reason for the better learning could be the close relationships that were formed with the professors aided in their learning. Students enjoyed the "Outcome Gates," more commonly know as "Goal Quizzes." These and other aspects of the Davis Project allowed the students the flexibility and time needed to fully learn and understand the course material. Student also enjoyed the skills they received from doing group work and presentation. They felt these were skills needed for future WPI projects and job experience. Some felt the format of the program enabled them to achieve higher grades. (Quinn, 3)

There were some drawbacks to the program. It was felt that students who were not self-motivated didn't perform as well without deadlines. Some felt the courses offered did not relate to their subjects. Others found the transition back to traditional classes hard. Classes were now more rigid then they were used to.

The subject of the interconnectedness between course materials arouses many mixed reactions. Students felt that project work helped make connections between the subjects. Some students believed the Tutorial tried to show the connection but did not always make it clear. In general, the students felt that the Tutorial did a better job relating material than the traditional classes. (Quinn, 4)

Students felt first year courses are not always related to each other but are essential bases for later courses. All felt that introductory classes were needed for a foundation for future math and science courses. Students agreed that courses outside of your major help you with courses in your major. The amount of help ranged depending on the class. (Quinn, 5)

The Davis Tutorial altered ideas of teamwork. Students learned how to work efficiently work in a group. Students learned various roles such as leader and motivator. They also learned the process from dividing up the work to organizing a final presentation. Students agreed that it depends on the project whether it is easier to do in a group or individually.

When asked why survey resulted conflicted with expected outcomes students felt they may have been inaccurate. Some students felt the timing of the survey had been to close following the Tutorial and they were not able to realize its full potential until more recently. Others felt the wording of some questions was hard to understand. The structure of the Tutorial does not cater to everybody, and they may have responded accordingly. (Quinn, 7)

Davis Tutorial students had a positive attitude about their time spent at WPI. They felt connected to WPI through the relationship with their professors. Many still visit the Tutorial professors with questions they stumble upon.

Reference:
"Bullets of Focus Group Findings: Tutorial October 2001 Follow-up of Attitudes and Opinions." AY 2001-2002 Davis Project. Prepared by Paula Quinn. 02/24/02.

4.6.3 Academic Year 2001-2002

4.6.3.1 Focus Group Findings

A focus group was conducted to further assess the 2001-2002 Davis Tutorial Program, in addition to a written attitude survey, with the intent of better understand the Tutorial groups experience. 17 of the 24 Tutorial students volunteered for the focus group.

The questions used to keep the focus group on track were made to elicit student opinions, attitudes, and perceptions of the Tutorial program. The focus group was conducted approximately six weeks after the termination of the Tutorial classes, and approximately two and a half weeks after the Tutorial students has started taking traditional classes.

The Tutorial students felt that the Tutorial Program was more demanding of time and academic challenge than traditional classes. In spite of this fact, Tutorial student reactions were "overwhelmingly positive". Tutorial students also gave the impression that they could not praise the program highly enough. "The following lists are highlight of the positive qualities the students believe the Tutorial fostered in them":

- An appreciation for self-motivated learning
- A heightened awareness of the interconnectedness of ideas and course material
- The ability to develop strong relationships with faculty members and other students
- Academic courage
- Respect for teamwork
- Skills necessary for successful teamwork
- Skills necessary for successful project work
- A feeling of connection to the ethos of WPI.

(Quinn 2)

As far as negative comments, there were very few and minor. Some of them were the limited access the students had to the Tutorial room, and difficulty in transitioning into traditionally run lab courses.

The students believe that the Tutorial program's success was rooted to the structure of the program and the strong commitment to the students given by Tutorial professors. The Tutorial required the students to work in teams whereby they were forced to be self-motivated and work on problem solving projects. These requirements were all performed in an ambience of professor provided support and clear goals. Using this approach allowed the students to build strong

relationships that helped them throughout the Tutorial and believed to continue benefiting them in the future.
All the students were in agreement that the skills learned in the Tutorial had equipped them to produce excellent IQP's and MQP's. All but one student believed that the Tutorial Program was such a benefit, that they desired to have this mode of pedagogy extended throughout their education at WPI.

In conclusion, the 2001-2002 Davis Tutorial Program was able to create a "cohesive community of learners who discovered that learning as a community is successful if the learning is first pursued by the individual." (Quinn 2)

Reference:
"Focus Group Findings: Tutorial Post-Treatment Attitudes and Opinions." AY 2001-2002 Davis Project. Report prepared by Paula Quinn. 08/23/02.

4.6.3.2 Survey Findings

Pre and Post surveys were conducted on the 2001 Davis Tutorial Program as well as a simultaneous control group. The Pre-survey was given to all first year students before the Tutorial began. The Post-survey was mailed to all Tutorial and control students during C-Term 2002 at the end of the Tutorial. Eleven Tutorial and ten control students completed both surveys.

The surveys were intended to examine the differences between the Tutorial and control group, as well as within-group changes for both of the groups. Basic differences on survey items were likely a result of the self-selection process for entrance to the program.

The results of the survey show that the Davis Tutorial was "overwhelmingly" successful at achieving the following goals:

- Promoting the benefits of interdisciplinary study
- Promoting the importance of strong communication skills
- Helping students develop strong communication skills
- Promoting the importance of good problem solving skills
- Helping students develop good problem solving skills
- Encouraging positive attitudes towards teamwork
- Fostering effective teamwork skills
- Helping students develop connections with faculty at WPI.

(Quinn 2)

The data shows that the group project approach of the Tutorial was "key" in the success of the program. Analysis of the results, by Paula Quinn, shows that the Tutorial student experienced significantly more project and group work than the compared control group students in A- and B-Terms of 2001. Below is a list of statistically significant differences between the Tutorial and control groups on the

Post-survey that can be linked to this fact. The Tutorial students, when compared to the control group:

- Held more positive attitudes about the benefits of taking courses outside of their majors
- Reported better progress at locating, screening, and organizing information
- Reported better progress at drawing conclusions after weighing evidence, facts, and ideas
- Reported better progress at making social connections with faculty at WPI
- Reported better progress at expressing their own views and opinions
- Reported better progress at clearly articulating their thoughts through writing
- Reported better progress at creating professional-quality reports
- Reported better progress at writing well
- Attached more importance to learning how to give a good oral presentation
- Reported better progress at learning how to giving a good oral presentation
- Felt more confident at giving oral presentations
- Reported better progress at being effective team members
- Agreed more strongly that they could learn a lot from others when working on a team
- Valued more highly project work in classes
- Believed more strongly that project work in classes aids their learning
- Valued more highly group work in classes
- Believed more strongly that group work in classes aids their learning
- Believe more strongly that working in an atmosphere that allows them flexibility to approach learning in ways that suit them aids their learning
- Valued more highly taking courses that are connected or related in some way
- Valued more highly taking multiple courses with the same group of students
- Believed more strongly that taking multiple courses with the same group of students aids their learning.

(Quinn 2)

The data also shows that the success of the Tutorial program was related to additional factors beyond the increased exposure to project work and group work that the Tutorial students had when compared to the control group. The success of the Tutorial program is also likely related to the following:

- The flexibility of the Tutorial's project-based environment
- The interdisciplinary nature of the project work

- Dedicated professors who were committed to teaching students how to be self-initiating learners
- The relationship between the team-based work environment and the grading policy for the Humanities portion of the Tutorial
- The self-selection policy for entrance into the Tutorial.

(Quinn 3)

In conclusion, the results of these analyses reinforce earlier qualitative findings that the students of the 2001-2002 Davis Tutorial Program benefited greatly from it (Quinn, 2002). Additionally, the current findings quantitatively supplement the earlier findings and demonstrate that the Tutorial succeeded not only at creating an excellent learning experience for the Tutorial students themselves, but also at creating a learning experience that excelled in many ways when compared with the learning experience of non-Tutorial students. (Quinn 3)

Reference:

"Attitude Survey Results: Tutorial and Control Groups: Pre- and Post-Treatment Attitudes and Opinions." AY 2001-2002 Davis Project. Report prepared by Paula Quinn. 09/23/02.

4.6.3.3 Grade Analysis

The purpose of this report was to compare the grade point averages (GPA) of the students who participated in the 2001-2002 Davis Tutorial, with a control group of students. By comparing GPAs, data was compared to see if the Tutorial aided students to perform better. Seven comparisons of the GPA's were made. They were the GPA's for the cumulative year, first semester, second semester, and each term individually. Data was collected over a year to see if the effects of the Tutorial remained with the students. (Henry, 3)

By the start of school, twenty-four students, consisting of twenty male and four female students, comprised the 2001 Davis Tutorial. The control group was organized of twenty-one students. Students in the control group were required to be taking Calculus I (MA 1021) and Physics I (PH 1110) (with the exception of students participating in special labs), concurrently in A-term, followed by Calculus II (MA1022) and Physics II (PH 1120) in B-term. Control group students who were taking a History in A and B-terms, or just A-term individually were favored due to the similar course load. One male in A-term, two males in A- and B-term, and two males in only B-term were enrolled in History. In total the control group consisted of seventeen males and four females.

To verify that the two groups were academically equivalent SAT math and verbal scores were compared. Mann-Whitney U-tests were used due to the unequal number of group members. No significant difference was found between the groups. For the SAT verbal scores the Tutorial's mean value was 576.52 with a standard deviation of 75.17, compared to the control group's mean score of 575.71 with 84.59 as a standard deviation. For the SAT math scores the

Tutorial's mean score was 635.65 with a standard deviation of 67.07, compared to the control group's mean score of 637.14 with 55.69 as a standard deviation.

It was believed that the results of the comparisons would show a difference in GPAs between the Tutorial and control groups for A- and B-term both collectively and separate. A number value 4.0 would be assigned for an A, 3.0 for a B, 2.0 for a C, and 0.0 for an NR. The grades were then averaged to find the GPA. Music and Physical Education classes were excluding due to their lack of severity. Mann-Whitney U-tests were used compare the GPAs of both groups.

The only significant variation present arouse when comparing A-term GPAs. Tutorial's mean GPA was 3.3 with a standard deviation of .40, compared to the control group's mean GPA of 2.7 with .78 as a standard deviation. In B-term and the first semester Tutorial student GPAs were slightly, but not significantly higher. It was discussed that this could be due to Goal Quizzes, which allowed students as much time as needed to learn the fundamentals of Calculus. The importance was placed on understanding all the material, since all Goals must be passed, at your pace. Both groups GPAs decreased from the first semester in C- and D-term showing no difference. This survey concluded that Tutorial students learn the same material and are not disadvantaged by missing the traditional first year path.

Reference:

"Grade Analysis: 01-02 Tutorial Program Grade Point Average." AY 2001-2002 Davis Project. Report prepared by Martha J. Henry. 9/28/02.

4.6.4 Academic Year 2002-2003

4.6.4.1 Focus Group Findings

A focus group was conducted on January 28, 2003 to further assess 02-03 Project-Based Learning Community (PLC). Unlike previous years, 02-03 PLC was consisted of two sections with each section having its own instructors. The focus groups were separately conducted for each section. From section 1, nine students (8 males and 1 female) participated in the focus group out of 23 students. From section 2, four students (2 males and 2 females) participated out of 22 students. (Quinn, 3) The results for both sections are reported separately due to the considerable differences in their feedbacks.

All Section 1 focus group participants were pleased that they had joined the PLC. They believed that the exposure they had gotten to material, especially regarding the Humanities, was more diverse than they would have gotten otherwise. They believed that they learned a lot through the projects. Most students indicated that they learned some very useful presentation skills. They also believed that they learned more in PLC than they had in other courses they had taken since leaving PLC. The section 1 students believed that the homework assigned in PLC was

designed to mesh with goals of the courses better than assignments from traditional courses. The participants said that the PLC format was "better than lecture" because a professor was always available, PLAs were available, students had the opportunity to talk with a professor every day, students could study with a group of people at tables, the atmosphere was more personal than in a traditional classroom, and there was a lot more discussion than occurs in traditional classrooms. (Quinn, 4) Focus group participants believe that they had good relationships with the PLC professors and that these positive relationships were a function of both the professors' approaches and the general atmosphere of the PLC. All PLC Section 1 focus group participants believed they benefited from the PLC in terms of working with other students. (Quinn, 6) Because everyone in PLC knew one another, the discussions were better than they would have been otherwise. The personal comfort that some students felt in the PLC also aided them in developing better public speaking skills.

While students agreed that the projects in the PLC contributed a lot to making them think about the interconnectedness of courses and material, they also believed that material in the PLC was less interconnected than the professors had wanted it to be. (Quinn, 6) When asked about the transition to traditional classes, focus group participants responded that they had a difficult time making the transition from the PLC to regular classrooms. Students indicated that they truly were not learning as well in traditional classrooms as they had in PLC. (Quinn, 7)

Focus group participants from PLC section 2 were deeply divided on their responses about the PLC. Out of 4 participants, two were pleased with Calculus and Physics portions of the program and would join PLC again because of those aspects; the two others were generally displeased with the program and regret having been a part of the program. The two who had been pleased echoed, to a large extent, the sentiments of the Section 1 students. The two who were pleased with having been in PLC believed that the challenge of PLC was equal to that of traditional classes but that the style of the PLC classroom offered learning advantages that the traditional classroom did not. The two students who regretted having enrolled believed that they would have been more academically challenged had they enrolled in regular classes. (Quinn, 8) PLC Section 2 focus group participants liked the style of the PLC classroom for reasons such as having access to computers and copy machines, having wireless networking in the classroom, and being loaned a laptop computer for the duration of the PLC. All focus group participants agreed that they were comfortable working with the professors. They thought that the professors appeared "human" and were approachable. (Quinn, 9) The participants in this group all agreed that a benefit of working in the PLC was that they were introduced to other students with whom they could then work, which is not a feature that the traditional classroom offers. The students who had not enjoyed the PLC did not mind the transition to the traditional classroom, and those who had enjoyed the PLC did not like the transition. The students who had not liked the PLC enjoyed their traditional classes more than they had enjoyed the PLC classes. Those who had enjoyed the

PLC view the traditionally taught courses as not being as beneficial to their learning as PLC courses had been. (Quinn, 10)

The responses from the PLC focus group of 02-03 was different than that of previous focus groups conducted with 00-01 and 01-02 Davis Tutorial students. However, the entire section 1 and half of section 2 PLC students who participated in the focus groups were very pleased with PLC and are willing to continue in PLC format courses if offered at WPI. The students who are displeased with PLC mentioned that they signed up for PLC simply because it had not been possible for their requests to enroll in certain classes to be met in any other way. These students did not know about the philosophy and goals of PLC before enrolling in the program, which could be reason for their negative feedback on PLC. Future offerings of the PLC would likely benefit from efforts to recruit students into the program whose learning styles and goals mesh well with the philosophy and goals of the PLC program. (Quinn, 11)

Reference:
"Focus Group Findings: PLC Post-Treatment Attitudes and Opinions." AY 2002-2003 Davis Project. Report prepared by Paula Quinn. 03/03/03.

4.6.4.2 Survey Findings

A pre and a post intervention survey were electronically administered to students in the 2002-2003 Project-Based Learning Community (PLC) and to a control group to quantitatively assess the effects of the program. The survey was also used to examine any potential difference between the experiences of PLC sections 1 and 2. Like the previous years all first-year students were invited to take the pre-survey during their orientation activities. All students who had completed the pre-survey were invited to take the post-survey during beginning of C-term, after the PLC had ended. 17 PLC students (9 from Section 1 and 8 from Section 2) and 14 control students completed both surveys.

4.6.4.3 PLC vs. Control Group

The analyses examined differences between the PLC and Control groups, differences between PLC Section 1 and PLC Section 2, and also within-group changes for the PLC group, each section of PLC students, and the Control group.

Results of comparisons between 2002 - 2003 Davis PLC and Control students reveal that members of the 2002 - 2003 Davis PLC Program attached more importance to improving their problem-solving abilities and reasoning skills, and reported having made more progress at each of the following:

- Improving their problem-solving abilities and reasoning skills
- Learning how to think and reason
- Understanding and applying math concepts

- Learning to create professional-quality reports. (Quinn, 4)

The data indicate that the focus the PLC had on both group work and project work was key to the success of the program. Analyses revealed that, in comparison to Control students, PLC students not only encountered significantly more project work and significantly more group work during A- and B-terms, but they also more greatly valued each and believed more strongly that each aided their learning. And each of the above conclusions can be linked to these facts.

The 2 following absolute aspects of the data reinforce the success of the PLC program: 1) In no instance did the Control students' survey responses reveal that they had made more progress than the PLC students had made in any particular area. 2) In no instance did the Control students' survey responses indicate that they held attitudes that were more in line with the goals of the PLC than the PLC students' attitudes were. (Quinn, 4)

It is obvious from comparisons between the PLC students and Control students that the PLC is a valuable program that effectively meets the needs of a segment of the class of first-year students. However, analyses examining both change within the PLC group and differences between PLC Section 1 and PLC Section 2 indicate that the PLC may not always have succeeded at achieving its aims, and they also reveal that the PLC experience was different for different students. (Quinn, 4)

4.6.4.4 PLC Section 1 vs. PLC Section 2

There were several differences between the PLC Section 1 and PLC Section 2 at the beginning of the PLC. Taking into account these important differences, analyses show that the PLC students from each section left the program with attitudes that were quite different from each other. On the post-survey, when compared to Section 1 students, Section 2 students attached more importance to attaining the following outcomes:

- Understanding and applying math concepts
- Applying scientific knowledge and skills
- Locating, screening, and organizing information
- Improving problem-solving abilities and reasoning skills
- Becoming more self-reliant. (Quinn, 5)

Additionally, when compared to Section 1 students, Section 2 students

- More strongly believed that taking courses that are connected or related in some way aids their learning
- More strongly believed that working with other students or friends from their classes aids their learning
- More strongly valued working on their own. (Quinn, 5)

Conversations with those involved with running the PLC and personal observations have indicated that the following issues may be worth investigating when trying to make sense of why the students from each PLC section had such different experiences:

- Number of "early joiners"/number of "late joiners"
- Gender ratio in sections and in teams
- Organization/stability of the PLC environment at the beginning of A-term
- Style of PLC professors from each section
- Continuity of PLC professors from A- to B-terms
- Goodness of fit between students' approaches to learning and PLC philosophy/goals
- Degree to which students are "locked-in" to a project team
- Extent to which a student felt as if he or she had a choice to enroll in PLC.

Efforts are currently underway to determine what other issues may have contributed to creating such different experiences for students in each of the PLC sections. (Quinn, 5)

Reference:

"Attitude Survey Results: PLC and Control Groups Pre- and Post-Treatment Attitudes and Opinions." AY 2002-2003 Davis Project. Report prepared by Paula Quinn. 03/04/03.

4.7: Results of PLC Survey

4.7.1 GENERAL RESULTS

Class year : 2000, 2001, 2002, 2003, 2004, 2005, 2006
Class year : 2, 0, 0, 1, 10, 16, 16

PLC Year or Section : '00 '01 '02a (Zeugner's section) '02b (Hanlan's section)
PLC Year or Section : 12, 14, 8, 11

Majors : ECE, ME, EE, BE, EE/CS, CS, CH, MFE, PH, TPSC, MGE, CE, ME/FPE, IE
Majors : 9, 20, 4, 1, 1, 1, 1, 1, 1, 1, 1, 2, 1, 1

Gender : M F
Gender : 36, 9

Student Type : Resident Commuter
Student Type : 36, 9

1. Was your advisor aware of the PLC program?
No idea. Slightly aware. Well aware. Pointed me to someone who was.
1 : 10, 22, 13, 0

2. In your first year at WPI were you able to form study groups more easily within the PLC or traditional classes?
PLC. No difference. Traditional classes.
2 : 38, 7, 0

3. Did any study groups formed in the PLC persist after returning to traditional classes?
Yes. No.
3 : 34, 11

4. On average have you formed a closer relationship with PLC professors or non-PLC professors?
PLC. No difference. Traditional classes.
4 : 35, 8, 2

5. Have you contacted a PLC professor for any of the following reasons since your completion of the PLC?
Advice. For a reference. Academic question. Just to talk. No contact.
5 : 11, 14, 8, 8, 4

6. Did you writing skills improve more in the PLC or traditional classes?
PLC. No difference, Traditional classes.
6 : 25, 19, 1

7. Were your problem solving skills improved more in the PLC or traditional classes?
PLC. No difference. Traditional classes.
7 : 25, 16, 4

8. Were your time management skills improved more in the PLC or traditional classes?
PLC. No difference. Traditional classes.
8 : 23, 11, 11

9. Do you believe a PLC style keeps students more interested in the subject material as opposed to traditional lectures?
PLC. No difference. Traditional classes.
9 : 36, 9, 0

10. A closer relationship with professors helps me feel more connected to the school.
Strongly agree. Agree. Neutral. Disagree. Strongly disagree.
10 : 28, 15, 2, 0, 0

11. A closer relationship with professors helps a student to excel in the course.
Strongly agree. Agree. Neutral. Disagree. Strongly disagree.
11 : 19, 26, 0, 0, 0

12. I have contacted a PLC teacher since the completion of the PLC for the following reasons.
Advice. For a reference. Academic question. Just to talk. Have not contacted.
12 : 10, 12, 11, 8, 4

13. The PLC had a positive effect on my group skills.
Strongly agree. Agree. Neutral. Disagree. Strongly disagree.
13 : 20, 19, 6, 0, 0

14. The PLC helped ease the transition into college.
Strongly agree. Agree. Neutral. Disagree. Strongly disagree.
14 : 18, 18, 6, 2, 1

15. My presentation skills were improved as a result of the PLC.
Strongly agree. Agree. Neutral. Disagree. Strongly disagree.
15 : 24, 15, 5, 1, 0

16. The PLC showed me how to apply what I learned to real life situations.
Strongly agree. Agree. Neutral. Disagree. Strongly disagree.
16 : 11, 13, 17, 4, 0

17. I believe that higher professor expectations directly relate to a student's academic performance.
Strongly agree. Agree. Neutral. Disagree. Strongly disagree.
17 : 12, 23, 9, 1, 0

18. I feel that the extra resources (computers, printers, whiteboards, couches, etc.) aided in my learning experience.
Strongly agree. Agree. Neutral. Disagree. Strongly disagree.
18 : 21, 21, 3, 0, 0

19. Learning from fellow PLC students aided me in my learning experience.
Strongly agree. Agree. Neutral. Disagree. Strongly disagree. Not applicable.
19 : 21, 16, 5, 1, 0, 2

20. Teaching other students helped me to learn the information more thoroughly.
Strongly agree. Agree. Neutral. Disagree. Strongly disagree. Not applicable.
20 : 22, 20, 1, 1, 0, 1

21. The PLA's aided in my learning experience.
Strongly agree. Agree. Neutral. Disagree. Strongly disagree.
21 : 9, 16, 16, 2, 2

22. I think it is important to obtain a foundation in calculus and physics before starting classes in my major.
Strongly agree. Agree. Neutral. Disagree. Strongly disagree.
22 : 22, 19, 4, 0, 0

23. I believe the PLC helped prepare me for the IQP, MQP, and/or Sufficiency.
Strongly agree. Agree. Neutral. Disagree. Strongly disagree.
23 : 15, 19, 9, 1, 1

24. PLC showed how fundamental classes relate to classes in my major.
Strongly agree. Agree. Neutral. Disagree. Strongly disagree.
24 : 8, 16, 18, 3, 0

25. The PLC illuminated the relationship between Math, Physics, and Humanities.
Strongly agree. Agree. Neutral. Disagree. Strongly disagree.
25 : 8, 23, 9, 5, 0

26. Goal quizzes aided in my ability to learn Calculus.
Strongly agree. Agree. Neutral. Disagree. Strongly disagree.
26 : 23, 20, 2, 0, 0

27. I think other WPI math classes should be taught in the same manner.
Yes. No. No opinion.
27 : 34, 2, 9

28. I believe the PLC teaches students in a manner that helps them retain knowledge for longer periods of time.
Strongly agree Agree. Neutral. Disagree. Strongly disagree.
28 : 15, 16, 12, 2, 0

29. The interactive environment of the classroom aided in my learning.
Strongly agree. Agree. Neutral. Disagree. Strongly disagree.
29 : 20, 21, 3, 1, 0

30. The transition back to the traditional WPI curriculum was not difficult.
Strongly agree. Agree. Neutral. Disagree. Strongly disagree.
30 : 4, 19, 10, 11, 1

31. I enjoyed the general humanities as opposed to one specific topic.
Strongly agree. Agree. Neutral. Disagree. Strongly disagree.
31 : 17, 16, 8, 3, 1

32. An applied, hands on supplement to the physics curriculum would have improved my understanding of the material.
Strongly agree. Agree. Neutral. Disagree. Strongly disagree.
32 : 13, 21, 10, 1, 0

33. A goal oriented structure, comparable to that of the calculus course, would have been helpful in learning physics.
Strongly agree. Agree. Neutral. Disagree. Strongly disagree.
33 : 12, 13, 18, 2, 0

34. Since completing the PLC program my level of academic performance has improved.
Strongly agree. Agree. Neutral. Disagree. Strongly disagree.
34 : 8, 16, 19, 2, 0

35. I think the PLC was right for me.
Strongly agree. Agree. Neutral. Disagree. Strongly disagree.
35 : 23, 15, 5, 1, 1

36. I enjoyed the overall PLC experience.
Strongly agree. Agree. Neutral. Disagree. Strongly disagree.
36 : 26, 13, 5, 0, 1

4.7.2 CLUSTER RESULTS OF ONLY FEMALES

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class year : 0, 0, 0, 0, 3, 2, 4
PLC year or section : 3, 2, 0, 4
majors : ECE, ME, EE, BE, EE/CS, CS, CH, MFE, PH, TPSC, MGE, CE, ME/FPE, IE
majors : 1, 2, 1, 1, 0, 0, 0, 0, 1, 0, 0, 1, 1, 1
Gender : 0, 9
Student Type : 6, 3
1 : 4, 4, 1, 0
2 : 8, 1, 0

3 : 5, 4
4 : 7, 1, 1
5 : 2, 4, 0, 1, 2
6 : 5, 3, 1
7 : 4, 5, 0
8 : 5, 1, 3
9 : 7, 2, 0
10 : 6, 1, 2, 0, 0
11 : 5, 4, 0, 0, 0
12 : 1, 4, 1, 1, 2
13 : 5, 2, 2, 0, 0
14 : 3, 3, 2, 0, 1
15 : 2, 6, 0, 1, 0
16 : 2, 1, 5, 1, 0
17 : 1, 6, 2, 0, 0
18 : 4, 4, 1, 0, 0
19 : 4, 3, 1, 0, 0, 1
20 : 6, 2, 0, 0, 0, 1
21 : 2, 4, 3, 0, 0
22 : 4, 4, 1, 0, 0
23 : 4, 2, 2, 1, 0
24 : 2, 1, 5, 1, 0
25 : 1, 5, 2, 1, 0
26 : 5, 3, 1, 0, 0
27 : 6, 1, 2
28 : 4, 2, 1, 2, 0
29 : 5, 2, 1, 1, 0
30 : 1, 4, 2, 1, 1
31 : 3, 2, 2, 2, 0
32 : 2, 4, 2, 1, 0
33 : 2, 3, 3, 1, 0
34 : 2, 1, 5, 1, 0
35 : 6, 0, 1, 1, 1
36 : 5, 1, 2, 0, 1

Chapter 5: Analysis of the Results

5.1: Analysis and Recommendation of the Learning Communities Section

Freshman Learning Communities (LC) are not just being implemented at Worcester Polytechnic Institute, but at undergraduate universities and colleges throughout the country. *US World and News Report* has even added the category of Learning Communities to its annual ranking of colleges and universities. Learning Communities have enabled a school to take a program, such as engineering, and update it to keep students motivated and interested in their studies. As an outcome, students do not only believe they have a better understanding of the concepts covered, they also understand how material from various courses is connected together, which aids the student when applying the material to real world situations. Learning Communities also ease the transition for high school to college. They make a big campus smaller by supplying mentor and tutors as well as other resources a student usually has to hunt down. Students are also placed with students who share the same interests so friendships and study groups are easily formed. Study groups not only enable a student to learn from another student at a level of peer understanding, but also allows a student to teach the material to another student solidifying the knowledge they have obtained. A Learning Community combines a student academic and social life allowing them to have fun while obtaining better study habits. Learning Communities also help students to form closer relationships with professors. They feel as though the professors expect a lot from them and in turn respect them. LC students do not hesitate to ask their professors a question, even if it is non-academic related. Project work also gives LC student the skills they need to work and cooperate within a group. Students also become more responsible for their own learning and learn to manage their time. Learning Communities have not just been shown to help a student academically and socially, but Learning Community students also have a higher overall satisfaction rate of their university or college.

A Learning Community can not just be planned and organized over a week or two and then expected to thrive. When beginning to plan an LC the first step to take is research and visit successful Learning Communities that are already established. Find out how the different programs are run, what they do that makes them unique, and ideas they tried to implement but were unsuccessful. With this knowledge a curriculum can be formed that will best suit your goals. Professors that are willing to try, and believe in this new approach must be obtained to lead the classrooms. They must encourage the environment of an open discussion classroom and be willing to get to know their students as well as be their mentors. Finally, in order to set the LC in action financial support needs to be acquired. This support cover resources, updating a website, assessment, tutors, and mentors
.

In order to make any Learning Community successful, administrative support much be obtained. Without a fair chance and full support no program will survive, especially a program like a LC that is reinventing the atmosphere in which a student learns. Another necessity is an Advisory Committee formed by representatives from all departments involved, Academic Administrators, Student Affairs, and open to faculty throughout the school. After the curriculum has been decided, a website must be formed or updated. In this age a website is the best and only way to inform students of possible opportunities. The Learning Community environment does not cater to everyone's needs. Through a website future students can learn if an LC is right for them. If a student is still interested, a description of the program, frequently asked questions, project descriptions, testimony from past students, and links can be easily found and understood. Another responsibility of the Advisory Committee is promoting awareness and knowledge of the program on campus. Hold an information lunch open to any student, professor, or school employee so they can be educated on how the LC works and the goals it hopes to reach. Through brochures, letters, or telephone calls alumni and other contributors to the university should be made aware of the program.

The final job of the Advisory Committee would be assessment of the Learning Community, which is very important for the long term success of a program. Assessment will show where the program is working and the areas it needs to improve. The positive feedback enables the LC to advertise its strong points so students who are interested in these aspects can apply to the program. Negative feedback will help the committee to reform the LC making it stronger. To evaluate the LC a control group must be formed consisting of student with similar SAT scores, high school rank, and course load. These students GPA's, year to year retention, and graduation rates will be followed and compared. A questionnaire is also given out to see how student felt about certain aspects of the program. For example, how much time was spent on class work, group study, and extracurricular activities? From these results the committee can find out if LC student participate in school activities, if they spend more or less time studying, and their overall satisfaction of the school. The committee can then take these results and see if the LC is helping student to achieve better grades using different study methods, studying more ore less, or just because they have a higher satisfaction rate with their environment. Finally, focus groups should be held so students can discuss their opinions in an open format. A facilitator will lead the discussion by asking students questions that inspire responses. The facilitator can ask various questions or just let the conversation lead itself. They then take a recording of the discussion and analyze it in a final report that is given to the Advisory Committee. This assessment along with the other forms described above help the Advisory Committee to understand what goals that have or have not been met. (See Appendix A for Quinn's question list)

The most important recommendation we have for the Project Based Learning Community (PLC) at WPI is an Advisory Committee must be formed. The first

job of the committee would be to spread CORRECT information about the PLC. Many students that never participated in the PLC are spreading information on to incoming freshman about how bad and useless the PLC is. These are the same students that don't understand the concept of Goal Quizzes and just assume that PLC students get an extra advantage by "retaking tests" until they are satisfied with their grade. An updated website must also be created giving incoming freshman ALL the information they need to make an informative position on wither the PLC is right for them. Also, information or presentations must be given to all students interested in the school or attending an open house. Most importantly the Advisory Committee would be responsible that the correct professors and curriculum are being used so that the full potential of a PLC experience can be reached.

Some other recommendations are for different types of PLC at WPI. One recommendation is for a Summer PLC. It should be offered to incoming freshman so they will receive a chance to meet people, become acquainted to the school, and learn about all that WPI has to offer. For example each day could cover possible studies or concentrations that WPI has to offer for students who are undecided. Another type of program could be a small Women Only program. As a woman at WPI it is hard to find women who share similar interests and studies. It is also a way for some women to achieve the confidence they need to propel them to excel in a school that is male dominated. Another type of program that could be implemented is a residential program. This type of program is very popular at other universities that have established Learning Communities. Students would study together as well as live on the same floor of a residence hall along with a mentor and tutor. This would go even further to combine a students social and academic lives. A community service PLC could also be offered so that students not only excel academically and socially but are also well rounded and active in the schools surrounding communities. A final recommendation for various different types of PLC is degree specific learning communities. For example students in the ECE department take one introduction course in both C and D term. This could be combined with humanities and math, either calculus 3 or 4, or differential equations and linear algebra for those who have completed calculus. Students will then create study groups they can use throughout their entire undergraduate career. They will also have a very concrete foundation for there knowledge to build on. The final recommendation to attract more students to the PLC is have guest speaker and field trips that pertain to material being covered.

5.1.1 Recommendation Outline

Things needed for successful LC program

- Administrative support
- Combination of academic and student affairs in implementation of program
- Financial support
- Updated informative website, brochure, etc...

- Research and visits of successful LC already established
- Knowledge of program throughout campus
- Advisory boards in some programs
- Mentors and tutors

Assessment is key to showing program works

- Matched with control group that has similar studies, sat scores, high school rank
- Compare GPA
- Year to year retention
- Time spent on class work
- Questionnaires
- Focus groups
- Annual enrollment
- Graduation rates

Outcomes of LC

- Form bridges between courses
- Make big school smaller
- Transition into college easier
- Develop better study habits (study groups)
- Combines academic and social life
- Better relationships with professors
- Project work and skills obtained
- Students more responsible for own learning

Possible implementation to PLC at WPI

- Guest speakers/ field trips
- Summer course offering intro level classes so entering students can become familiar with WPI
- Women's program
- Degree specific for example ECEs have two intro course in c and d terms which could be run with humanities and math , either calc 3 and 4 or differential equations and linear algebra for those who completed calculus
- An additional humanities class offered in C or D terms
- Residential program

5.2: Interactive Learning Analysis

It is clear that the present day undergraduate education system is stuck deeply within the rut of traditional lecture methods. Perhaps these methods were effective in early years of undergraduate education, where students were fewer in number and had a more genuine interest in learning. However, today, as enrollment increases, many aspects of student diversity are rapidly increasing. Most importantly, student learning styles, and educational goals have become widely expanded. For this reason traditional lecture methods are becoming less and less valuable to the present day student. To free itself from the lecture rut, undergraduate education must turn towards more interactive learning methods, much like those employed in the PLC, which cater to the modern day student.

First among these interactive methods is teaching with cases. Although it is more demanding of the teacher, many find teaching with cases a very stimulating and effective method. However, for this method to be successful every participant must become an involved learner. Those students who have avoidant learning styles would find it extremely difficult to participate, and would find it tough to benefit from this method. Yet, teaching with cases would still easily adapt to the PLC, as those with avoidant styles, through completing the online questionnaire, would be advised that the PLC may not suit them ideally. Therefore, to ensure the greatest benefit to the student, it is essential that a test is given to prospective students to ensure that their learning style is compatible with the interactive and integrated teaching styles of the PLC. Those students who are concrete, abstract, and active learners, in addition to those with competitive, collaborative, participant, dependent, and independent learning styles should be advised that they are suited for the PLC, as the PLC addresses aspects of all these styles.

Being an engineering school, reading, writing, time management and oral communication development are often considered unimportant among students. However, these are skills which become invaluable as one enters industry. For this reason the PLC includes, and should continue to expand and develop, an intensive reading, writing and discussion program. Much like the program outlined in "Humanities for Undergraduate Engineers: A Rich Paradox" the PLC curriculum includes activities which engage students in analytical reading, writing, and, most importantly, lecture free interactive discussion. Additionally, following the writings of Constance Staley, students are encouraged to work in groups, and make connections between course material. By expanding upon this part of the curriculum not only will students further hone essential skills, but they are encouraged to draw important connections between engineering and the ethic repercussions of engineering decisions. These are two things vital for the development of a well rounded engineering student, and should be further improved through the introduction of new PLC course material.

5.2.1 Recommendation Outline

The following recommendations are based on the above analysis and literary research.:

- Traditional lecture methods are becoming incompatible with the students of today.
    - Student enrollment is continuously increasing.
    - Diversity in learning styles and educational goals are growing.
- Interactive leaning methods cater to the modern day student, and thus the PLC must continue to, and expand upon, its use of the following methods.
    - Teaching with cases.
        - Although more demanding of the instructor, teaching with cases is an effective and stimulating method.
        - Requires each participant to become an involved learner.
            - Avoidant learning styles would not fully benefit from the effectiveness of this approach, and thus avoidant learners may be more suited for another environment.
                - Online self test is required to inform incompatible learners of this possibility.
            - Easily adaptable to the PLC
    - Analytical reading, writing, and interactive discussion.
        - Sharpens essential skills
        - Helps draw valuable connections between subjects.
        - Facilitates the development of a well rounded student

5.3: Reform in Education Analysis & Recommendations

This analysis flows from all research done in chapter two of this paper. According to the literary research done in the area of reform in education, there are many changes that must be implemented within the freshman year alone, especially among engineering institutions.

As research indicates, the freshman year is of the most importance to a student, yet it has gone without pedagogical change for centuries. The freshman year is of such importance because it is the transition period of social and academic standings. In current models of education, these transitions are sought to be eased by study groups, extra curricular activities, professorial advising, and tutors. The current model, however, is most often the least satisfactory in terms of curriculum, concept, and pedagogy; which are the same terms by which institutions are judged to be superior to one another.

The aforementioned issues can be boiled to two points within the freshman education: the student – student relationship, and the student – faculty

relationship. The student-faculty relationship has been shown to have a direct effect on a student's GPA, degree attainment, prospective enrollment in graduate studies, all areas of self-assessed intellectual and personal growth, satisfaction with the quality of instruction, and the decision to choose a career in college teaching. The student-student relationship has been shown to have a direct effect on student GPA, graduation with honors, analytical and problem solving skills, preparation for graduate studies, leadership ability, public speaking skills, interpersonal skills, and general knowledge.

5.3.1 Recommendation Outline

The following recommendations are based on the above analysis and literary research:

- The freshman year must be redesigned for maximum benefit of the previously mentioned student needs.
    - The first year should consist of small groups of students taught by experienced faculty (Learning Communities).
        - Working in small groups will give the students more direct faculty time, relation, and ultimately trust.
        - Small groups more effectively use faculty time.
        - Small groups teach students to work in harmony and peer scrutiny, and increase knowledge depth as well as retention rates.
    - Students should work on topics that allow learning by inquiry in the collaborative ambience.
        - Courses must have a higher degree of interconnectedness.
        - Courses must require a high degree of written and communication projects.
    - Faculty should engage students within the teacher's interested areas, then allow interested students to come along side the faculty through more interpersonal learning, not lectures.
        - Students should learn to develop interests driven by their own questions, not assigned questions.
        - Students will then foster a better sense of community and relation to the professor.
- WPI must accept and desire that there is a need to change.
    - Staff must see the need for change in order to want to implement change.
    - Professors must be excited about teaching and cohesive with one another.
    - A visionary leader must be selected to lead the reform and be aware of what changes are being implemented by other successful schools.

5.4: Analysis and Recommendation of the Paula Quinn Report

Project-Based Learning Community (PLC), previously known as the Davis Tutorial, was initially started in A- and B-term of academic year 00-01. Since then three more PLC sections were successfully completed during the first semester of each academic year (1 in AY 01-02, and 2 in AY 02-03). The WPI administration hired Paula Quinn to assess the performance of all learning communities. Quinn assessment involved a focus group, a survey comparison of PLC students and control students, and a GPA comparison of PLC and control students. A summary of the Paula Quinn Report was presented in the Results Chapter.

Results from the Paula Quinn focus group results show that almost all students who took part in PLC program had an overwhelmingly positive response about their experiences in the program. According to the students who participated in the focus group, PLC aided them in easier transition from high school to college. They also agreed that PLC emphasized them on learning as opposed to performing in a test. Students who participated in PLC welcomed the interactive approach of the program as opposed to the traditional lecture based classes. One of the main objectives of PLC was to link all courses the students were taking while they were in the program. Students from each PLC section agreed that they developed a better understanding of how issues are interrelated. With regular projects, reading assignments, writing assignments, and other homework, PLC students liked the challenging environment that they worked in. PLC provided the students with a family-like setting and a home base where resources and other students are always available, making their freshmen year at WPI more comfortable.

PLC students had a bond amongst themselves that even lasts while they were in the traditional classes. PLC offered students to work in groups, create presentation, observe and critique each other's presentation, and opportunities to learn from each other. Students in PLC were required to be self-motivated while working on team-based and problem-focused projects. PLC prepared the students to work in groups that they would be expected to do in their professional lives. Students recognized the skills they needed for good teamwork and project work, and they respected their teamwork. PLC students enjoyed working with their professors, which provided them an opportunity to get to know each other. The students also appreciated the extensive one-on-one time with the professors. Students believed that PLC's success was grounded in the design of the program and the personal commitment of the professors involved with program.

The GPA analysis of PLC students and their control groups did not reveal any significant difference. However, the analyses for the AY 00-01 PLC did reveal that during B- and C-term, PLC students evidenced higher GPAs of .5 points higher and .6 points higher respectively, and the t-test were approaching significance for both terms. More fine-grained analyses, using *t*-tests, for the

introductory Calculus and the introductory Physics courses revealed a highly significant difference between PLC students and their controls for Physics in B-term with a final grade of .9 points higher than the control group.

Statistically significant differences related to academic performance for students who were involved in the innovative PLC program for AY 01-02 and their respective controls were found for mean GPA for A-term. Other significant statistical differences were not detected for any other term in AY 01-02 nor were they detected for cumulative terms AB or CD or for the overall academic year. In B term and A&B-term combined, PLC students mean GPAs were higher (although not significantly) than their control counterparts. The GPA analyses for the AY 02-03 PLC sections are not done yet. The GPA analyses suggest that PLC students are not disadvantaged academically by the innovative educational experience and they do not appear significantly different than their control peers.

A pre intervention and a post intervention survey were given to AY 01-02 and AY 02-03 PLC students and their control groups to further assess PLC. The analyses for this study involved not only examining differences between the experimental group and the control group on both the pre- and post-surveys, but also examining changes within each group between the pre- and post-surveys. During AY 02-03, the survey results were also used to examine differences between both PLC section 1 and PLC section 2.

The analyses done on the pre and post survey revealed that PLC students successfully achieved almost all goals of PLC. Compared to the control group, PLC students promote the benefits of interdisciplinary study, promote and help students develop strong communication skills, promote and help students develop good problem solving skills, and encourage positive attitude towards teamwork. The data from the survey indicate that the group project approach of PLC was key to the success of the program. The interdisciplinary nature of the projects that are done in PLC required the students to conduct research, contact experts in various project topic fields, writing reports, giving oral presentations in front of an audience, and working as a member of a project team. In no instance did PLC program have an effect on the students that was contrary to the program's intentions. Survey responses reveal that the control students did not made more progress than PLC students had made in any particular area and in no instance did the Control students' survey responses indicate that they held attitudes that were more in line with the goals of PLC program than PLC students' attitudes were. In almost all aspects of the survey PLC students were able to agree more positively than their counterparts on issues pertaining overall progress in academics and social life on campus. Paula Quinn's explanation for this positive reaction is that PLC students had worked in both PLC and traditional classroom environments and, through benefit of contrast, they were able to see how flexible PLC was when compared to the traditional classroom, and see how that flexibility had assisted them in their work.

Paula Quinn report shows positive results from the student focus groups, pre intervention and post intervention survey, and GPA analysis. Most of the students who attended the focus group had positive feedbacks on their respective PLC section. The survey results show that PLC students agree more strongly than their control students that the main goals of PLC program are important and they have claimed more strongly than the control students on achieving most of these goals set forth by PLC. The GPA analysis shows that PLC students tend to perform better (close to statistical significance) than their control groups while they were in PLC program. According to Quinn almost all students who participated in PLC program enjoyed the environment. Paula Quinn believes that the voluntary nature of the program was its success. The students self selected themselves into the program and they had the same goals as of the program. Quinn report also revels that the nature of PLC may not fit all students. However, the students who attended the focus group suggested widening PLC to include other courses like chemistry, calculus 3, Biology and many other courses and even expanding the program to the whole freshman class. According to the Quinn report, Project-Based Learning Community was successful, and it is recommended that further funding and expansion of the program is worth it.

5.4.1 Recommendation Outline

- Clearly explain the goals of the program to the students before enrollment.
    - Students might have different goals or different learning styles.
- Students should voluntarily select themselves into the program.
    - Quinn report shows that not all students are fit for the program.
    - Most of the students who had negative views of PLC were forced to take PLC classes because all other traditional classes were closed or they had conflict in the schedule for taking those classes.
- Include more courses like chemistry, and biology for the freshman year.
- Further funding and expansion of the program.

5.5: Analysis and Recommendations of the PLC Survey

The following is a summation of the survey results we compiled. We analyzed the data question for question and will begin by summarizing the best and worst points of what we observed. Secondly we will observe the female portion of the results. The PLC has been seen to have a stronger female appeal from our general conversations with several female participants. Compared to the male to female ratio of the total WPI student body, the PLC has also been shown to have a slightly greater percentage. For these reasons we feel it is important to take a look at how this portion of the population responded to the survey we administered. Lastly we will attempt to conclude on our findings and gather recommendations based on how the respondents felt about the PLC.

5.5.1 Strong Areas

The survey results suggest that the PLC has been doing a fairly complete job of accomplishing the goals the program set out to achieve. Despite the mainly positive results only 23 of the 36 questions came out over 75% positive. The following are some of the strongest responses we received.

Every respondent to the survey either strongly agreed or agree that a closer relationship to their professor helps students to do better in the course. 91% of the respondents made contact with a PLC professor for one reason or another after leaving the program to start traditional classes. The results also showed strong results on the role a professor's expectations play on the student's performance, and the ease of forming a good student/teacher relationship in the PLC as opposed to traditional classes. These results show that the role the professors in the PLC have been playing is preferable to the role professors in traditional classes play from the student's perspective. This is one of the many goals of the PLC, to further interaction between the professors and students to achieve a single goal of learning and doing well.

The results of the survey show that PLC students generally like the format of the calculus portion of the curriculum. 91% of the respondents feel they would need a strong background in both calculus and physics. 96% said they either strongly agreed or agree that the goal quizzes aided in their ability to learn and do well in their calculus courses in the PLC. 76% even agreed that other math classes at WPI should be taught in the same manner.

One of the many goals of the PLC is to create a learning environment that is productive for learning. The survey results suggest it does just that. On top of the student/professor relations we already discussed, students felt that the environment and resources at their disposal aided in their learning. 91% of the respondents either strongly agreed or agreed that the interactive environment in the classroom aided in their learning.

As you can see, there are many ways in which the PLC helps students learn and enjoy the experience in the process. One of the most telling results of the survey come from the end. 84% of the respondents either strongly agree or agree that the PLC was right for them and 87% responded that they enjoyed the overall experience. That is a very strong and positive result.

5.5.2 Weak Areas

Unfortunately the survey reveals several points where the PLC failed to achieve some of its goals. Despite failures, none of the results was more than 50% negative, and in many of the less positive results, there is a large neutral portion. The following summarizes the weak areas of the survey results.

One the less positive areas was centered around the improvement of certain skills the PLC is designed to help students hone. 45% of the respondents were neutral or did not agree that the PLC helped improve their writing and problem solving skills. 49% responded neutral or did not agree that the PLC improved their time management skills.

Another area that the PLC is designed to help improve for students is their understanding of basic core materials in science and engineering. 46% of the respondents weren't positive about the PLCs affects on showing the way that fundamental classes relate to their major, with 40% neutral in this case. 31% of the respondents said that they didn't think the PLC helped to illuminate the relationship between Math, Physics and Humanities.

The program also received weaker results on the organization of some portions of the curriculum. For example 45% were either neutral or did not agree that the goal-oriented structure of the calculus class should be applied to the physics class. Their data could entail a general malaise about the physics portion, though, since the same respondents seemed to think the goal-oriented structure was beneficial to their learning. 44% responded that the PLAs the PLC had to help with homework and conference were not necessarily beneficial. For this question 36% responded neutral.

From these results we can see that there was much less negative feedback about the program than there is positive. More than half of the respondents were in the positive area on every question and the far greater majority were between neutral and positive. This entails a generally positive result from the people who responded to our survey.

5.5.3 A Look at the Female Responses

We decided it would be pertinent to observe the female portion of the population for reason stated previously. The following is a quick summary of the result from this portion of the data. Half of the four people who professed to never contact a professor after leaving the PLC were female. The only respondents to strongly

disagree or disagree with the PLC being right for them were female. In several instances one female response was very negative about the PLC. Since there were only 9 female responses to the survey, this one decidedly negative vote shows through dramatically in the data. Although the PLC seems to have been good for many females it is not right for all of them. Despite a few irregularities, in general it is obvious the female results correspond with the trends of the whole population.

5.5.4 Recommendation Outline

Strong Areas

- Advisors seemed mostly aware
- 84% of PLC students had an easier time forming study groups in the PLC than in traditional classes
- 76% had those study groups persist after the program
- 76% formed better relations with professors in the PLC than in regular classes
- 91% of PLC students made contact with a professor after leaving the program for some reason or another.
- 80% said the PLC format makes the subject matter more interesting
- 100% either strongly agree or agree that a closer relationship with a professor helps a student to better in the course.
- 86% either strongly agree or agree that the PLC had a positive affect on their group skills
- 80% either strongly agree or agree that the PLC helped ease the transition into college
- 87% either strongly agree or agree that their presentation skills were improved as a result of being in the PLC
- 78% either strongly agree or agree that higher professor expectations directly relate to a student's performance.
- 93% either strongly agree or agree that the extra resources of the PLC helped them in their learning experience
- 82% either strongly agree or agree that learning from other students helped them I their learning experience.
- 93% either strongly agree or agree that teaching other students helped them learn information more thoroughly
- 91% either strongly agree or agree that it is important to get a foundation in calculus and physics
- 80% either strongly agree or agree that the PLC helped prepare them for further projects such as the MQP and IQP.
- 96% either strongly agree or agree that the goal quizzes helped them learn calculus.
- 76% said they thought other math classes at WPI should be taught I the same manner.

- 91% either strongly agree or agree that the interactive environment of the classroom aided in their learning
- 73% either strongly agree or agree that they enjoyed the general humanities class.
- 76% either strongly agree or agree that an applied supplement to the physics curriculum would help them understand the material.
- 84% either strongly agree or agree that the PLC was right for them
- 87% either strongly agree or agree that they enjoyed the overall experience

Weak Areas

- 55% said writing and problem solving skills were improved more in the PLC than in traditional classes.
- 51% either strongly agree or agree that the transition back to traditional classes was not difficult.
- 55% either strongly agree or agree that the goal oriented structure of the calculus course would be well applied to the physics course as well. 40% were neutral.
- 53% either strongly agree or agree that that their academic performance has improved since the PLC. 42% were neutral
- 54% either strongly agree or agree that the PLC showed how fundamental classes relate to their major. 40% were neutral
- 69% either strongly agree or agree that the PLC illuminated the relationship between Math, Physics and Humanities. 51% of total agreed, meaning 74% of the positive responses were between strongly agree and neutral.
- 56% either strongly agree or agree that the PLAs helped them learn. 36% were neutral.
- 51% said time management skills were improved more in the PLC.
- 62% said they feel a closer relationship to a professor helps them feel connected to the school.
- 53% either strongly agree or agree that the PLC helped them how to apply what they learn to real life situations. 38% were neutral
- 69% either strongly agree or agree that the PLC teaches them in a manner that helps them retain information longer. 27% were neutral

Bullets on just females

- The only respondents to strongly disagree or disagree with the PLC being right for them were female.
- Half of the 4 people to never contact a PLC professor after leaving the program were female.
- The only respondent to strongly disagree that the PLC helped them transition into traditional classes was female.

- The only respondent to strongly disagree that the transition into the WPI curriculum was not difficult was female.
- The only respondent to strongly disagree that they enjoyed the PLC experience was female.

5.6: Overall Recommendations for PLC at WPI

Reasons to support and grow a learning community:

- Forms bridges between courses
- Makes a big school smaller
- Makes transitions into college easier for Freshmen
- Develops better study habits (study groups)
- Combines academic and social life
- Builds better relationships with professors
- Emphasizes project work and group skills
- Students are more responsible for own learning
- Traditional lecture methods are becoming incompatible with the students of today.
    - Student enrollment is continuously increasing.
    - Diversity in learning styles and educational goals are growing.

Things needed for any successful LC program:

- Administrative support
- Combination of academic and student affairs in implementation of program
- Financial support
- Updated informative website, brochure, etc...
- Research and visits of successful LC already established
- Knowledge of program throughout campus
- Advisory boards in some programs
- Mentors and tutors
- Analytical reading, writing, and interactive discussion.
    - Sharpens essential skills
    - Helps draw valuable connections between subjects.
    - Facilitates the development of a well rounded student
- The first year should consist of small groups of students taught by experienced faculty (Learning Communities).
    - Working in small groups will give the students more direct faculty time, relation, and ultimately trust.
    - Small groups more effectively use faculty time.

    - Small groups teach students to work in harmony and peer scrutiny, and increase knowledge depth as well as retention rates.
- Students should work on topics that allow learning by inquiry in the collaborative ambience.
- Courses must have a higher degree of interconnectedness.
- Courses must require a high degree of written and communication projects.
- Faculty should engage students within the teacher's interested areas, then allow interested students to come along side the faculty through more interpersonal learning, not lectures.
    - Students should learn to develop interests driven by their own questions, not assigned questions.
    - Students will then foster a better sense of community and relation to the professor.

Implementations for PLC to grow at WPI:

- Further funding and expansion of the program.
- Clearly explain the goals of the program to the students before enrollment.
    - Students might have different goals or different learning styles.
- Students should voluntarily select themselves into the program.
    - Quinn report shows that not all students are fit for the program.
    - Avoidant learning styles would not fully benefit from the effectiveness of this approach, and thus avoidant learners may be more suited for another environment.
    - Most of the students who had negative views of PLC were forced to take PLC classes because all other traditional classes were closed or they had conflict in the schedule for taking those classes.

- WPI must accept and desire that there is a need to change.
    - Staff must see the need for change in order to want to implement change.
    - Professors must be excited about teaching and cohesive with one another.
    - A visionary leader must be selected to lead the reform and be aware of what changes are being implemented by other successful schools.

- Summer course offering intro level classes so entering students can become familiar with WPI
- Degree specific for example ECEs have two intro course in c and d terms which could be run with humanities and math , either calc 3 and 4 or differential equations and linear algebra for those who completed calculus
- An additional humanities class offered in C or D terms
- Residential program and/or Women's program
- Teaching with cases.

- Create an Advisory Council of former students and outside faculty to suggest improvements.
    - Although more demanding of the instructor, teaching with cases is an effective and stimulating method.
    - Requires each participant to become an involved learner.
- Online self test is required to inform incompatible learners of this possibility.

Assessment is key to realizing that the program works:

- Matched with control group that has similar studies, sat scores, high school rank
- Compare GPA
- Year to year retention
- Time spent on class work
- Questionnaires
- Focus groups
- Annual enrollment
- Graduation rates

Appendix A: Collection of Referenced Articles

Teaching with Cases

For many instructors, teaching with cases is new. Most teachers find it to be one of the most effective and exciting ways to teach. Cases allow instructors to take students to the highest levels of Bloom's Taxonomy. Thus, cases allow us to fully prepare students for the rigors of college learning.

Like most things in life that have value, case teaching is more difficult and demanding of the teacher. You must come to class well prepared. You must know the major teaching points to be covered that day and how they fit into the overall teaching objectives of the course. You must also be prepared to keep the discussion from straying away from these teaching points, but you cannot control it. The best analogy is you are like the walls on a handball court. You allow the discussion to go wherever its wants to go, but you keep it within the court.

A good way to approach the teaching of the cases in this book is to do the following:

- Have students read the chapter (including the case study) and complete all the active learning exercises before coming to class. They can hand these into the teacher at the start of class. This insures that everyone is fully prepared for class before it starts.
- Ask someone in the class or a member of the presenting team to break the class into teams of 2-4 students (hum groups) to discuss what is the big point of the case (5 minutes). Sometimes the key point of the case is easy to identify. In others, there could be many issues.
- After a few minutes (5 minutes) of discussion, ask each team to tell you what they feel the problems are and why they feel it is a problem.
- Allow a few minutes (5-10 minutes) for the class to reach a consensus about what the problems are. Write them on the board. Use student words, not your words. Whenever possible, get everyone involved.
- Put the class back into the original small teams and allow them a few minutes (10 minutes) to develop solutions to the problems.
- Ask each team to tell the leader what their solution is and why they think it is best (5 minutes).
- Once the class reaches a consensus about what is the best solution (and there can be more than one) draw the teaching points out of the solution (5-7 minutes). For example, the case could involve a student who is so tired he cannot do well in school. The teaching points can be the need for better time management techniques such as studying during the day. You can also relate this problem to the importance that adequate sleep plays in personal health and classroom performance.
- The teaching points should be clearly defined at the end of class and written on the board. This makes sure that everyone knows what the learning objective is. By writing it down and talking about it is more likely to be remembered. It also reinforces the idea that cases are not just frivolous exercises done to fill the class period. There is something to be learned here. It also gives you a chance to link various student success topics such as time management and personal health.
- Have students put their comments on the case, its solutions, and their feelings about what was done into their journal. They can submit these to you the day after the class or before the next class. This makes the student reflect on what they learned and integrate it into their prior knowledge base. This makes the students think about the links between today's material and the rest of the course (i.e., everyone must be an active learner, and operate at the higher levels of Bloom's Taxonomy).

Case Study ~ Dad Wants Me to Be a Scientist

Jennifer always said she wanted to be a scientist, may be a medical doctor but possibly a researcher in a laboratory in private industry like the big pharmaceutical company where her father worked. Her first semester in college focused on calculus, chemistry and biology and political science. By the end of her first semester she felt uncomfortable with the sciences while earning less than the A grades she always earned in high school. In fact, a C+ grade point average at the end of her first semester suggested to Jennifer she should eliminate any future career in the scientific community. The A grade she received in political science suggested she should move into the social sciences for a major.

After Jennifer spoke with her father about her reluctance to pursue a degree in one of the sciences, his stern response about not quitting her long-time goal to be a scientist confused Jennifer about her own feelings. Her homemaker mother encouraged her to make up her own mind without feeling pressured by others to decide about a major or future career. During next summer's vacation, Jennifer planned on working as a waitress in a restaurant in her hometown so she could think about choosing a major. She thought earning money was extremely important for financing her extra expenses for the fall semester. She believed her parent's generosity to pay for her tuition, room/board and books should not include her extra expenses like movies, pizza and football games. Clueless about a major, Jennifer planned to return to college in the fall when she would decide about a major.

Is Jennifer making a good decision about waiting to decide about a major or a career?

What should she do to discover a major?

Case Study
Angela's Angst

It was just after 11:00 p.m. when Julie opened the door to her dorm room and turned on the light. She was surprised to find Angela, her roommate, sitting in the dark. Julie knew Angela seemed down the last couple of days. Both of them had struggled with their first round of tests this semester, but Angela had taken their mediocre grades very hard. Julie had tried to tell her that they were not that bad for a first semester student. All Angela kept saying is: "What will my parents say when they see these horrible grades? I know I have disappointed them. I will never get into a good law school now. What am I going to do?"

As she tried to console her roommate, Julie thought about what Angela had told her about her background in the few weeks they had lived together. Angela is the oldest of three children and the first member of her family to attend college. Her younger brothers, Matt and Jason, are going to follow her to college and major in engineering. Her father made that very clear when they moved Angela into the dorm. In the first week of the semester Julie sensed that Angela was really enjoying college but as time went on she felt that her enjoyment came more from the relief of being on her own. During high school, Angela's mother got her up at 6:00 a.m. so she could practice the piano for an hour before school. They expected her to come directly home after school to keep an eye on her brothers, except on days when she had marching band practice. She played the clarinet. She once confided to Julie that she always did what her parents told her to and even followed their recommendation on whom to vote for in this year's presidential election.

College was nothing like Angela thought it was going to be. She had trouble seeing how Introduction to Political Science could lead her to a good law school despite what her mother had told her. In fact, she had come to this school because of the reputation of its political science program. Her father said it was one of the best in the country.

As Angela began to open up to her roommate, she told Julie what had caused her to feel so depressed tonight. Today's political science class was about the death penalty. When her professor had found out that she wanted to be a lawyer, he asked her if she were a prosecuting attorney could she recommend that someone be put to death? She was not sure she could do that. It was then that the whole idea of being a lawyer began to feel like a bad decision. It had always been her parent's dream to have a lawyer in the family. She had trouble seeing herself in college for another seven years. As she began to search her soul, she was not sure she even wanted to be in college. As the idea of being a lawyer began to fade, she realized she really had no idea of what she wanted to do with her life.

Angela looked at Julie and asked her what she thought she should do. If you were Julie what would you say to her?

Case Study ~ Chris and Sherry's Different Worlds

Their mother was beaming as she watched her two children head off to school together. It was a sight she never thought she would see again since her son Chris was now 23. When he finished high school he wanted nothing else to do with school ever again. Chris wanted to get out of town and see the world. The navy offered him a great program in nuclear engineering technology and off he went for the next four years. He mother noticed a real maturing in him during the past two years. During one of his last leaves he and his sister Sherry had a long talk about her plans to attend the state university a few miles from home. Sherry had always been a top student and never once doubted she would attend college.

The more Chris listened to Sherry the more he began to think about attending college. During his navy days he had many hours to think about where his life was going and what he want to do. Chris enjoyed his job and was very good at it. In many areas he knew as much or more about what was going on than some of the officers who had college degrees in engineering. When he found time he would read his technical manuals so that he could understand how all these systems worked. He decided to leave the navy because he wanted to do more than just be a technician, but he was not sure just what he wanted to do. After seeing how excited Sherry was about going to college, he began to look seriously into it for himself.

After his discharge from the navy in March, Chris drove over to the school and talked with an admissions counselor, and was soon thinking about a degree in engineering. The idea of going to school at his age seemed kind of strange. Guys his age should be done with school and starting off on a career. Besides, he would be a fellow freshman with his baby sister. This was strange. Chris worried that he would be too old to fit in with a bunch of 18 year olds. How would he ever get back to taking tests and studying again. The admissions counselor had told Chris about a freshman seminar that touched on all of these things. Sherry had said she was going to take it. In the end, Chris decided that college was as good as anyplace for right now and enrolled for the fall semester. He even signed up for the same section of the freshman seminar as his sister did. Chris still had trouble seeing how this course could help an older guy like him and an 18 freshman coming straight out of high school. Even though their mother loved the idea of her two kids going off to school together, Chris still felt weird about being in class his sister.

What do you think Chris wants to do with his life? Is college a good place to find out? Would the freshman seminar, such as the one outlined in this book, be of value to him and his sister? How? Is Chris too old to be in college?

Case: Jennifer's Big Time Dilemma

It was just after 4:00 p.m. on a beautiful Friday afternoon as Jennifer was walking back from her last class. The first full week of classes had just ended and she was looking forward to having some time to catch up on her sleep and a do a little partying this weekend.

Jen felt making freshmen take all the early classes was unfair. The upperclassmen did not have classes until 11:00 a.m. She had been up to at least 2:00 a.m. every night this week and she was already behind in several of her courses. If she could not keep up in the first week, how would she make it through the semester?

Being able to sleep the weekend away seemed like a great way to catch up on her rest so she would have the energy to bring her work up to date. Jennifer did not have to be at work in the library until 1:00 p.m. on Saturday. She felt fortunate to have found a job there for 10 hours a week during the school year. The money she earned from this job covered her laundry and other incidental expenses during the week.

As she walked along, she started thinking about all the things that her professors had assigned this semester. It seemed as though each professor thought their course was the only one she was taking. Didn't they realize that she was carrying 16 credits this semester and that included a biology lab every Tuesday afternoon? Jennifer's history professor assigned at least 300 pages of reading each week. She had to write a term paper that was one third of her grade but it was not due the last week of the semester. The economics course did not require much reading but it sure took a lot of time to figure out what was going on. Fortunately, Jen had good English teachers in high school who stressed writing skills so she would not have too much trouble writing the five page paper due each Friday in her freshman composition course. Some topics looked like they could be fun. Because she had done well on the placement test, Jen skipped French I and enrolled in French II. One semester of a language and she would be finished with this graduation requirement. The only problem with the course was that it had a huge vocabulary to learn during the semester and the professor gives periodic quizzes to measure her mastery of all these new words.

As she reflected on all this work, Jennifer felt overwhelmed and frustrated. It seemed there would not be time for anything but school and work. Wasn't college supposed to be fun? She remembered how refreshed she felt after her aerobics classes when she was in high school. How would she find time for something like this when there was not enough time to get her school work done. She brought her aerobics clothes with her to school, but they were still in a gym bag in the back of her closet.

In high school, she never studied any more than 90 minutes a night and she did very well and still had time for lots of other things. College was not turning out at all like she thought it would. When Jen reached her dorm, she sat on the bench outside to soak up some sun and to think about how she could overcome her big time dilemma.

If Jennifer asked you for some advice on how to overcome her time dilemma, what would you tell her?

Presentation for Worcester Polytechnic Institute
January 16, 2003

Teaching & Learning: It's A Matter of STYLE!!!

Donna M. Qualters
Northeastern University

Discovering My Own Learning Style Preferences

Respond to the following questions in order o your preferences:
1 = First choice, 2 = Second choice, 3 = Third choice, etc.

1. You have heard about a new teaching method. You prefer to:

( ) Read an article assessing method

( ) Talk with a colleague who has tried it

( ) Attend a lecture on "New Approaches to Education"

2. You want to improve your ability to assess student learning. You prefer to:

( ) Attend a lecture/slide presentation about assessment

( ) Participate in a hands-on workshop on assessment

( ) Watch an expert colleague do assessment

3. You need to be able to access the new computer system that you department will soon be installing. You prefer to:

( ) Read the manual

( ) Spend the weekend after it's installed figuring it out

( ) Attend an ongoing workshop series

( ) Watch a demonstration

( ) Spend the first month paired with a colleague who is familiar with this program

4. Your student population is now 30% international. You would like to learn enough Spanish to speak a little to students in their native language. You prefer to:

( ) Enroll in a once-a-week Spanish course at the school

( ) Buy "Learn to Speak Spanish" tapes for the car

( ) Use a "Spanish for Dummies" program for your home personal computer

( ) Ask your Spanish-speaking colleague to work with you

5. You're given a once in a lifetime opportunity to schedule your class. To be at your best, you schedule it for:

( ) 7 a.m.

( ) 12 noon, before lunch

( ) 1:30, after lunch

( ) last class of the day

6. For this class you prefer to:

( ) Design your own syllabus

( ) Look at the syllabus of another person who has taught the class

( ) Go on the web and copy one

7. To do your best, you would:

( ) Complete the course a week before you start

( ) Complete the course as you go along

( ) Outline the course in your head, but not prepare in a formal manner

8. The Graduate Record Exams are in June. Do you:

( ) Study independently

( ) Join a study group for most of your studying

( ) Study partly in groups and partly on your own

Learning Styles Preferences

Definition

Learning Style:	A person's preferred method of receiving, processing, storing and expressing information. Learning style also includes preferences for rate of learning, social conditions and incentives.

Learning styles vary on the following dimensions:

Receiving:	The ability to gather information by using visual, aural, spacial and manipulative.
Processing:	the ability to incorporate new data into existing knowledge, to classify and categorize, to make connections, to tolerate ambiguity.
Storing:	the effectiveness of short and long term memory; the strategies used for memory storage and retrieval.
Expressing:	the ability to use different modes for expressing information, e.g., written, oral, or manipulative.
Rate:	the preference for a reflective, thoughtful speed or a get-the-information-quickly-and-let's-get-going speed.
Social conditions:	the preference for learning independently or collaboratively; the ability to stay focused on a task despite interpersonal interactions.
Incentives:	the motivational factors which encourage learning, e.g., praise, grades, money, perfectionism.

Parallels with Teaching Styles

- There are NO right or wrong learning styles!
- We tend to have an overall style preference.
- We may vary our preference over time and for different subjects.
- Sometimes educational objectives dictate the most effective learning style preference.

- Sometimes circumstances/environment dictate the most effective learning style preference.
- Effective learners are able to adapt to the style that the learning situation requires.
- Teachers should help students develop flexibility in using learning styles.

Learning Style Preference Inventories: The Literature

There have been several accepted and validated conceptions of learning style preferences. Different conceptions are not mutually exclusive. Some conceptions may seem more relevant to you than others. Some may have no practical application to the learning tasks you are teaching.

Learners are not absolutely fixed on any one dimension; rather, they score somewhere on the dimension. It is important to encourage flexibility.

Field Dependent vs. Field Independent (Witkin and Goodenough)

A **Field Independent** style can organize, analyze and reorganize information. They are more abstract and impersonal, and are better at traditional learning tasks such as reading and factual recall. Radiologists and surgeons test high in field independence.

A **Field Dependent** style can indicate strong interpersonal and communication skills; greater interest in others; is better at working collaboratively; prefers discussion; and invites collaborative problem solving. Internists and psychiatrists were found to be significantly more field dependent.

The Four-Dimension Experiential Inventory (Kolb)

A **Concrete Learner** receives information best by getting involved and participating in experiences; has strong feelings; and relies on his/her senses, e.g., what is seen, or heard.

An **Abstract Learner** receives information best by carefully analyzing and evaluating ideas or symbols; is rational and relies on logical thinking.

A **Reflective Learner** processes information best by watching and listening; is careful; takes time to look at all sides of an issue;.

An **Active learner** processes information best by actively trying things out; wants to see the results of their work in a practical way.

Grasha-Riechmann Learning Styles

Competitive: Learns material to perform better than others. Wants to be recognized as a "star" and likes to be the center of attention. The competitive learner tends to be motivated by rewards of recognition. Prefers teaching methods that are lecture oriented and teacher centered.

Collaborative: Appreciates learning b y sharing ideas and talents with others. Likes to work closely with preceptor. Learns best when there is give and take during the learning process. Particularly enjoys discussions and projects where all concerned are trying to reach agreement about medical issues. Prefers case studies, role plays, small groups, and team projects.

Avoidant: The avoidant learner is withdrawn and disengaged during the learning process. Tends to be uninterested in or overwhelmed by the learning process. Not Enthusiastic about the educational process or required medical activities. Feeling inadequate and his/her knowledge and skill, fearing failure, and potentially receiving harsh evaluations contribute to the avoidant style. Indifferent to the preceptor's choice of teaching methods.

Participant: Finds learning enjoyable and takes responsibility for getting the most out of any medical situation. Is energetic and enthusiastic about the learning process and tends to express excitement to preceptor. Eagerly attends and is generally a "good citizen" who takes initiative and responsibility. Appreciates all teaching methods used by the preceptor.

Dependent: Relies on authority, structure, and guidelines for how to function. Wants preceptor to provide parameters for his/her behavior. Tends to seek specific answers and direction rather than formulating independent ideas and approaches to patient care. Typically shows little intellectual curiosity and learns only what's required. Prefers didactic, lecture-oriented, and teacher centered methods.

Independent: Has a strong need to learn for themselves rather than depending on the preceptor. Likes to think for his/her self and is confident in learning abilities. Often goes beyond what is required, to learn what he/she believes is important. Takes initiative and responsibility as a learner and because of tendency for self-exploration often develops breadth and depth of information in ways that learners with other preferred styles may not. Prefers independent projects, guided readings, and problem based learning.

Learning Styles

This chart helps you determine your learning style; read the word in the left column and then answer the questions in the successive three columns to see how you respond to each situation. Your answers may fall into all three columns, but one column will likely contain the most answers. The dominant column indicates your primary learning style.

When you..	Visual	Auditory	Kinesthetic & Tactile
Spell	Do you try to see the word?	Do you sound out the word or use a phonetic approach?	Do you write the word down to find if it feels right?
Talk	Do you sparingly but dislike listening for too long? Do you favor words such as *see, picture*, and *imagine*?	Do you enjoy listening but are impatient to talk? Do you use words such as *hear, tune*, and *think*?	Do you gesture and use expressive movements? Do you use words such as *feel, touch*, and *hold*?
Concentrate	Do you become distracted by untidiness or movement?	Do you become distracted by sounds or noises?	Do you become distracted by activity around you?
Meet someone again	Do you forget names but remember faces or remember where you met?	Do you forget faces but remember names or remember what you talked about?	Do you remember best what you did together?
Contact people on business	Do you prefer direct, face-to-face, personal meetings?	Do you prefer the telephone?	Do you talk with them while walking or participating in an activity?
Read	Do you like descriptive scenes or pause to imagine the actions?	Do you enjoy dialog and conversation or hear the characters talk?	Do you prefer action stories or are not a keen reader?
Do something new at work	Do you like to see demonstrations, diagrams, slides, or posters?	Do you prefer verbal instructions or talking about it with someone else?	Do you prefer to jump right in and try it?
Put something together	Do you like at the directions and the picture?		Do you ignore the directions and figure it out as you go along?
Need help with a computer application	Do you seek out pictures or diagrams?	Do you call the help desk, ask a neighbor, or growl at the computer?	Do you keep trying to do it or try it on another computer?

Adapted from Colin Rose(1987). Accelerated Learning.

Teaching and Learning: It's a matter of "STYLE"

Donna Qualters
Director
Center for Effective University Teaching

What is learning style?

Learning styles refers to a person's preferred method of:

- Receiving
- Processing
- Storing
- Expressing information
- Rate of learning
- Social Condition
- Incentives

Learning styles vary on the following dimensions

- Receiving - by visual, aural, tactile/kinesthetic
- How do you "get" information to visual learner?
- How do you "get" information to t/k learners?

- Processing - ability to incorporate new ideas into existing frameworks
- What do you need to do to help students process information more effectively?

- Storing - effectiveness and strategies for long and short term memory
- How do you "store" information that might be helpful to share with learners?

- Expressing - ability to use different communication modes?
- What are some techniques to allow students to communicate what they know in different ways?

- Rate - preference for reflective, thoughtful speed Vs "get the info" and go
- What can you do so that the thoughtful, reflective learner doesn't get run over?

- Social condition - preference for independent Vs collaborative work
- What does this mean in the classroom?

- Incentives - motivation to learn, I.e. grades, money (extrinsic), self-satisfaction, wanting to learn (intrinsic)
- What are some ways of finding out student motivation?
- What kinds of things can you do in the classroom to appeal to both intrinsic and extrinsic types

REMEMBER:

- There are **NO** right or wrong styles?
- We tend to have an *overall* style preference
- We may *vary* our preferences overtime and for different subjects
- Sometimes our class objectives dictate the most effective learning style preference
- Effective learners are able to adapt styles

Knowing this, what are the implications for you in working with students?

Implications for working with Students

- Acknowledge the usefulness of different learning styles
- help students describe his/her learning style preferences
- Accommodate to the learner's style when appropriate

Case Study

Instructor of record/recitations

You're teaching a section of freshman in an introductory class. The first few classes contain a lot of basic information they need to know right away. So your first two classes are very well organized, interesting (even funny) lectures. However, when you're reviewing the information at the third class only a few students raise their hand to answer your questions, the rest look at you like they never heard it before.

1. What do you think is happening in this classroom?

2. Should you stop lecturing, even if you don't cover everything?

3. What can you do to differently to match student styles more closely?

Lab instructor's

You come into your skill-based lab and demonstrate a new technique to students. You ask if there are any questions (there aren't!) and then you tell them to try it themselves. As you walk around you notice some students are doing terrific, others are really struggling, and a few have just given up.

1. What are the some of the issues in the lab?

2. What can you do differently to match student styles more closely?

Office hours

You're having your weekly office hours when a student comes in very angry and upset. He/she has been trying to do the homework assignment and just isn't getting it. You go over the material with him/her just the way the professor did in class but they still don't get it.

1. What could be some of the reasons this student isn't "getting it"?

2. What questions could you ask this student to find out how they learn?

3. How else could you go over the homework?