

## Using a Self-Paced Course to Introduce Students to Life-Long Learning Skills and Ethical Choices

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### Introduction

The past sixteen years a second semester, junior level course has been taught using a self-paced format. The basic philosophy for using a self-paced approach is that after graduation individuals are solely responsible for remaining current and competent in their field. This continuing education for the most part will be informal in nature. The self-paced approach is an effort to aid the student in making the transition from the traditional college learning style to a life-long learning style. This course also provides the students experience in setting personal goals, developing the self-discipline necessary to achieve these goals, and dealing with any setbacks. This information is conveyed to the students in a handout given the first day of classes. This handout is shown in Attachment 1.

### Course History

Initially paper exams were given whenever a student felt ready to take an exam. Later as enrollments rose it was necessary to limit the exams to twice a week, with students signing up for an exam when they were ready. Students were tested for mastery of the subject material with mastery being defined as receiving 90% on an exam consisting of ten questions. Each exam consisted of a closed book section with seven questions and an open book section with three questions. Final grades were assigned based on the number of chapters mastered and the number of projects completed. The topic order was arranged such that a student earning a passing grade would be able to analyze rate data and design simple reactors with single chemical reaction occurring. To obtain a higher grade a student was required to be able to handle reactions and reactor systems that were more complex. Students were required to demonstrate mastery of one topic or to have tested three times in a topic before they were allowed to proceed to the next topic. This structure resulted in a number of different chapters being tested simultaneously. In addition, an effort was made to provide a new exam for each testing period.

To provide more opportunities to take the examinations and to reduce the time consuming administration of the exams, a computerized examination system was implemented in 1996. The software package, Question Mark Designer (1), was selected to test and assess each student's progress. This package has the ability to randomly select the questions, store the student responses, and to grade the exams. The package allows the use of the following five types of questions:

- Multiple choice with the option to randomize the answers when they are presented.
- Multiple response, which is the same as multiple choice except that more than one response can be selected.
- Graphic "hot spot" questions where the user answers by dragging an icon or marker onto a particular point on the screen.
- Numeric answer questions with the option to set a range for the correct answer or for partial credit.
- Text questions, where the user supplies the answer, which is then compared to a set of possible correct answers.

In our application, the questions have been entered into a series of question library databases. When the software creates an exam, the specified numbers of questions from each library are randomly chosen. Other options used include setting a time limit for the exam and recording the student's answers to a file so that any disputed answers can be checked. Most numerical problems use multimedia calls to activate a MathCAD® and/or EXCEL® spreadsheet. The problem statement and data are included in these multimedia calls, permitting the students to work the problem and then return to the exam question and enter the answer.

Each student is provided with a floppy disk on which the exams for the current unit are loaded. Students are required to achieve 90% on the exams before proceeding to the next unit. When a student has mastered a unit, the disk is returned to the instructor for verification of mastery and loading the next set of unit exams. This computerization has eliminated the need to limit the number of attempts required for mastery of a unit.

In addition to the mastery of the course material, completion of assigned projects are included as a requirement. These projects are returned for corrections until successfully completed or the deadline for submissions has passed. The final grade is determined by a combination of the number of units mastered and the number of projects successfully completed. The material has been divided into nine units and the grading for the course is determined as follows:

Grade	Number of Units Mastered	Computer Projects Worked
A	9	4
B	8	3
C	6	2
D	5	1

## Modifications

Often students procrastinated and were then completing several units during the last couple of weeks of the semester. It was also observed that some students took the exams a large number of times and appeared to be memorizing the answers to the questions in the databases. In an effort to eliminate these problems, the following changes were made to the course policy.

- Only one new set of unit exams is loaded on a student's disk per week.
- A grade deduction of one letter is applied to anyone who does not complete the first three units by mid-semester.
- To test material retention a final exam was included as part of the course. Grade deductions are then applied based on the final exam scores. The final exam only tests the material in the units that each student has covered; that is, if a student covered material for a grade of C, then only that is the only material included on that student's final exam.

The grades deductions from the earned grade are as follows:

Description	Number of letter grades deducted
Not completing Unit 3 by Mid-term	1
Scoring 50 -74 on Final Exam	1
Scoring 25 - 49 on Final Exam	2
Scoring below 25 on Final Exam	3

Monitoring the exams to verify ethical behavior presented a problem. To point out that the students are responsible for their behavior, the following statements have been added to the course policy:

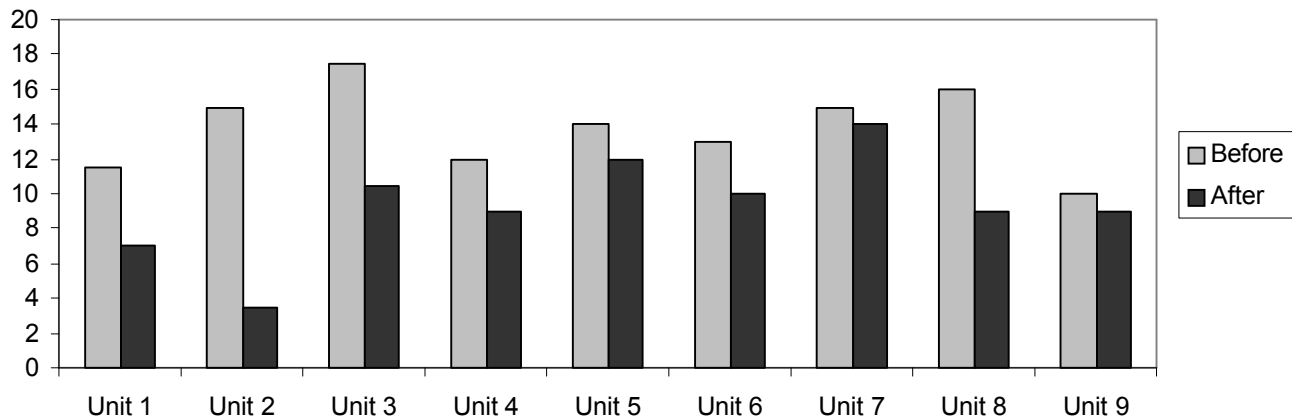
This course offers many opportunities to be less than ethical. It is easy to keep retaking the exams until you have memorized all of the questions in the question database. You can also develop and save spreadsheet templates to solve the various types of problems. I'm sure other ways can be found to "beat the system." Keep in mind that you are expected to master the material, the final exam will check your mastery and retention of the material. The final exam will be a written exam taken in a classroom setting. You will be permitted to use your text and calculators. You will also be provided integration and conversion tables.

Evidence of the copying of a project solution and modifying it to solve your project assignment can result in the permanent rejection of that project. The student penalized may be the one who did the original work or the one that copied the work. You need to protect your work, don't share it and don't leave it stored on the hard drive of a lab computer.

## Results

The results for the maximum number of attempts for each unit are shown in Figure 1. In each case the number of attempts decreased after the course policy was modified. Similar results were observed when looking at the second highest number of attempts. Before the modifications to the policy, two students had grade deductions of two letter grades each while after the modification the only deductions were of one letter grade. The number of grade deductions on a per student basis were 0.714 before modifications and 0.333 after the modifications. From these results, it appears that the course policy modifications are working.

**FIGURE 1**  
**Maximum Number of Attempts**



## Bibliography

1. Presence Corporation, "Question Mark Designer for Windows," Stamford, CT. (Now known as Question Mark Corporation) Web addresses: <http://www.questionmark.com/us/home.htm>

## Biographical Information

Dr. Doner received his B.S. CH.E. degree from Tri-State College (Now Tri-State University) and his M.S. and Ph.D. degrees from West Virginia University. He is currently Professor of Chemical Engineering at West Virginia University Institute of Technology. His experience includes nineteen years at WVUIT and eleven years with Environmental Energy Engineering, Inc.

## ATTACHMENT 1

### Why This Instructional Format?

Some of the reasons for this instructional format are:

- About eighteen months from the start of this semester you will probably have graduated. After graduation you, alone, will be responsible for staying current in your field and learning new technologies. This course is structured to aid you in making the transition from the traditional college based learning style to a life-long learning style.
- Another instructional objective of this course is for you to set personal goals, develop the self-motivation required to achieve these goals, and deal with any setbacks. It is recommended that you set a goal of the grade that you want to earn. Then you should establish a schedule of when you should have completed each unit necessary to achieve the desired grade. When you fail to meet your schedule you should revise it and if necessary lower your goal.
- Soon you will be requesting faculty members to complete reference forms needed for job applications. Often one or more questions refer to the applicant's self-motivation or ability to be self-directed. Here is your chance to demonstrate these skills.
- You must also be an ethically responsible engineer. This course offers many opportunities to be less than ethical. Often the consequences for unethical behavior do not occur immediately, but sometime later such as the final exam in this course.

**You should be warned that it is easy to put this course off until later.** As the semester ends, you may become swamped with other course work and unable to devote the necessary time required to achieve your goals in this course. To help you start setting some goals, a penalty of one letter grade will be assessed, if you have not completed Unit 3 by mid-term.

The instructor will be available to answer any questions concerning the text material. A minimum amount of time will be spent on lectures. These lectures will be use to clarify some of the areas that have traditionally caused difficulty or to present unfamiliar calculation techniques. Most of the class time will be spent informally answering questions or discussing the problems in the text. Class attendance is not required, **you alone, are responsible for mastering and retaining the course material.**