

The Personalized Class Binder (PCB): A Powerful Tool for Enhancing Active and Collaborative Learning Environments

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Abstract – This contribution introduces a very efficient approach to integrate the production of notes into an active learning process where the student (and not the instructor) is at the center stage. The Personalized Class Binder is a method where the students must use class sketches, modify them with additional material from discussions, consultation with the instructors, and other classmates to produce notes that help them to understand better the course material. The PCB is the key student resource for a given course and enhances the ability of students to become life long learners. The article describes the basic aspects of the approach, introduces an assessment designed by the students and summarizes some of the main advantages of the approach. It is clear that the approach is a considerable departure to the power point production of notes that is currently widely used by instructors in many engineering classes.

Keywords: Active learning, documentation, life long learning, collaborative learning

INTRODUCTION AND MOTIVATION

Documentation of activities or procedures performed by students in engineering education is usually summarized in formal reports, such as those used to communicate the results and analysis of laboratory projects. These reports are frequently an effort that is shared with other team members, and are focused in technical aspects such as discussion of references related to the project, summary of experimental techniques, data gathered, and the analysis of these data. The students at the end of the report usually offer suggestions for experimental improvement. These reports are typically typed and submitted to the instructor with a formal submittal letter. For courses other than laboratories, where lectures are the dominant mode of instruction, journals or diaries are sometimes used as supplements to help students enhance their learning. These journal entries are usually summaries written by the students as they go through the process of learning new material. The exercises previously discussed are useful; however, they are not the “heart” of the learning process for each student.

When an instructor radically changes the mode of instruction and he or she adopts active and/or collaborative learning approaches, there is an opportunity to increase the learning potential of every student. In ordinary lecture courses students are usually given a “summary” of instructor notes. These notes tend to be polished, well organized, and personalized from the instructor’s point-of-view. If the students are required to prepare notes instead of passively taking notes, individual student learning could be significantly improved. In this approach students organize their notes in a unique way and enhance these notes with comments from their own efforts to learn the material.

In this contribution, the authors will describe an approach where students are coached to produce a personalized class binder (PCB). The PCB is created and maintained by each student throughout a semester, and is eventually evaluated by the instructor who assigns a percentage of the course grade based on its completeness. The sections required in the PCB include class questionnaire activities, “dirty” notes, “clean” notes, re-worked assignments, and a

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section on the “history of science.” Building the PCB gives students plenty of opportunity to use an active and/or collaborative approach to learning and applying new materials. Examples of models for the preparation of class binders will be included on the subject of kinetics. This approach can be adapted to other technical courses such as transport phenomena, colloidal sciences and process design. Examples of PCBs from these courses will also be offered as illustrations.

RATIONALE BEHIND THE BINDER MODEL

Many studies [Felder, 3] have shown that passive learning activities produce considerably low results with respect to the learning efficiency of each student. The “flagship” of this quite ineffective technique is the “Traditional Lecture,” where almost all the effort is centered on the most trained person, the instructor. As a “Traditional Lecturer,” the instructor acts as the motivator, the translator of notes (from the textbook to the board and to some personal notes), the organizer of the material for each lecture, and the producer or “distiller” of wonderfully-written, neat notes to “help” each student digest new material.

The scenario of the traditional lecture technique could be contrasted with two other present-day learning situations. Consider the sports trainer who desires to prepare a player under his instruction to be successful. Only when the trainer requires the player to engage in rigorous, repeated practice sessions will success be achieved. The trainer who simply “lectures” his player on the fine points of a given sport will transmit few if any skills. Or consider the novice violin student who bought a front row ticket [Woods, 5] in order to learn (from a master) how to play the violin, attentively observing the “masterful” performance. Following the concert, the student realized that he still could not play a single note on his own violin. Many hours of personal practice, not merely observation, was the key to success. Unfortunately, many engineering classes still utilize passive learning activities rather than adopting the very best training methods that help students master the techniques and methodologies of a given subject. In order to produce successful students, we must engage them in engineering education methods, which train them, from the beginning, just by doing!

Within the spectrum of possibilities to engage the students in highly efficient learning approaches, we address here the process of producing notes that are relevant from the point-of-view of the students! The students are the ones who need to develop notes and tools that relate to the way they learn/understand the subject best, their personal way. Every student is unique in the way he or she studies, collects, and assimilates the material. Students should select the material portions that help them understand information clearly and promote their deepest understanding of the subject. Therefore, in this contribution, we propose a model that places the “burden” of producing notes not on the instructor, but on the person who most needs these notes, the student. This approach parallels well with an example of a successful training coach, who ensures that the trainee exercises to tune up their body. In the same way, instructors who coach their students in the construction of a Personalized Class Binder ensure that the students tune up their brains to increase learning efficiency.

The “personal class binder” is then the central device where the student makes an effort in collecting and polishing notes, and in re-writing and enhancing these notes from the textbook material and/or through the discussion with classmates and/or instructors. In short, the PCB makes the student walk a very active, collaborative, and hands on activity path that dominates the process. The students become the driving force for their own learning process and for making the necessary learning tools. The PCB is the instrument that drives their “personal efforts.” Instructors take a “back seat” to allow the students to become drivers in the whole learning process. Finally, the PCB becomes a useful instrument to promote life-long learning and responsibility, since it will become the natural consultation source for future applications in the work force. This result would be a positive by-product of the student’s efforts. The PCB has been divided in several sections that are briefly described in the section below.

MODEL FOR A PERSONALIZED CLASS BINDER

The PCB model most widely used in our efforts is divided into several sections covering a number of important aspects in the student learning process. The sections give the students the opportunity to work in an active/collaborative fashion by gathering information from their classmates, instructors and other sources. The following are the most commonly used PCB sections:

- a- The Syllabus and outline of activities of the course.
- b- “Dirty Notes”
- c- “Clean Notes”

- d- "History of Science"
- e- Quizzes and Mid-Terms
- f- Homework Sets
- g- Handouts
- h- Personal Assessment of Mid-terms
- i- Re-work of Mid-terms, Homework sets, and others
- j- Miscellaneous

We are providing, below, a brief description of the characteristics and functions of section a, b, c, d and h identified above.

- a- *Syllabus and outline:* The first section of the PCB is devoted to the syllabus and description of the course. One important difference with respect to other more classical syllabi is that this is a flexible list of major topics covered, the essential elements of the material. There is no fixed timetable and only at the end of each major topic will an assessment take place. Once all students feel they are ready to participate in such an assessment, the exact date of the mid-term is designated. The syllabus includes the suggested breakdown of the course grade in terms of percentages assigned to midterms, quizzes, and team project. A modification of this grading policy can take place with the strong participation of the class to accurately reflect what has been done in the course. The PCB is assigned a percentage of the final course grade and is discussed with the class; the important role the PCB plays in enhancing learning is highlighted.
- b- *Dirty Notes:* This section consists of the rough notes and sketches that students make during class discussion and other active and team learning activities that take place in the classroom. To focus on the key points of the topics, a "Lesson Plan" is discussed with the class and a suggested questionnaire is given to the students. This questionnaire is the key in identifying Principal Objectives of Knowledge or POK's [Arce, 1] for helping the students to master the material. Students are divided into informal groups to work and the instructor(s) becomes the coach(es) of the class [Creighton, 2] during these activities. Teams that are successful in reaching potentially good results post their findings on the board and share the information with other teams. When all the teams have reached a level of proficiency, an overall discussion takes place to ensure that every student understands the key concepts. At this point, the concept of "clean notes" becomes very useful.
- c- *Clean Notes:* This is the section where the "personalized" aspect of the binder becomes imperative. Student are required to re-write their dirty notes to enrich the material with their own summarizing comments, the comments and findings of other teams, and answers to their personal questions. Material from the textbook can also be included as well as other handouts given by the instructor. One of the most useful elements is the use of free Internet material readily available for the students. The clean notes strategy could lead to "textbook-less" learning environments where all the material can be obtained from sources other than the classical textbook. This version, however, has not yet been used in current versions of the approach.
- d- *The History of Science:* This section features all major scientists that have made a significant contribution to the body of knowledge of the course material. Every student is responsible for researching the biography of the scientists and authors that have been named during the discussion. Students need to know the time when the scientists lived, where they attended school, places they worked and key contributions they made. The list includes the author(s) of the textbook used in the course as well. James Maxwell [Pethig, 4] used to say, "Every student must be an antiquary of the subject that s/he is learning." This section adds considerable student appreciation of scientific contributions made by remarkable and notable people. A more 'local' version of the history of science is also used to recognize student contributions during class discussion. When a student suggests their own unique application of course material during class discussions, the name of the student is sometimes used when referring to the particular concept, for example "the Joe definition." Students are advised that this "named" concept maybe described as such and that the biography of the student author may be added to the history of science section. A question on this historical aspect of the course is always included in Mid-Term assessments.
- h- *Personal Assessment of Mid-Terms:* Since mid-term assessments have different sections, i.e. a question section, problem section, an individual part and a team-based part, the total contribution of the grade points is divided based of these sections. The instructors grade the assessment and return the work to students with a suggested breakdown. The students are requested to assess their work and identify other possible grade distribution that will maximize their personal performance and submit the proposal to the instructor for consideration. The students are also required to identify weak points in the assessment and propose a

remedial action for improvement. This aspect of the binder promotes individual responsibility, lifelong learning, and has a favorable effect on increasing performance and confidence of the students.

TIPS TO BUILDING AN EFFECTIVE PCB

The following are tips to constructing a PCB that can effectively become the “Course Resource Center”:

- Create an outline of how the PCB should be organized (see III.)
- Assemble folder system, starting with an appropriately sized notebook
 - 4-inch D-ring, heavy duty binder is suggested
- Utilize a divider tab system to organize binder sections (described in III.)
- Organize PCB daily or after each class meeting
- Enhance Clean Notes section
 - Rewrite notes daily
 - Define terms that are not understood
 - Collaborate with classmates to help fill informational gaps that may exist
 - Research the history of scientists that are mentioned during class
 - Keep detailed list of course assignments/due dates (separate from notes)
- Rework all assignments (exams, homework, quizzes, class activities)
 - Correct and clarify where uncertainties may exist

The two co-authors (Robyn Rawlings and Scott Allen) were students in a course that utilized the PCB as a learning tool. The list above consists of their tips to create a useful course resource center. The summary was discussed in more detail in a workshop style presentation for the benefit of the entire class. Input from other students has also been added to the list. We believe that these suggested tips have value for those students that had difficulty constructing their own PCB and/or for those that need an extra boost to get started.

ASSESSMENT

A formal assessment was designed and conducted for the Kinetics course, CHE 4120, and has been analyzed. The assessment was designed using guidelines for active/collaborative learning environments by the two student authors. The student questionnaire allowed students to rate several aspects of the learning process as it relates to the PCB. Even though this class model required extra effort, the results of the assessment indicate a positive student response regarding the value of the PCB as shown in Table 1. In general, we noticed a high level of acceptance from the students, and a majority of the class indicated that the PCB was valuable in helping them achieve success in the course.

Assessed Area	High	Medium	Low
Value Placed in Managing Class Information	59%	41%	0%

Assessed Area	High	Medium	Low
Individual Effort Put Forth Managing Class Information	59%	41%	0%

Assessed Area	High	Medium	Low
Value Placed in Reworking Notes and Assignments	71%	18%	12%

Assessed Area	Too High	Correct Value	Too Low
Binder Valued at 10% of Course Grade	41%	47%	12%

Assessed Area	Extremely Valuable	Valuable	Not Valuable
Value Placed in PCB	24%	59%	18%

Table 1 – Summary of Assessment Results

SUMMARY AND CONCLUDING REMARKS

The PCB has been designed and implemented with favorable acceptance from the students. The binder may be viewed as the “Course Resource Center” where key aspects of supporting material and tools for the learning, review

and practice of the concepts are always at the fingertips of the student. The binder puts the burden of producing notes where it should be, on the students! In addition to offering a centralized resource for the course, the PCB is a valuable source of information for future reference in professional engineering careers. The PCB enhances the opportunity to practice active/collaborative-learning approaches and, therefore, could be viewed as a considerable departure from more traditional approaches in engineering education.

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Senior in Chemical Engineering at Tennessee Tech University. Robyn is currently a member of the Distinction in the Major program and will graduate Summa Cum Laude in May 2005. She is active in AIChE and Omega Chi Epsilon and serves as the Fund-raising Chair for the TTU AIChE Chapter. She was a member of the Fuel Cell Car (Chem-E-Car) Team that placed second at the 2004 National AIChE Car Competition in Austin, TX. After graduation Robyn plans to continue her career either as an engineer or in graduate school.

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Professor and Chair of the Department of Chemical Engineering at Tennessee Tech University. Dr. Arce is a strong advocate of modernization of engineering instructional methods, focusing on active and collaborative learning environments. He has proposed a number of learning models including the *Colloquial Approach*, *The Coaching Model of Instruction* and the *Hi-PeLE*, among others. His research interests focus on Applied Field Sensitive Technologies including Cold Plasma High Oxidation Methods, Electrokinetics, and Nano-structure Soft Materials for bio-separation and drug delivery.