From Chalk to Electrons – Blended Engineering Education

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Abstract:
"Performance counts!" In many ways this may be the only way to change the world. This paper chronicles one instructor's journey from chalk-mediated, in-classroom andragogy to electronic-mediated, learning-time andragogy in an introductory course in management. The student population is 3:1 engineers to managers. Blending technology with purposefully mediated course design and multiple teaching methods, a diverse student population, year on year, demonstrates improvement of mastery of knowledge-skill relationships coupled with professional attitude development. Using 1) student exemplars, 2) anecdotal comments and 3) a standardized course evaluation instrument, IDEA from Kansas State University, a record of course design, teaching methods, and student performances is depicted. A chronology of interaction amongst student, instructor, and course developer underpins the discussion.

Engineers and managers, scientists and artists, architects as well, engage in their initial undergraduate foray into management through [Name of Institution-Name of School]'s Introduction to Management, MGMT-1100. This course is designated as one half of the Institute's communication requirement, and, as such, awards performance. "The course, by design, makes you **"think"** by exposing you to management and business situations, calling upon **you to decide** "what to do." This requires both **individual and team** performance criteria promoting a participative and active learning environment. The four broad areas of evaluation are (1) class participation and attendance, (2) case write-ups and presentations, (3) final executive presentation and (4) special assignments[1]." This paper outlines a nearly eleven-year chronology of the student's improved performance as I, the instructor, journeyed into the blended learning processes.

The student population

The 1894 students I taught over the past 11 years have come from 28 different disciplines and were engaged in 45 sections. The time slots varied: 8 a.m., 10 a.m., noon, and 2 p.m.; the day of week varied in pairs: Monday – Thursday and Tuesday – Friday. The relevance to this paper is that the Kansas State University's IDEA instrument, used to capture the student's memory of their educational experience, adjusts for these parameters.

From chalk …

Originally designated a 'laptop course' ten years ago when I initially taught my first section, I disallowed the use of this tool – I thought the students ill equipped to pound the keys while I 'lectured'. As the case-based design began to become comfortable to the instructor, the students became aware of a necessary need to participate in analytic and synthetic processes, communicate (in the broadest sense), develop a personal managerial philosophy, work individually and within a team, and perform under duress (final presentation to unknown executives role-playing as board of directors).

F'97-S'98

This was the first full year I taught Introduction to Management. The development of the course was under duress: the two talented instructors became unavailable [retirement and quick passing, stroke]. Using the basic principles they developed, modifying them to the notions of education that I knew [2]. I developed the notion of an extensive research report, I engaged the Institute's business librarian to set up a library Web-page to facilitate the complex nature of company and industry analysis. All submissions were in paper. All lectures were chalk on blackboard supplemented with an occasional duplicated handout. You can keep score of the student numbers, sections and number of majors, as well as more, with figure 1.

F'98-S'99

Much as the first year, but with more comfort, I engaged the students with more specific styles: problem-based, resource-based, team-based and narrative. Students became more 'participative' measured by the dynamic discussions centered on synthetic thinking. The library site had an unintended consequence of 'getting the students into the building'. Chalk use was reduced, augmented with PowerPoint generated

transparencies and more duplication of those transparencies. Introduction to Management was used as a prototype course for 'calibrating' the IDEA[3] instrument to our Institute generally, and our School specifically. It was predicated on both the magnitude of the student population and multiple sections delivered by a single faculty.

F'99-S'00

Building on the 'action' oriented response of the students, I focused on the 'seamless' transitions between teaching styles. Here I began to delve into the mapping of Bloom's educational objectives into these styles. Students began to maintain 'time on task' within the classroom. An unintended consequence was the higher preparation before entering the classroom discussions: case write-ups, individual and team, began demonstrating the exploitation of the newly introduced textbook.

F'00-S'01

Continuing in the same vein as the year before, the ability to select the appropriate teaching style for initiating and maintaining class discussions was now further refined by identifying the 'trigger' within the questions asked by the students. Here, the 'on-the-fly' deployment of different style (from the one that was used to develop the discussion under inquiry) was developed. Additionally, the sections were now 'capped' at 35 students; I often would lift caps since the reputation of the course and the instructor became a forcing function. In addition, we have a seniority-based scheduling process where seniors select classes before juniors and so on. So fall entering students in management would necessarily have the earlier sections open; the spring sections would not fit well with some engineering core schedules. Laptop use increased; I found that the students were indeed capable of following the dialectic discourse while 'pounding' the keys. The chalkboard diagrams were still paper/pencil bound.

… To electrons

F'01-S'02

In the fall semester I was assigned a course developer to help me redesign a graduate level course – International Business – planned for distance delivery through the course management system WebCT. This mandated use of Web-based technology triggered a dialogue that is still going on. Although her primary responsibilities were to work with me as I integrated Web-based technology into my classroom,

she became the outsider looking in. She observed the different sections of this course and confirmed my four teaching styles. I began to experiment[4] with teaching methods measured by IDEA (specifically no individual assessments, only aggregate assessments – the class of all errors, ideas for improvement, great performances…).

F'02-S'03

In F'02 I began to raise the notion that I could use what I had learned in the Web-based environment and deploy it in the face-to-face classroom. This time, I requested the help of the course developer so that we could uncover a mechanism to capture the students, a way to have them 'use' WebCT when NOT in the classroom; I see this as 'learning time'. It is not a single place, but, it is certainly in a time when 'they' are ready.

We designed a one week, two class meeting prototype. Students' performances demonstrated greater 'depth of analysis' and mature synthetic processes bordering on the creative. Their feedback on the experiment was overwhelmingly positive and we decided to implement the first blended course on campus.

Blended learning is a "combination of face-to-face and online instruction[5]". At RPI we use an adaptation of Harmon and Jones[6] levels of Web use to define our blended courses. With Level 0 being the traditional face-to-face class, Level 1 reflects the Administrative/Web-enhanced first option. At this level, there is no course content posted and the online component is mainly used for administrative information such as the syllabus, the schedule, or contact information. Level 2 refers to Supplemental/Web-enhanced courses. There is some course content posted online such as course notes, handouts, and homework, as well as additional materials such as pre-instructional activities, study guides, or assigned readings. At Level 3, Essential/Web-centered, the majority of the course content and materials is available online, and asynchronous tools are used on a regular basis. At this level, student must be Web and computer savvy and be able to access the Web regularly.

Level 4, Communal/Web-centered, is often considered to refer to a "real" blended course and can also bear the label of "hybrid". The course proposes a true blend of face-to-face and the Web-based instruction with 30 to 79% of the content delivered online. Synchronous and asynchronous tools are an integral component of the instruction. Level 5, Immersive/Completely online, refers to "distance education" or

"distributed" courses with most or all of content delivered online, and an extensive use of asynchronous and synchronous tools[7].

The course developer identified and made me aware of two more of my teaching styles: constructivism and situated learning which are reflected in the IDEA responses. Students gave positive feedback on the experiment.

F'03-S'04

So, with great intentions for the fall semester of creating a blended course while teaching it, I succeeded in desinging nine weeks out of fifteen. The rigor of maintaining three sections with 84 students and grading 252 submissions per week (every week, for weeks three through eleven, at least three submissions per student; without the support of a teaching assistant or a grader) was just too much. I did have to contend with the students discontent of not having a 'complete' WebCT site for the duration of the semester. The students' work however demonstrated an improvement similar to past year, starting in the sixth week.

The spring semester sections both saw the deployment of a full-up WebCT tool and a fifth week maturity. The 8 a.m. section (more first year students than normal) had the IDEA summative grade at my all-time low (all four elements averaging 56) while the 10 a.m. (mostly non first year students) matched my all-time high (all four elements averaging 68). The details are beyond the scope of this paper.

F'04-S'05

The fall semester saw me taking full maintenance responsibilities of the site. The course developer, who had been providing the development and technical support for the course until then handed me the "keys" saying "You have complete 'ownership' now." I was now coding HTML, working with new software packages such as Dreamweaver and PhotoShop, understanding the vagaries of the WebCT software itself and the like.

I got aggressive in my action research experimentations. I consciously engaged in schizophrenic behavior in the spring – in one section I deployed 5 of the 20 teaching methods measured by IDEA, in the other section I deployed 15 of 20 teaching methods. I got the expected results: more methods better summative performance. Yet, the students' individual performance within the course content remained identical

across both sections; they were nearly at mature thinking level in the fourth week! Their performance on final presentation was identical (I have used the visiting executive across sections all along).

The dialog with the course developer uncovered modifications to Bloom and Kolb[8]. I was learning a new language: education science which helped in sorting out what I was learning. Electronic submission of assignments, paper for team presentations only and the reliance of electronic media formed the basis of educational transactions. Chalk remained the tool of choice for the immediate, right now answer that was in the future.

F'05-S'06

Both semesters were marked by my gaining a great deal of comfort with the tool suite. WebCT offered a discussion area that could enhance the communication of students in need of immediate help, advice… their 'learning time'. I designated only two times a day, mostly seven days a week, as electronic access time – when I read campus email and WebCT entries. This now offered another dimension for the development of managerial attitudes that could begin to inform a value system that could eventually transmogrify into a managerial philosophy… a way of thinking. I provided less structure to the classroom environment as part of the action research. IDEA did report this. Yet the performance of students remained high with many discussing their use of WebCT in the open area of the IDEA instrument. Spring '06 was especially difficult: I accepted the role of Director of the Undergraduate Program, gaining 400 advisees along with the other traditional duties that post suggests and carried a three-course load to cover the revitalization process within our faculty.

F'06-S'07

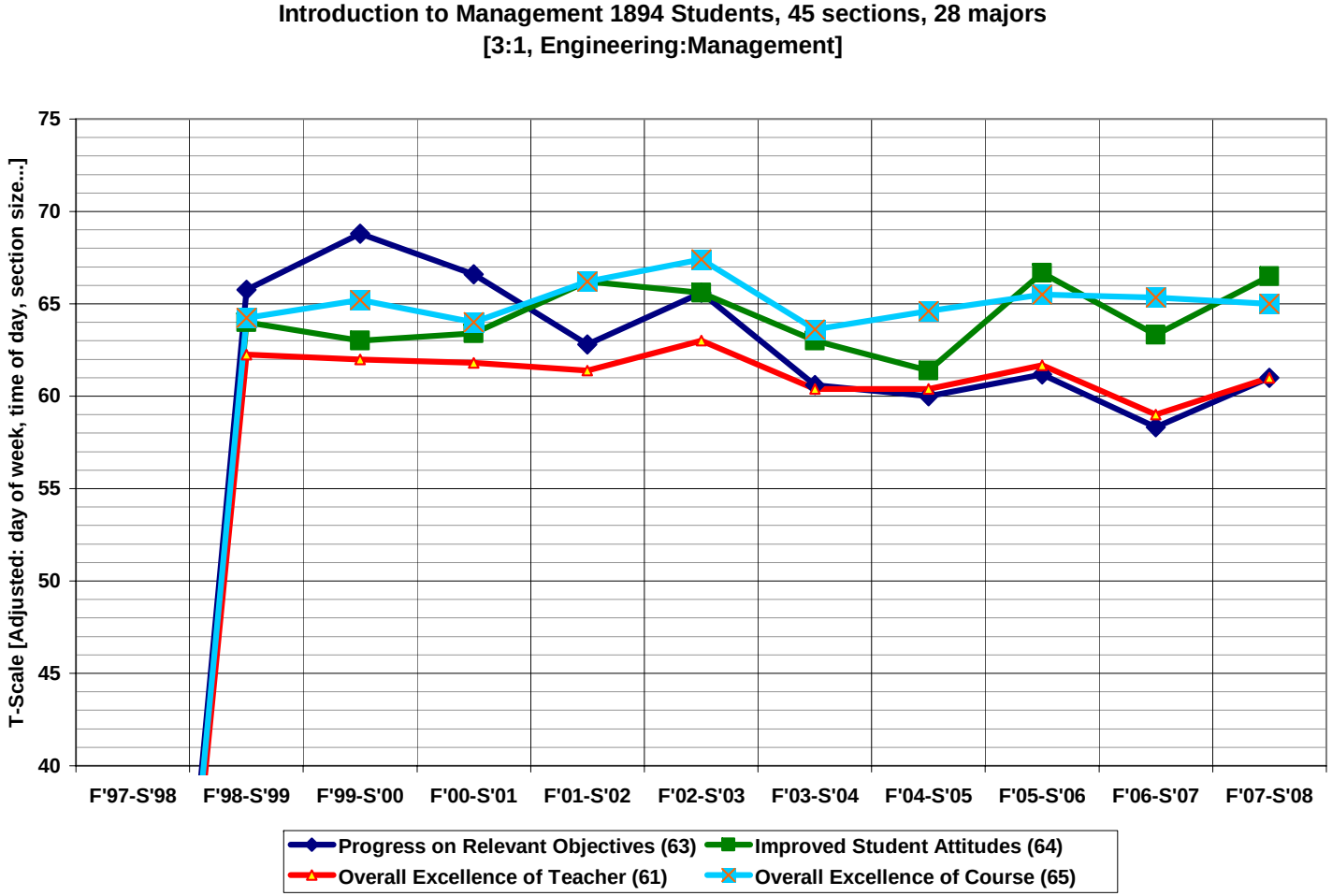
This was the first year under the reduced classroom loading and Director posting. The students remained responsive to the action experiments. This time I deployed modified teaching methods with 'delayed' feedback. IDEA again identified this. The students' performances were consistently mature within the fourth week of class and they strived to deploy the tool suite, now called Blackboard, to their best advantage. The students were given the opportunity to offer permanent additions that may help students in the future. This was done through any of their submissions, or, through the discussion area.

F'07-S'08

Fall brings us to the current state: the Look-and-Feel (Graphic User Interface) has been designed by me while the development and maintenance has now fallen again to course developer. A deeply professional dialog has been established between the two of us. Learning from each other, challenging each other, the electronic mediated learning management system now incorporates elements from 'subject matter expert' (SME), developer and students (also SME's). Student performance is superlative (metric: one team was offered jobs during the executive feedback portion of their final presentation).

This sojourn, notionally captured in this brief chronology, challenges everyone associated with it: originating SME, developer, and novice SME. It benefits from being dynamic enough to reach any student in their 'learning time' and ensnares students into developing an affinity for their team. They see this as a mechanism for change, change in themselves and that requires courage that , somehow, is nourished by the site and their peers' performance acknowledgement… transparency perhaps. That is something that is yet to be unearthed.

Chalk has its role, but the electrons seem to be on the rise; blended technologies reach everyone once you travel a path like this. Our discussion here is an attempt to shorten it for you.



	F'97-S'98	F'98-S'99	F'99-S'00	F'00-S'01	F'01-S'02	F'02-S'03	F'03-S'04	F'04-S'05	F'05-S'06	F'06-S'07	F'07-S'08
Student Population	222	219	304	257	239	184	144	147	178	113	75
Sections	4	5	5	5	5	5	5	5	6	3	2
Majors	23	19	27	28	27	20	21	18	23	17	12

Figure 1 – Introduction to Management and IDEA

References

1. From the MGMT-1100 syllabus, unchanged over this entire time period.
2. Kolb, D. A. (1984) *Experiential Learning: Experience as a source of learning and development.* New Jersey: Prentice-Hall; Bloom, B.S. (Ed.) (1956) Taxonomy of educational objectives: The classification of educational goals: Handbook I, cognitive domain. New York ; Toronto: Longmans, Green.
3. IDEA Student Ratings of Instruction Relationship of Teaching Methods to Learning Objectives, retireved from http://www.idea.ksu.edu/resources/index.html 02.22/2008
4. I use the concept of Action Research under IRB control.
5. Bonk, C. J. & Graham, C. R. (Eds.). (in press). Handbook of blended learning: Global Perspectives, local designs. San Francisco, CA: Pfeiffer Publishing.
6. Harmon, S. W. and Jones, M. G. (1999). The five levels of web use in education: Factors to consider in planning online course. *Educational Technology*, 39(6), p. 28-32.
7. Jones, M.G., Harmon, S.W., & Lowther, D. (2002). Integrating Web-Based Learning in an Educational System: A Framework for Implementation. In R.A. Reiser & J.V. Dempsey (Ed). *Trends and issues in instructional design & technology*.(pp298-301). New Jersey: Pearson Education, Inc
8. Bloom: Anderson, L.W. & Krathwohl, D.R. (Eds.) (2001) *A taxonomy of learning and assessment: A revision of Bloom's taxonomy of educational objectives*. New York: Longman.; Kolb: Svinicki, M.D. & Dixon, N. (1987) The Kolb model modified for classroom activities, *College Teaching*, 35(4), pp. 141-146..

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