

PROMOTING ANALYTICAL THINKING WITH TECHNOLOGY IN A CHANGING CLASSROOM

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Abstract

There are conflicting opinions about the use of computer programs in schools which provide tutorial instruction rather than foster fundamental critical thinking skills. One view is that such programs can be easily integrated into the curriculum, allowing the teacher time for more demanding activities. In addition, they are effective, and they command the attention of some students, particularly low-achieving students, better than does conventional teaching. Furthermore, the use of computers in tutorial instruction offers a convenient method to introduce computers into the classroom¹. Alternately, some feel that these activities can be carried out by teachers or aids effectively and that the use of such programs limit students' and teachers' visions of the power of computers, undermining the ability of computers to promote knowledge development and critical thinking skills. The objective of this paper is to examine several teaching styles and techniques adopted by the author in a junior level course, CIS 380 Systems Analysis and Design in the Computer Information Systems major program, in response to a changing college classroom in a small undergraduate college, Valley City State University (VCSU) in Valley City, North Dakota.

Introduction

Today, computer use is heavily integrated with education. While the use of teacher controlled educational systems remains stagnant, there has been a sharp rise in technology enabled, learner-centered educational systems. Technologies such as streaming video, virtual learning environments, and teleoperated scientific experiments are entering the Web-based learning arena.

In the Fall of 1996, VCSU became a technology intensive “notebook campus,” requiring each student to have an IBM laptop computer. In subsequent years, after having experimented with different online instructional programs, VCSU adopted Blackboard CourseInfo as its online instructional tool. Currently more than 50% of this institution’s regular courses are partially taught using the Blackboard CourseInfo online classroom management software package.

A Systems Analysis and Design Class with Each Student Actively Engaged in Using a Laptop

The phenomenal development of the Internet and the World Wide Web during the latter half of the twentieth century is probably one of the most significant factors to impact the educational arena in a powerful way. Today's teachers are facing a student very different from those faced by their predecessors. Students have been exposed to computers and electronic communication from grade school. Furthermore, a large number of students entering colleges today have been exposed to the Internet and the World Wide Web.

In a typical systems analysis and design course, more than 50% of the work is done conceptually. The college professor’s task of promoting higher order analytical thinking skills in students, who are actively involved in manipulating laptop computers connected to the Internet in today’s technology-savvy classroom, has therefore become a formidable, if not a frustrating challenge.

Another challenge college professors face today is customizing education, which can be defined as providing a flexible curriculum, allowing students a more proactive role in controlling their own education. This form of education is particularly useful for those students who are unable to attend classes in person on a regular basis due to other responsibilities or other personal reasons. The changes that are taking place in this area are not only rapid, but are bound to have a significant impact on the future direction of education. Universities and colleges funded by the state are in competition with the private universities and the corporate world in this process of customizing education in trying to provide education on a versatile, asynchronous basis. Online virtual universities that were on the horizon a few years ago have become a reality, offering accredited undergraduate and graduate programs, while competing with traditional universities. Meanwhile, small colleges, which don’t have resources and finances allocated to more traditional teaching methods like their larger traditional counterparts, have the option to migrate from a face-to-face educational delivery system to this changing interface of education with revolutionary learning technologies.

In an educational environment in which the traditional classroom is in transition, instructors need to find creative methods to challenge students to engage in certain expected learning experiences to satisfy the guidelines set by curricula. This would allow the students to use digital technology

productively within or outside the classroom. Could the promotion of analytical thinking be assured in such a changing educational set up? The author adopted the following five different methods in an attempt to promote analytical thinking by actively engaging the students in a learning experience different from of traditional pedagogy. These methods are: 1) adopting a non-traditional learner-centered style instead of a teacher controlled lecture-based pedagogical style; 2) using documentation and journal-writing to enhance analytical thinking; 3) using class projects and team work to enhance analytical thinking; 4) using a pro-technology assessment /evaluation and grading techniques including peer evaluations that promote student learning; and 5) using online classroom management tool/s to deliver content material and other daily announcements relating to the class. A discussion of each of these methods follows.

Adopting a Non-Traditional “Learner-Oriented” Teaching Style to Promote Thinking

In the author’s opinion, continuing to use traditional teaching methods in a technology-savvy and pro-technolgy environment would eventually prove to be an ineffective and unproductive exercise. Therefore, the author emphasized learning rather than teaching, assessment rather than evaluation, continuous process improvement (CPI), and life long learning as measures for promoting leaning with technology. Content delivery using lectures was minimized. Examinations focused on analytical thinking and not on rote memorization. Students were encouraged to use textbooks during examinations. The main emphasis in a given class was to make connections with the content material relevant to the topic of the day as stipulated in the course schedule. Students were expected to read and understand the recommended content material before attending class. The main topic of discussion on a given day was placed on Blackboard, allowing students the opportunity to analyze the material before class. This method of teaching encouraged student independence and accountability, while increasing the depth of discussion on any given topic. Furthermore, this method of electronic content delivery, if carefully read and understood by the students, would save a substantial amount of class time compared to the more traditional lecture method of teaching.

Using Documentation and Journal-Writing to Enhance Analytical Thinking

Writing is a great stimulator to thinking: as one struggles with writing s/he struggles with thinking. The implementation of a mandatory writing requirement in the course serves several purposes, including the development of innovative ideas and concepts, organization and documentation of those ideas, communication, and it serves as a method of analyzing one’s own thought. Writing is encouraged through the use of assigned ‘micro-themes,’ a minute paper demanding a very short definition of a concept, at the beginning or end of a class. This assignment probes student minds, enhances class participation, and promotes thinking, while determining students’ cognitive skill levels regarding a selected topic. Subsequent to the writing phase, a classroom discussion phase occurs, where students are asked to critically analyze their work as well as their peers’ work in an open discussion format. While the practice of writing micro-themes gives every student in class an opportunity to participate in a collective process, the immediate feedback given to randomly selected ‘micro-themes’ written by students is an effective way to engage students’ attention and active participation in a classroom discussion.

Another method of challenging students to think and actively participate in the learning process is by engaging them to brainstorm and commit to writing answers to questions relating to the assigned text material scheduled for the day. This method encourages students to account for their own education and read the text before attending class. The author utilizes writing to encourage students to prepare ahead by doing the required reading, to participate in brainstorming sessions in class, and finally to submit their work in written form to the critical review of their peers.

It is the author's observation that the habit of regular writing in class helps students to make connections with the textbook chapter material relating to the day's schedule. Students are encouraged by the author to keep journals of their daily class activities in a separate folder that they maintain on their laptops. Such journals should ideally enable students to take control of their own learning. The author's daily journals relating to the class are placed in Blackboard Course Info. daily announcements that reach students before each class on a regular basis. These journals are accessible to students at all times through the use of their laptops.

Using Class Projects and Teamwork to Enhance Analytical Thinking

Can analytical thinking be taught? Is thinking teachable? Can thinking be promoted online in an asynchronous format? Does every systems analyst think the same way? Does the type of formal training received make someone think in a particular way? Can higher order thinking be taught with technology? These and many other questions relating to thinking make the "teaching" of analytical thinking a complex task. Juxtaposed with all of these questions is one certainty: unless a person is willing to think, thinking does not occur. This is true in any problem-solving environment in which the problem solver will have to be willing to study the problem at hand, understand it by gathering all available information and formulate a problem-solving plan. This process involves intensive thinking, which is dependent upon the complexity of the problem intended to be solved. The experience in having thought through similar problems gives an added advantage to the problem solver in recognizing patterns that eventually may help solve a problem quickly and efficiently. An experienced systems analyst may therefore be able to guide a novice in systematic thinking patterns more effectively than a person who has had no experience as a systems analyst in the real world. Brainstorming and discussing problems in teams may therefore promote experienced systems analysts to transfer their knowledge and experience to novices.

Developing teamwork skills has become a necessity in today's changing workplace. Work teams are important organizational units in corporations. The demand for employees who possess communication and teamwork skills in addition to the required technical knowledge and skills has greatly increased in the employment sector. If employer demands are to be satisfied by educational institutions, changes have to be made in the way students are prepared in the academe. Students must learn new skills within the curricula that we teach, and changes must be made in the way they are taught and the performance standards to which they are held.

Realizing the difficulty of radically changing an existing system, the author incorporated the teamwork approach to class in several phases. One of the very first challenges in applying teamwork in the classroom was determining how to engage students in teamwork while still

preserving the quality of conceptual learning experience that they must receive from the course. With active communication among team members in mind, the author changed the seating arrangement of the classroom so that students would face each other, instead of the teacher or the computer, to facilitate active discussions, brainstorming, and practice group thinking sessions. The groups were allowed to select leaders, recorders and presenters. They were also encouraged to use technology to communicate by email, record with word processors, create graphics with MSVisio, and schedule and create project documentation using MS Project.

Using a Pro-Technology Assessment/Evaluation and Grading Techniques including Peer Evaluations that Promote Student Learning

Many scholars have done research on assessment, evaluation, grading, and other methods of measuring student learning.² While there is considerable debate as to which method of evaluation maximizes students' learning experiences, the author's classroom assessment and evaluation practices are based on the hypothesis that the essence of the learning experience should remain the same no matter which method is used to reach its goal (i.e. higher order analytical thinking).

Distributing the grade points over a variety of activities that students are required to engage in on a regular basis is one method the author uses to encourage active participation of students in the learning process. A point scheme giving a certain percentage of the total grade for teamwork is one way in which students' active participation could be ensured. Assessment and evaluation of the projects are done using several criteria: 1) peer evaluation; 2) periodical written reports; 3) class discussions; 4) unobtrusive observation by the instructor; 5) regular journals kept by individual team members; and 6) presentation of project outcomes to a panel of judges. Percentages assigned to each of these criteria are specified to teams at the beginning of each team activity. Each team is required to evaluate and grade other teams' work; evaluating teams need to first come up with evaluation criteria before they begin the evaluation process. The evaluation criteria must be consistent with the standard criteria given in the literature.

In addition to these methods, the author tells students what questions will be asked during the final examination as an incentive to study and learn the material in the textbook. Students are required to find answers to the questions individually, brainstorm their answers in their respective groups, and make modifications as needed. At the end of a brain storming session, the author facilitates a group discussion where randomly selected answers are presented by members of different teams to the entire class. This is an opportunity for each student in the class to participate and discuss answers regarding: a) the depth of understanding of the problem; b) the gathering, organization, and analysis of relevant data; and c) the solution presented. These discussion groups indirectly help students to evaluate their own answers. Although the available time for such classroom activities is limited, this process, if properly followed, enables the entire class to concentrate on a single problem and formulate a comprehensive solution. However, the success of this process in promoting analytical thinking mainly depends on the preparation, participation and motivation level of class as a whole entity, and more importantly, the maturity level of students.

Using Online Classroom Management Tools to Deliver Content Material and Other Daily Announcements Relating to the Class

Beginning in year 2000, VCSU adopted Blackboard Course Info. for online classroom management. The author utilizes this facility to deliver course content material and all daily announcements relating to the class online. Some advantages of using this classroom management package are: a) the ability to communicate with students constantly on a daily basis regarding learning activities related to a class; b) the ability to send topics and summaries of content material that students are expected to review before they arrive in class; c) the ability to perform assessments using true/false questions that would give instant feedback; d) the ability to reach students who are unable to make it to class; and e) the ability to archive all classroom material in one place that is accessible to students 24 hours a day 7 days a week.

Discussion

Many years of teaching in many different educational environments including partially online classes using Top-class (1997), Web-CT (1998), and Blackboard Course Info. (1999-2002), indicates that not every student is engaging in the learning process in the same way. Cognition is a dynamic process that results from multimodal perception, and research has shown that cognitive competence presents itself differently in different learners. Therefore, it is not surprising that in every classroom there are students who are motivated to learn in different ways.

One critical success factor of any teaching/learning environment is the learner's motivation to learn. Most students are motivated by their desire to obtain a good grade, and learning activities which are not tightly coupled with a grading scheme that assigns points for their successful completion by students are not perceived by some students as valuable. These students would be less likely to attend a rigorous classroom discussion if they are not awarded points for attending or participating in this discussion. Unless attendance in the class is made mandatory and an integral part of their grade, students usually do not attend classes regularly.

When the intended goal of the learning experience is not to reproduce textbook material through memorization, fewer students make it a habit to read textbook material in preparation for a class except for an examination purpose. Likewise, when exams are open book, most students read the textbook at the last minute while taking the examination. However well intended, open book exams invariably result in defeating the very purpose of learning – most students copy answers right out of the textbook, some e-mail their answers to other students. The tendency among most online instructors today is not to pay much attention to online cheating, thereby trusting that the online students engage in an honest and responsible job of learning.

A classroom environment in which each student has a laptop computer in front of her/him has provided the students with a device to shield them from the rest of the students in the classroom. The author has observed students in his class engaged in performing work related to other classes online, sending and receiving e-mail, navigating favorite web sites, maintaining their own web site, and doing business on eBay.

Students rarely are motivated to engage themselves sufficiently to bring a project to completion, as most analysts do in the real world. This is mainly because students are not employees in an educational set up. Project work is not an occupation for students as it would be if they were employed in industry, and a student's livelihood does not depend on the success of her/his projects. The motivation for completing project work, the available time within the semester, motivation of team members, project scheduling, leadership, and many other factors in a classroom environment are very different from that of the real world work environment.

The lessons learned in experimenting with team projects in the classroom over 15 years have convinced the author that students could be exposed to only some aspects of team/project activities in the classroom setting, especially in the changing classroom of today. For example, a team of students can engage in a preliminary investigation or a requirement analysis of a given system. The team project ends within a limited time with a report that would enable students to understand the standard systems analysis methods followed in the industry.

Hybrid or partially online classroom has to be strictly defined. Does this mean that some students attend class face-to-face and others participate online? Or does this mean that every student in the classroom meet face-to-face on certain days during the semester and meet online during other scheduled days? Should instructors be required to have online office hours? Many other details need to be defined for achieving successful results in this changing classroom.

Conclusions

Through the use of adopting a non-traditional learner-oriented teaching style for students in a modern technology-centered classroom, assisted by the use of documentation and journal-writing, along with team projects, and novel evaluation methods, it may be possible to promote analytical thinking with technology in a changing classroom. Evaluating higher order analytical thinking skills of students who do not have the motivation, maturity or the time to participate in the activities described presents extremely difficult challenges for those instructors engaged in delivering fully/partially/web-enhanced/web-enabled/hybrid online courses.

As one recent author has pointed out “ Of the numerous pedagogical models proposed in education science literature, those developed for online distance education do not take full advantage of the online medium. In attempting to harness the capabilities of digital interfaces, the mistake is often made of recreating a classroom-teaching model within the online environment. Online technology designed to mimic the classroom becomes a restriction and a barrier to the teacher's ability to impart knowledge.”³

Finding the “middle ground” amidst this changing face of the “face-to-face classroom” to “a fully/partially/web-enhanced/web-enabled/hybrid online classroom” and at the same time rendering a quality service to education could perhaps present enormous challenges to educators of today and tomorrow.

References:

1. Janice H. Patterson and Marshall S. Smith, *The Role of Computers in Higher Order Thinking, a paper prepared for inclusion in the 1985 Yearbook for the National Society for the Study of Education*, Wisconsin Center for Education Research, p.17
2. Thomas A. Angelo and K. Patricia Cross, *Classroom Assessment Techniques*, Jossey-Bass Publishers, 1993.
3. Syllabus, *New Dimensions in Education, Changing the Interface of Education*, November 2001, Vol. 15, No. 4