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Learner-Centered Instruction

Inquiry-Based Technology-Enriched Integrating Workplace Reality

A Resource Guide for Teachers

Baird W. Lloyd, Editor

Miami University Middletown
Middletown, Ohio
Learner-Centered Instruction

Inquiry-Based
Technology-Enriched
Integrating Workplace Reality

A Resource Guide for Teachers

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Introduction

Inquiry-based instructional strategies function best with motivated students whose interest and imagination are already enlivened and whose curiosity will help them master new learning skills. The responsibility for supplying the initial impetus falls upon many diverse entities across the student's educational life. College teachers often inherit students with years of spoon-fed, low-expectation instruction, challenging instructors in higher education to overcome this deficit. Fortunately, most students possess a native curiosity that is eventually heightened by academic success, especially when their achievements are perceived to stem from their own work and thought processes. This is the power of inquiry-based learning.

The rapidity of technological advances often leads to a lack of knowledge, understanding, or acceptance of newer technologies. Inexperience often translates into distrust and fear, preventing faculty from attempting to exploit these tools to enhance their teaching effectiveness. Adjunct and part-time faculty are offered minimal support with respect to available resources and procedures to access them. Within this Resource Guide are suggestions to help all instructors obtain ideas and guidance concerning technology as a tool within inquiry-based learning.

This Resource Guide

The Middletown Campus of Miami University was funded by the National Science Foundation to pursue a project entitled Furthering Advances toward Learner-Centered Education (NSF-DUE # 9850015). The primary goal of this project has been to create an active, learner-centered educational community by providing opportunities for faculty and staff to develop and implement instructional strategies that would enhance the way in which students learn. We hoped to achieve this goal by providing faculty the knowledge, time, and resources to develop and test innovative inquiry-based curricular materials that are technology-rich and which integrate workplace reality with academic principles. If a heightened awareness could be created among the faculty of how inquiry-based instruction could become part of their syllabus and overall curriculum, a wider adoption of these strategies would ensue, producing campus-wide curriculum reform. Another important outcome of this project would be to produce students who could enter a work force that constantly calls for incorporation of cooperative and active-learning strategies. Inquiry-based learning helps develop an appreciation for
curiosity and questioning vital to life-long learning. It increases students' proficiency in problem-solving strategies, enabling them to draw conclusions that integrate experimental processes and results with theoretical principles and everyday living.

The Middletown Campus of Miami University includes a diversity of academic departments, many having one- or two- person faculties. These educators tend to be broadly based, motivated, and creative. Within this environment a variety of approaches to similar teaching goals emerge, generating numerous examples that demonstrate the variety of teaching resources, strategies, and technologies used in day-to-day classroom instruction and activities. These people proved to be the most valuable resource for this project.

Examples demonstrating the diversity of teaching resources and technologies used in day-to-day classroom instruction and activities abound on our campus. This Resource Guide, based on exposition of successful activities currently used by Middletown faculty, as been created to share these valuable ideas. It includes models of inquiry-based learning strategies backed by examples from existing courses, suggestions for implementation, and a list of existing curricular materials and references. The Resource Guide was compiled through the concerted efforts of three teams composed of selected faculty, staff, and students from throughout all departments on the campus. Each team focused on one of three concentrations: 1) Communication, information and computer technology, 2) Inquiry-based learning, and 3) Integration of workplace experiences with academic principles. The team members related their experiences and advice, and solicited the same information from the other teaching faculty at Miami University Middletown.

**Using the Resource Guide**

The Guide is organized into three parts and an index. **Part I** contains general information, issues and comments about inquiry-based learning as an instructional strategy that have been collected from faculty and students in a series of surveys concerning their teaching and learning experiences. It is included in this Guide so the reader may understand the broad perspective of a group implementing new curricular ideas. This introduction also discusses the uses of different technologies, along with trends, problems, and suggestions for better implementation. The purpose is to provide a view of how a variety of technologies may be integrated into various courses to afford students new kinds of learning experiences. The objective is to integrate these tools into the existing curricula in order to augment, enhance, and advance pedagogical goals.
Part II contains descriptions of a variety of activities and uses of technology within inquiry-based instruction found across the broad diversity of disciplines on the campus. The examples, case histories, suggestions, strategies, benefits, and pitfalls are detailed under headings indicating general activities widely used for instruction. Guide users are strongly encouraged to explore many of these topics, even those seemingly not related directly to one’s own discipline. Many ideas spring from examination of strategies in areas outside your own. Each activity type is broken-down to depict its various aspects, including a general description of the activity and its educational purpose, examples of applications across different disciplines, and a comprehensive description outlining its implementation. Since many of these strategies are applicable across many subjects, an Index to the Activities appears at the end of the volume, containing key words, and cross-references. Users may find only particular parts of an activity description useful, and could mix-and-match among exercises to create one fitting a specific purpose. These descriptions are meant to guide, suggest, and encourage.

Part III offers detailed descriptions of seven courses that address one or more of the primary themes of the project: inquiry-based instruction, technology-enriched presentation, and integration of workplace reality with academic principles. Initiating and establishing inquiry-based instruction into a syllabus or curriculum may seem a daunting undertaking, but detailed and thorough preparation is a key to success. Nothing replaces experience and experimentation. You will be able to learn how the courses are structured and taught and how students respond to the innovation.

Our Invitation to You

You are encouraged to tap the most valuable resource available when planning instructional changes: the faculty who already use these techniques. They serve as a font of information for what works in various situations, different technologies making certain activities easier or even possible, and as a source of support and encouragement. It is important to remember not to fear failure. The activities and courses described in this Resource Guide will help you start challenging your students to use their knowledge and abilities to achieve their potential by becoming thinkers instead of responders.
Part I

Ideas, Issues & Comments
Definitions of Inquiry-based Learning

My definition of inquiry would be a situation where students are not mere recipients of information in a passive setting, but take information and apply it in ways in which they can internalize learning. I think it is ideal if they can transfer that learning from one situation or discipline to the next. I encourage this kind of learning in my classrooms. They must be able to engage with other learners, do a certain degree of problem-solving, and create with what they are learning. (Faculty 12)

Inquiry-based learning occurs when students critically examine and engage each other in order to understand the important concepts, theories, and subject matter of a discipline. In Sociology it is especially important for the students to understand the application of the subject matter to their own experiences and to critically examine what we know and realize that we don't know everything and that many of our choices are constrained by assumptions and myths about the nature of reality. (Faculty 1)

Student-directed activities where students are actively engaged in the learning process through discussion, involvement in activity and processing information through response methods other than sitting and listening. (Faculty 9)

Inquiry is a method of education in which students, under the direction of teachers, assume primary responsibility for learning through group and individual activities. (Faculty 16)

Learning that is interactive and encourages students to discover pertinent information. (Anonymous)

Inquiry learning is a process/set-up where students can engage in exploration and meaning-making where they are in their own lives. (Faculty 17)

Students become actively involved in the learning process. They work together (or separately) to discover concepts or reinforce ideas that have already been presented. Doing equals understanding. (Faculty 18)

As these comments demonstrate, there are nearly as many specific definitions of inquiry-based learning as there are people who have it as a goal for student learning. Nevertheless, the definitions are consistent with the idea that inquiry-based learning involves students actively engaged in the pursuit of meaning. Students are expected to learn how to organize, prioritize, and apply knowledge, discriminating among guesses, assertions, opinions and
tested beliefs. Inquiry-based learning is interactive and encourages students to discover important information. The interactions can be strictly with the subject matter or can include cooperative and collaborative projects.

Inquiry-based learning activities require students to use content rather than just acquire it. Such activities will be thought provoking, leave room for intelligent failure, and involve experiences for which the answer is not perceived as already known. Whenever students are accountable for the acquisition of knowledge and skills, they seem to learn in a way that involves more thought than other learning approaches. They are challenged to explore specific content areas more deeply, critically examining important ideas, and investigating their own questions. They engage in reflective thinking, examining what they know and have experienced in order to analyze and assess the line of thought, identify connections, and consider alternatives.

The role of instructors in classes engaged in inquiry-based learning varies, depending upon the tasks at hand and the instructor’s personal definition of inquiry. Instructional strategies will range from very guided inquiry, in which the teacher identifies questions and content to be investigated and the direction in which students should go to find answers, to very open-ended inquiry in which the students must identify and refine relevant questions for themselves, then find and apply methods of finding answers. In guided activities, the instructor might show students how to identify implicit assumptions, what to pay attention to, and how to ask questions of material. They may direct students to think about something they already know in a new or different way, searching for additional information or relationships to apply. In open-ended classes, the instructor creates an environment conductive to inquiry and acts a resource, ready to respond to the students’ needs as they arise. All inquiry experiences require time for students to explore and test ideas, to talk about meaning and interpretations, and to make mistakes and find ways to correct them. In Parts II and III of this Guide, you will find many examples of activities that have been used successfully in inquiry-based learning classes.
Inquiry-based Learning Issues

The best way to learn about what is happening on campus with respect to inquiry-based learning and how it affects student learning is to ask students and teachers to discuss their experiences. The primary method of faculty data collection was a written survey that was distributed to faculty at the end of Fall semester, collected over the following semester, and supplemented in many cases with follow-up interviews. Some faculty also wrote a short essay or narrative describing some of their experiences. A total of 32 people participated in the study. In a given semester, there are approximately 150 faculty, 60% of which are full time. Almost all of those who participated in the survey were full-time faculty. Three percent of those who participated were Senior Instructors, 27% were in visiting positions, 12% were Professors, 35% were Associate Professors, and 15% were Assistant Professors. The majority of the faculty was from the School of Arts and Sciences, but some also came from Applied Science, Fine Arts and The School of Education. A variety of disciplines were represented.

To obtain student input, each member of the Inquiry-Based Learning Team invited several students to participate in an on-line focus group. Fourteen students and three instructors participated in a single 75-minute, online focus group. Students were given a survey to complete before the session. During the focus group, all participants were identified only by number to ensure comments remained anonymous. One faculty member (not a current instructor of any of the students) was present in the room with the students for the on-line forum. The other instructors went online from their offices. Students began by posting two of their survey responses on a web site created specifically for the purpose. All participants then read and responded. This led to discussions on a variety of inquiry-based learning issues. Thirty-nine pages of dialogue were collected.

What follows here is a general summary and analysis of the responses to the issues raised by the survey. Accompanying each summary is a collection of some representative comments made by the students and faculty for the purpose of allowing you to hear their individual voices in the discussion.

Student Population

Students at Miami University Middletown represent a wide range of academic interests, job and family obligations, maturity levels, and cultural backgrounds. On the one hand, this diversity can make inquiry-based learning more viable, as students bring a vast array of interests and concerns to subject matter and classroom exercises. In this sense, they can
challenge their teachers and each other to negotiate their various perspectives, to question the poignancy of their investigations, and to consider unanticipated insights. On the other hand, the diversity of our students’ backgrounds can place additional burdens on teachers to accommodate the different learning styles and even the different levels of commitment students bring with them to the classroom. Hear some of their voices.

Part of the problem with inquiry-based learning is that students are not really subjected to it in the pre-college years, I mean junior high and high school, to a certain extent. This has been the hardest thing for me to adjust to in college. I wrote approximately 3 papers in all my years of MS/HS and had even less experience working in groups or discussions. When I entered college, I was asked to analyze, interpret, discuss material, and I had no skills to work with. (Student 3)

From my observation if anyone seems more prepared and willing to participate in inquiry-based learning it is non-traditional students. They seem to have more at stake in their education and often are paying for it themselves. I know from experience fresh out of high school I had little concern for my education and didn’t take things as seriously. (Student 1)

Non-traditional students are able to bring in experiences to the participation exercises but I wonder if they get frustrated by these exercises which (because of their age and experience) they need less in order to understand the material. (Faculty 1)

I notice sometimes that women will let the men lead in a group situations, even if they know more. . . I also notice differences in learning and reactions by personality and learning style (not that I always know what their styles are, but I attribute some differences I notice to that) rather than gender, experience, or age. (Faculty 2)

Older students tend to be seen as anchors by their groups—giving stability. Younger students, though, sometimes bring more to the group. The variety enhances group work, but it’s hard to generalize. (Faculty 3)

I think each student is different but in all my experiences the non-traditional students want to give less, but receive more (i.e., get extensions on assignments because their kids are sick, want extra credit but can’t seem to get the regular amount of work completed). Perhaps the lifestyle differences are the key factor. School is my top priority right now, but of course I don’t have a family. (Student 14)
The younger-aged students appear to prefer activities (lab, etc.) versus lecture more than the older students. (Faculty 4)

Working students who are taking the course for content would prefer lecture. For example, a working professional who takes my course to learn Visual C++ is frustrated and dislikes the group work used in some of my classes. The needs for this kind of student are very different than the needs of a freshman or sophomore just beginning their degree program. Adult working students who are taking a course for technical content generally do not like group work. They do, however, like hands-on computer work. (Faculty 5)

Sometimes students enroll in courses only because of certain requirements, and thus they lack the motivation to carry through on projects that entail a lot of independent learning. Due to job and family obligations, students may not have schedules adaptable to other students’ when group work is assigned. Because of varying levels of academic preparedness (with computers, with labs, with learning on one’s own), students may require much more coaching than teachers originally plan for their inquiry-based exercises. Basically, it is hard to tell which type of student will profit most from inquiry-based learning and which type of student might contribute most to such exercises. What is certain is that inquiry-based learning requires teachers to come more into contact with the human side of learning than they need to in classes comprised predominantly of lectures and Scantron examinations.

Faculty Workload

More than likely, inquiry-based learning strategies will add to teachers’ workloads. As with the lecture approach, where teachers must update or revise their notes, inquiry-based learning demands that teachers keep abreast of developments in their field so that they can intervene in students’ investigations, ask pertinent questions, locate resources, and assess results. On top of this preparation time, teachers using inquiry-based learning must carefully plan activities for their students, which may include time setting up labs and equipment, composing step-by-step directions, and monitoring group activities once students get to work.

Active learning in the classroom takes a lot of planning and thought to ensure that students are prepared, that they collaborate responsibly, that the project or assignment fits the time frame, that it meets clearly articulated goals, and that there is time for closure. (Faculty 3)

Although I do a little bit of lecturing (about 20%), most of my time is spent on active-learning activities. I find it much less time consuming to
prepare a lecture than active-learning activities. In fact, for most of the courses that I teach, I have lectures already prepared. Even though I have used many active-learning activities in the past, I am always looking for new ones or different ways to present the activity. It takes a long time to prepare a class that primarily uses active-learning activities. (Faculty 6)

Once I have carefully designed my course content and tried it out in lecture several times, I am ready to design active learning strategies. Creating the project’s content, active learning strategy, and developing materials takes more than twice the time it took me to develop the lecture content. (Faculty 7)

With my inquiry-based learning approach, I do a lot of backloading of information. Since I can’t always anticipate what questions or concerns come up in class, I have to do a lot of my work after class. After class, I’m often looking up answers to students’ questions or looking for new texts that I might add to the reading list to address students’ concerns. I don’t know if the lecture approach would take more time. I guess it would involve more frontloaded time, whereas my inquiry-based learning approach involves more backloaded time. (Faculty 8)

Both lectures and inquiry-based learning activities require similar preparation, if they are initially being developed. (Faculty 9)

The time in the classroom is often not the issue in using inquiry learning; it is having the time to prepare those activities well in advance of the first day of class. (Faculty 10)

I see my class preparation as a whole thing, which incorporates all the aspects of a course, and so I do not separate out active-learning stuff from lecture stuff in my mind. I am looking at my courses more conceptually and view my preparation in terms of these conceptual units and not by type of activity done. I am always looking at how I can improve class time so it is most valuable to the students’ learning the topics or skills, and I don’t keep track of the different things I prep for. (Faculty 2)

It takes as much or more time to prepare activities than to prepare lectures. To prepare successful interactive activities requires thinking through them, making handouts, connecting activities in a series that builds meaningfully on each other and then connects with reading. (Faculty 11)

In one sense, inquiry-based learning is much riskier than conventional methods, for teachers need to be prepared to adjust activities, schedules, and assessment measures to account for the often unpredictable nature of their students’ lives. Inquiry-based learning frequently requires students to work in groups and to work independently of classroom instruction.
Teachers should be aware that projects are often hampered by absenteeism (intensified by the student's job and family obligations), by personal clashes between students of different gender, race, class, and religious backgrounds, and by the various levels of academic preparedness our students represent. Unlike the lecture format, where student and teacher roles and expectations are generally well-described, inquiry-based classrooms can be much less predictable, as students' different learning and life styles enter into the mix. These factors can impact inquiry-based teachers' workloads in that instructors find themselves shuffling their calendars, supplementing instructions, conferencing with (or even counseling) students outside of class, and developing new methods of assessment as exercises roll along.

On the positive side, the riskiness of inquiry-based learning represents a challenge to teachers to continually modify activities to meet the individual needs of students and to persistently question and augment their own knowledge of their field as students' inquiries sometimes yield surprising difficulties, issues, and results.

**Compatibility of Inquiry Methods and Content Coverage**

The success, type, and usefulness of inquiry-based learning strategies may depend on a variety of factors, not the least of which is subject matter.

*There are times when I think lecturing is the only way a particular class could be taught, but then again, when ever is something so straight forward? At some point there must be room for practice, conversation, or just a break from the norm. (Student 14)*

*Recently I had a paper due for which there was no particular assignment. In other words the prof gave us the topic of middle-working class, poverty, or ideology. From this, and only this, we had to write a paper using two sociological journals. Sounds nice, but when you are used to having a well outlined assignment, the panic really sets in. (Student 1)*

*Thinking for themselves seems to be a scary thought for most. In a history class I'm taking my prof seems to do his best to get people to think for themselves. Every Friday we get into a circle and discuss some material that was assigned to be read... What is best of all is that the prof doesn't involve himself in the discussion. He lets the class take charge of where the discussion goes. The students define what is important and what isn't. (Student 7)*

*There must be some type of boundaries in the class. There will always be some classes that are so tunnel visioned it's depressing, and some*
so unrestricted it loses meaning. Neither extreme is much fun for 16 weeks. (Student 14)

Discussions have the potential to change minds. Projects have the potential to make minds burn up, turn to ash, and blow away with a letter-grade. I’ve come out of discussions, mainly in a diversity discussion-based class, with a better understanding of my own beliefs, or sometimes, new beliefs and more at peace with my stance on a topic. (Student 5)

I often feel that if students do not have a "full" notebook at the end of the semester, then I have not done a good job. (Faculty 6)

My students know that they might not be able to complete a task in the amount of time that I give them, but that it is working on the process and not necessarily the final product that is important at that moment. (Faculty 12)

I have become convinced that the expanded knowledge they gain is worth the loss of quantity. (Faculty 1)

We have a 6-7 course sequence in Systems Analysis. Students must cover the topics that are on the standard electronic syllabus of the department if they are to take the next course or move to Oxford. I think that takes away from the ability to experiment with different inquiry-based activities. (Faculty 5)

You have to let go of the coverage imperative in the history surveys to use active learning extensively. (Faculty 3)

In one recent Children’s Literature course, I had to set aside the final novel of the semester because we were unable to complete the syllabus. That had something to due with class cancellation due to bad weather, but if I’d been lecturing, I could have accelerated the pace to make up the time. (Faculty 13)

Not all elements of the curriculum benefit from an inquiry-based learning approach. Sometimes it behooves an instructor to merely describe to students the proper way to use a piece of equipment rather than set up a series of exercises to help them come to some expertise on their own. In this case, a short lecture on proper use of equipment may allow for an inquiry to proceed. On a different note, a lecture-based course does not necessarily exclude elements of inquiry from the curriculum. Students in lecture-based classes may still be encouraged to question the information offered to them or given a glimpse into the type of inquiry the professor undertook to construct a lecture. In short, teachers need to weigh their course’s demands for coverage against students’ needs and concerns in order to design a feasible inquiry-based learning practice.
The degree to which teachers intervene in students' inquiries is also determined by course and subject matter. In nursing programs, for instance, inquiry-based projects are often structured by teachers to produce predetermined outcomes. Since improper use of materials and processes may actually cause harm to patients in a hospital setting, it is necessary that students conduct a process of inquiry that lead to correct answers. In literature courses, on the other hand, students may be encouraged to take part in open-ended inquiries where no set answer has been predetermined. Such inquiries can help students acknowledge the viability of multiple perspectives. Along the way, teachers need to determine how much of the inquiry itself needs to established: How much time is allotted for students to sink or swim on their own as they search the library for sources or a laboratory for the proper equipment? How little or how much should teachers impose themselves in students' discussions of subject matter? Should an inquiry-based project leave room for multiple conclusions? Do all the stages of the project need to be mapped out before hand for students? Do the directions for the project unnecessarily constrain inquiry? Would it be helpful to look critically at the procedures themselves?

Inquiry-based learning requires that students be allotted time to develop their thinking about subject matter—time to discuss topics in class, to revise their writing, to learn how to use lab equipment, to conduct interviews, to consult with peers, to organize presentations, and to fail and try again. When teachers place emphasis on memorizing information rather than developing the skills students need to create and critique knowledge themselves—as teachers might do in lecture classes—coverage is not really so much an issue. In lecture classes, teachers can speed up the pace according to the demands of their calendars and their departments, since the aim is to expose students to a range of information with which they need to express familiarity for a final exam or for the next course in a sequence. In inquiry-based classrooms, teachers cannot merely speed up the pace of their class because they are no longer just telling the story of their discipline to students; in inquiry-based classrooms students need to work on the skills and values they need to become active forces in the story.

Generally, teachers who use inquiry-based learning feel that what their students might miss in breadth of knowledge they make up for in depth, and that it is this depth of understanding that will help students advance through the next level of courses. Other teachers would reject the notion that they sacrifice anything in terms of coverage in their use of inquiry-based practices. These teachers plan their exercises accordingly so that even if the exercise itself does not reach the anticipated level of completion, students can still come away from a project competent in the
process that would have brought them to the desired results. In other words, students acquire the skills necessary to conduct the process of inquiry. In the meantime, it is not necessary for these teachers to disrupt the course’s calendar or otherwise compromise the coverage that their courses demand.

Student Cooperation

Probably no aspect of inquiry-based learning is more critical than student cooperation in terms of the motivation they bring to the exercises, and their willingness to work alone and with each other.

_It seems to me that atmospheres that are more cooperative and involving students and inquiry-based are more likely to create new ways, not just to gain information, but to learn, learn to think, and learn to learn._ (Student 5)

_For my classes to be successful, I need motivated, reliable students. When a class has students who do not complete assignments, the whole class can suffer. Have I had any classes where 100% of the students put in 100% effort into their work? No. Would a lecture-and-test-model be easier? Yes, because it really isn’t reliant on the students. If I were prepared, I could deliver my lectures and administer my tests, and those who chose to could participate, but each class session would follow my script. It’s the unscripted nature of active-learning activities that results in occasional failures. The successes are worth that risk._ (Faculty 13)

_I think everyone has been around a student who didn’t do his/her share of the load. This is as common as the sun coming up every day. I am sure that among profs there are profs who don’t do what is expected either. However, having group a lot of times inspires students to do better. At least that’s what it does for me. If I know I’m in a group and we have a group project we have to do, I’m going to do my best not to let my group down. I usually do my best work when I know other people are counting on me._ (Student 7)

_Group projects are frustrating and time consuming. No one has the same schedule and it becomes so hard to get together, and knowing that your grade is riding on someone else’s work is too stressful._ (Student 14)

_Of course, the obvious problem is keeping the individual groups on task and not using the groups as an opportunity to visit. I just keep floating around the room and give them slightly less time than I think it will take them to complete the activity._ (Faculty 12)
I have never had a good experience with a group project. Either the other member has no ambition, no real concern for the grade, or doesn't think like me. The list goes on. (Student 3)

I feel that some of my non-major courses did have inquiry learning. In fact, I did learn better in these classes than my non-major, non-inquiry classes. I actually became interested in topics that have really no involvement with my major that I had no idea I would like. (Student 4)

Sometimes in chemistry lab I get frustrated because I consider myself to be an inquiry-based learner of life, but when I have to inquire (and worse, for a grade) it loses its essence of freedom from conventional learning/teaching. . .Since I do not like the subject, I am probably not going to search out the information in a text — not only is the want not there, but inquiry-based learning takes considerably more time. I know this sounds like a terrible student, but I am trying to be honest, and it has to do with motivation (which is equally complex). So sometimes I just want to say (shout, whisper, whine) give me the material, your knowledge, guidance, support, encouragement, and a grade, and I'll do the rest. (Student 2)

I find working with other students to be challenging but also a good learning experience. I tend to be a perfectionist and have had to learn to accept others study and work habits. It is really hard to sit back and let someone in your group goof-off when your grade is at stake. (Student 6)

Students sometime feel that these exercises are "free time" rather than learning experiences and I have yet to figure out how to deal with that. It is a real problem. (Faculty 1)

For awhile, I stopped using student project presentations because I wasn't happy with the quality of them. Then I started using them again, but stipulating very carefully and throughout all I expected in terms of quality. I’m happy with the work students are doing now. I just had to ask for more from them, and ask for it explicitly. (Faculty 11)

If students are required to work in groups outside of class time I give them their assignments about one month ahead of time to allow students time to find mutually agreeable meeting times. I also have them complete a peer evaluation so that each member has some accountability to do their share of the work. I also provide the group with information on group dynamics and roles of group members. Students need to be taught how to work in groups. Because of the increased work involved for the students, I incorporate their product and peer evaluations into their course grade. (Faculty 7)
Teachers may develop a series of measures to encourage cooperation amongst students and themselves, such as peer review to inspire conscientiousness in group projects, consistent intervention in small-group discussions to ensure that students stay on track, student choice in curricula to help students develop projects vital to their social, academic, and professional lives, and advanced scheduling and planning to guarantee that students find the time and help they need to conduct research, meet with peers, learn how to operate equipment, and draft and revise reports. However, a variety of social, cultural, and institutional factors may hamper students' cooperation in inquiry-based exercises. Culturally, students in our society are often brought up to respect individualism and competition over values more akin to cooperation. Socially, our students frequently have job and family obligations that take priority over their studies, especially when those studies entail their learning modes of inquiry contrary to the passive approaches many students previously learned in school. Institutionally, we frequently deal with students who are not majoring in our discipline and whose motivation to undertake extensive work (beyond the lecture/memorization format) in their non-majors courses is limited. And for some students, institutional pressure to acquire credits in courses outside their interests and to compete for grades in those courses impinges upon the motivation and creativity they might otherwise bring to a course's subject matter. Group projects evoked the most stressful emotions in the student responses. The biggest complaint has to do with other students in their project groups. Students resent depending on others for grades, relying on others for work that may not be completed in a timely fashion, and finding time outside of class to meet with other group members.

Inquiry-based instruction can sometimes make clear to teachers the variety of forces in our culture, society, and institutions that make cooperative, learner-centered environments problematic. At the same time, however, such environments can also act as motivation for students and teachers to challenge such forces, to overcome the inertia of passive learning, to find ways of negotiating the work and family obligations in order to open access to more students of more varied backgrounds, and to learn to value situations in which people work together to discern the various ways knowledge is and can be used.

**Students' Appraisal of Inquiry Learning Experiences**

Students are generally positive in their reaction to active learning practices. Overall, they feel that teachers that take the time to prepare special activities prove their commitment to students' education and learning. They report that they work best when given the freedom to learn.
No one likes a lecture over some other activity. I would rank a lecture right below a midterm exam. However for some classes they are near a close tie. (Student 7)

Yeah, it’s almost as if the profs sometimes forget that what they teach us has the potential to stay with us forever. Well, I guess there’s learning how to write faster, take better notes, or perfect that doodling habit. (Student 14)

I cannot count the times that I have spaced out during a class because the professor just drones on and on about the very thing you were supposed to read before you came. When the professor just lectures the text straight back to you the only thing the students do is quit reading the material before class. (Student 6)

It’s so easy to write everything down that the prof says, read it, repeat it word for word, but unless I get to actually do something with it, there’s no point. The lecture remains just words. (Student 14)

Before I really found what I wanted to do with myself, I didn’t find much desire in my education. But it seems there is a moment in which some people just click and something happens and from there on out you have found your drive, desire, and passion for education. (Student 1)

No student wants to sit down in class and listen to a professor talk about something they already know or it’s so boring they can’t follow . . . Let us students learn. (Student 7)

The students are lukewarm about traditional lecture methods. Most feel very comfortable in lecture classes, but they become bored and lazy in such an atmosphere. Student 7 reported, “I don’t mind a lecture-based class. Sometimes it is good. However I can say for myself it gets boring when all you have day after day is a teacher getting up in front of the class and lecturing. Boredom leads to unproductivity in my mind. I lose interest usually within the first 15 minutes or my mind goes in and out of the lecture gaining small amounts of the lecture.”

Students realize that lectures do not allow an instructor to cover every possible detail in class, although one student preferred lecture classes so that he/she would not have to do as much studying in the course. On the other hand, Student 3 reports that lectures are “useful, but part (or most) of the time, I have lectures that are telling me what I am about to read in my text books. This doesn’t mean I have never attended a useful or helpful lecture, it has its place. I just need something more stimulating . . . before I go to sleep!” Student 9 prefers the lecture method: “I like and prefer lecture because it gives me a better understanding of what I have read. I
haven't had a teacher that was not energetic in their lectures, then I may feel differently.” And Student 6 adds: “I guess because I really don't have time to do much reading I rely on lectures to give me the information I need to study for exams.”

The consensus seemed to be that the lecture method is “okay when it is kept to a minimum.” Students want a classroom that employs many types of teaching/learning strategies employed. Student 1 writes: “I prefer the inquiry based learning or even a course mixed of lecture and inquiry based. That way it lets me know where I stand in the class and if I, like my peers, am getting the information and finding it of use.” Student 14 adds: “I can’t really say that I like the lecture over inquiry learning. I like a classroom with both. I think to really get the materials across to the class that a form of inquiry learning must be used to reinforce the lecture material.”

Students like being involved in discussions. They realize that for discussions to be effective, they must prepare before class. Although they complain about more work, they also praise the results. Discussion groups allow for “free opinion making and openness in the class.” Students see the benefits from learning from their peers. Student 14 posted, “Discussion is great; I always end up leaving class seeing things in a new light...” Student 5 agreed: “In discussion, there is an exchange in ideas and attitudes with more than a grade at stake. Discussions have the potential to change minds.”

Students agree that discussions are most effective when the teacher is a “guide and sets the tone.” But teachers must also allow for freedom in the discussion. Student 7 posts: “Thinking for themselves seems to be a scary thought for most. In a history class I’m taking, my prof seems to do his best to get people to think for themselves. Every Friday we get in a circle and discuss some material that was assigned to be read. It is a kind of a discussion that forces you to go think for yourself. Some people agree with others while some disagree. Sometimes people just go along with whatever is being said...What is best of all is that the prof doesn’t get involved himself in the discussion. He lets the class take charge of where the discussion goes. The students define what is important and what isn’t.”

Students never related specific examples of assignments that involved negative experiences. They did, however, share the types of things that can go wrong in an activity. Clearly students want instructors to be more involved in group dynamics. Responsibilities in the group need to be rotated and individuals need to be held accountable. Student 1 posted, “It really frustrates me when I do my share of the work and find that several of the other members are not doing theirs... My grade suffers and so I dislike group projects for that. I condition that by saying that I have rarely found a
professor that has noticed one person's efforts over the group's and that is just not fair in my eyes." But students also caution that projects that allow them to split up the work into disconnected parts are not effective. Students know that for projects to be successful instructors must carefully plan and carefully evaluate them. Teacher planning is considered crucial.

Students are very positive about well-planned activities. They report that these activities help them find out if they really understand the material. Students learn to think for themselves, increase interest in courses outside their major, and make learning easier. The activities force them to organize the material and keep a clear focus on what is important. They must not only keep actively up-to-date with the material, but also regularly prepare for class in advance. The skills they learn in doing group activities are ones that help them develop interpersonal relations and prepare them for the future. They take these skills with them to other classes and use creative ideas in working assignments in other classes.

Students were happy to provide us with examples of positive experiences. Student 6 writes: "I remember a group project that took 7 weeks to complete. There were 5 students involved and it was up to us to develop a strategy for presenting a patient case study to the class. This was the greatest project that I have ever been involved in! Each student laid out their own strengths and weaknesses and we went from there. We decided that each person would contribute their strength to the benefit of the grade. But they also had to work with someone who was strong in their own weakness so that they would gain knowledge from the experience. The end product was a 20-minute oral presentation followed by a computerized slide show of the work in progress. The teacher loved it!"

Student 14 adds: "I've interviewed my grandparents to learn about the ways in which the world worked when they were growing up. My grandfather fought in the war, my grandmother took over the house when her mother died when she was very young. It was nice to learn more about my family at the same time that I was learning history. This type of history really pertained to me, more so than the write-ups in textbooks. I appreciated the assignment."

**Student Reactions from a Faculty Perspective**

Teachers evaluate how students perceive their classes through student feedback.

*Students comment positively on the in-class activities. They feel that they have more "hands-on" experience and can speak the language more effectively. (Faculty 12)*
Students like order, clarity, structure—that gets muddled more in active learning. (Faculty 3)

Most students seem to comment positively on the value of the individual critical and peer evaluations. By learning to judge the writing of their classmates, they become better prepared to judge the worth of their own writing assignments and, consequently, revise and improve their work. (Faculty 14)

I believe that it probably makes the evaluations go up, but I'm not sure since this is probably not true for students who would rather sit back, take notes, and worry about "if this is on the exam." (Faculty 1)

I have not noticed a change in my evaluations since I started using more active-learning activities. (Faculty 6)

My instructor evaluations from first year students are not nearly as good as evaluations from juniors with the same type of active learning activities. I believe the students who have been in college a few years have more information to share and like the opportunity to share in class. (Faculty 7)

I think active learning practices help my student evaluations because I'm more involved with the students as individuals. They respond to me, to our conversations, our meaning making, rather than subject matter alone. In other words, the subject matter becomes an interaction, not something static. Evaluations of me, in this sense, might become evaluations of us, of the students and me interacting. You might say the same thing about grades: they become as much an evaluation of me as they do the students. (Faculty 8)

Most readily available to all instructors are student evaluations. Instructors were asked how their student evaluations were affected after they started using more activities in their classes. Of those responding to our initial faculty survey, two instructors thought that activities did not alter student evaluations, two thought evaluations were worse, 14 thought evaluations were raised, and 6 realized that some students would provide higher and some would provide lower evaluations because of using activities in classes. Most instructors agreed that students enjoy activities and benefit from them—with a few reservations. Many echoed Faculty 15’s remark, “Students like activities—as long as they are planned well and I participate.” Many pointed out that students prefer and benefit from a variety of teaching techniques. Students seem to prefer that an instructor deliver classes that are well mixed with both activities and lectures.

Most teachers feel that students respond positively to inquiry-based techniques, and our poll of students seems to bear this out. On the other
hand, some teachers find students resistant to active-learning practices. This resistance may stem from students’ own conditioning in previous (and even current) school experiences, where they have been given little chance to actively participate in the development and critique of course material. Those students who expect their teachers to tell them what to know for an exam may feel that inquiry-based instruction represents their teacher’s abdication of responsibility. Particularly in open-ended inquiries where the learning process may take some unsuspected turns, the messiness of some exercises may only serve to confirm students’ suspicions. In light of such resistance, it is necessary that, when applicable, teachers plan inquiry-based exercises carefully and that they do not take for granted their students’ competency at any stage of the exercise. It is also necessary that teachers explain their goals and practices to students. Students, particularly those predisposed to be suspicious of any pedagogy that is not teacher-centered, can be especially resistant to any practices they can identify as “busywork”, and this resistance can undermine the teacher/student and student/student cooperation often demanded of inquiry-based learning.

**Faculty Assessment of Inquiry Learning Experiences**

Assessing student work in non-traditional assignments is a task that most instructors struggle with.

*I think it (using activities) enhances student work and understanding.*  
(Faculty 17)

*Discussion groups require good planning and execution to promote dialogue among all members of the groups.*  
(Faculty 9)

*Classes in general may become disorderly or disorganized if you’re not careful.*  
(Faculty 18)

Instructors do not have the experience of having been graded in similar activities from their university days, and many are uneasy about assigning grades. No one reports any way in which they have measured the effect of inquiry methods on improvement in student learning; rather, they feel that student learning has improved through perceived improvement on test scores or written work. One instructor reports that for some group work, she has individuals assess their own work based on a rubric of scoring items. She maintains that students take this part of the assessment very seriously and for the most part are very honest about their individual participation. She also assigns an overall project grade for each group.

Instructors do believe that students’ work shows better quality when the students have been engaged in activities other than lecture. A few instructors realize that their impressions do not necessarily mean that there
is a measurable improvement: not one instructor mentions any rigorous attempt at comparing quality of student work done under various teaching modes. But the anecdotal impressions are widespread and consistently supportive of student learning using activities. Students are able to "remember more of the content," "spend more time critically thinking about content," "do better on tests," understand more of the material, communicate more effectively, and reflect. Besides learning, students also benefit from a sense of community: "The students are able to speak without as much fear of ridicule by the class as a whole." (Faculty 12)
Using Technology to Enrich Learning Environments

Inquiry-based instruction functions best with motivated students whose interest and imagination are already enlivened and whose curiosity will help them master new learning skills. Technologies as disparate as simple overhead projectors and the Internet enhance learning and relieve repetitive processes that may, otherwise, impede the advancement of a student’s line of inquiry. For example, computers dramatically decrease literature search times, allow rapid feedback via electronic mail among students and instructors outside the classroom, and make writing more rapid and convenient. In the laboratory, data collection and analyses have moved forward to higher levels of sophistication and flexibility. New technology allows students access to a volume and detail of information never before available and enables new teaching techniques. In many cases, some sort of advanced technology (e.g., computer retrieval) is vital to effectively conduct inquiry-based classes or exercises. These observations do not mean that advanced uses of technology are mandatory. Overhead projectors, wall charts, blackboards, and flashcards still are the backbone of most courses. Whatever the equipment and technology used, however, it is the instructor and students who make inquiry-based classes successful. Information supporting the following descriptions and comments was gathered via detailed surveys and interviews of faculty and students.

General Trends

There are few distinct patterns of technology use among those instructors responding to the survey. The best defined trend is that faculty most often use simpler technologies, such as blackboards, overhead projectors, audiotape, and videotape in passive ways. Many faculty report using videotape as a classroom tool for practices varying from lecture and recitation to more active forms of learning. The familiar and ubiquitous overhead projector is utilized in many ways by instructors and students. By their direct nature and ease of use, these familiar resources also lend themselves to everyday application by adjunct and part-time faculty.

Most of the advanced applications of technology are based on the data storage, retrieval, and communications capabilities of computers. These machines have proven to be quite versatile when instructors use their own imagination and are persistent. Computers may interface with a variety of peripherals enabling support of many different pedagogical exercises. However, use of these digital servants is a double-edged sword. There are significant time demands to develop and
implement meaningful activities and exercises for use in the classroom or laboratory.

The most common instructional applications for computers are CD-ROM, email and the World Wide Web. These are rapidly being incorporated as significant applications within a number of courses. Currently, students use these technologies for information searches and extra-classroom communications. For example, one important aspect of Internet use is the ability to obtain texts, images, and other materials that would otherwise be unavailable or require protracted time to acquire. Email is enabling students and faculty to interact more outside the classroom. CD-ROM’s and videodiscs are used in lectures or for interactive exercises or drilling.

The Benefits

Instructors mention a number of positive aspects associated with computer-based technology. Computers enable self-paced learning, address multiple learning styles of students, provide remote access to new kinds of visual data (including virtual tours, three-dimensional imaging, and animation), are good for drilling and skill development, can create a sense of community in a class, and are useful for multimedia demonstration purposes. An important benefit derived from incorporating computer technology as a normal part of coursework is that those skills requiring computers as everyday tools are transferable to other classes and the workplace. It is the experience of many instructors that the computer skills of entering students have been improving as students increasingly view the computer as a commonplace tool.

Another characteristic noted by instructors is that today’s students seem to perceive working with a computer to be more active than reading or writing, and thus students appear to be more receptive and motivated to participate in learning activities that incorporate computers. Many students become more animated and develop both increased class participation and improved interaction with other students as the result of group-based computer use and the development of their own computer projects. One of the main goals of learner-centered and inquiry-based education is thus realized as students gain a new sense of responsibility for their own learning through computer technology.

The Drawbacks

While faculty surveyed voiced positive aspects of higher technology use, they also expressed drawbacks and problems they encountered both inside and outside the classroom. Many do not know where to start or cannot find adequate learning resources. Mastering new technologies requires a significant, extra commitment
of time and energy. The most common complaints are centered around the time available to develop and implement exercises employing new technologies and the more specialized support required to use and maintain them. For example, one problem encountered by faculty using email as part of a class forum or discussion is the large amount of time needed to maintain the group. Students may embrace email initially but gradually lose interest, causing effective discussion to lag. This kind of problem places an additional burden of time and effort on the instructor to constantly monitor the group and then devise ways to keep the discourse interesting and free-flowing while encouraging wider participation.

Preparing exercises and subsequently integrating them into course material place further demands on time and attention. Some faculty are frustrated by a lack of high-speed computers, access to networks, availability of computers in more classrooms, compatibility among computers and peripherals, and technical support. The ease of plagiarism through digital communication is an issue requiring imaginative consideration and solutions. The unregulated nature of web sites is another area of concern, with many students abandoning the traditional refereed and reviewed library resources for the ease of web searches yielding information of questionable validity.

Findings, Future, and Suggestions

There is no doubt that higher technologies will be an integral part of inquiry-based instruction in the future. The amount, diversity, and complexity of information available will require the aid of computers to provide competent, meaningful, and substantial instruction and guidance. The change of student perception regarding the use and utility of computers as everyday tools in classrooms foretells the future. Skills students gain with computers are transferable between courses and work experiences. Today’s students seem to grasp technological connections across the curriculum that impact their lives everyday. In reality, reading and writing abilities remain as important as ever in using technology, but, in students’ eyes, these skills simply support the use of technology. Thus, many students are learning basic reading and writing skills in spite of themselves. It is not known how many teachers understand these connections and conduct classroom exercises to exploit them. Perhaps this is an area calling for more investigation.

Education experts stress that technology should not be used simply because it is there. Definite pedagogical goals should be developed and distinctly delineated before implementing particular technological tools. In many cases, an instructor need not change his/her materials or methods but rather augment and enhance them with carefully selected tools. New technologies afford opportunities for new teaching techniques by creating novel ways of gathering and using (or retrieving)
of time and energy. The most common complaints are centered around the time available to develop and implement exercises employing new technologies and the more specialized support required to use and maintain them. For example, one problem encountered by faculty using email as part of a class forum or discussion is the large amount of time needed to maintain the group. Students may embrace email initially but gradually lose interest, causing effective discussion to lag. This kind of problem places an additional burden of time and effort on the instructor to constantly monitor the group and then devise ways to keep the discourse interesting and free-flowing while encouraging wider participation.

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information and images. It is thought by many that enhanced interconnections (e.g., distance learning) will change the fabric of higher education.

Technical support is vital to helping teachers use technological tools. Instructors must know that someone is available to help get the computer going when nothing is working two minutes before class. Technical support is necessary to help teachers learn about the equipment and software. While money may be available for hardware and software, it must also be emphasized that support and maintenance funds are equally important when planning an investment in any type of technology. Technological support should be a standard part of budgets. Faculty cannot be expected to embrace and effectively use new technologies if adequate technical support is not available.

It is increasingly important as technologies permeate modern life that students learn how to critically interpret the mass of information bombarding them daily. They need to understand how to think and call upon their physical and mental resources for professional and personal problem solving related to learning. Inquiry-based classes are designed to encourage and guide students to informed conclusions and decisions. Current and future technologies can either stifle such development by removing initiative through automation or nurture exploratory activities by facilitating personal expression and data analysis. If used effectively, these technologies can free students to turn more of their attention to the discovery process. It is incumbent upon teachers to encourage and assist students while they develop their abilities to employ the powerful tools and expanded potential provided by technology.

Student Perceptions and Comments

It is clear from the student surveys that most students arrive on the Miami University Middletown Campus with a rather high level of computer skill and that they enjoy learning with the aid of multimedia. Most students responding to the survey have used computers for at least five years and several have used computers for at least fifteen years. Almost all their early educational computer use involved writing papers.

A number of effective uses of technology and multimedia was cited by students. Email, as a means to communicate between single users and through listservs, was judged to be perhaps the most effective use of technology in learning. Students value the improved communication that email affords between student and instructor and among themselves. A number of other effective uses were mentioned:

- Using slides and videos in zoology botany systems analysis, anthropology, history, the history of jazz, and geology.
Students want to feel confident in using technology and realize that acquiring this confidence takes time. While they are positive about the use of technology, they do admit to some obstacles. One of the main difficulties involves the expense of acquiring a personal computer and learning how to use it. There is a desire for more computers in more places on campus. Software bugs, difficulty of using some software, instructions that are difficult to read, slow computer speed and power outages were among other problems mentioned.

Finally, students surveyed listed several things they would like to accomplish through technology that they are unable to do presently:

- I would like to find my way around computers more easily and gain a better knowledge of what is available to me.
- I would like to have a voice-activated computer.
- I would like to be able to talk into my computer and have it type what I say.
- Develop web pages.
- I would like to be able to do more coursework for school online.
- I want a holoprojector [for projecting holograms].
- I would like to know more about how to use presentation software.

Students expect that new technology and multimedia will be an integral part of their learning experiences. The willingness of instructors to participate in a learning approach that fulfills this expectation seems likely to contribute to the success of most courses.
Part II

Activities

Inquiry-based
Technology-enriched
Integrating Workplace Reality
Cooperative Learning

Description of the Activity

Cooperative learning occurs when students assist each other in the learning process through peer feedback, group/class projects, paired problem solving, etc.

Purpose

Generally, cooperative learning encourages students to articulate course concepts to others in order to help them deepen and extend their understanding of the subject matter as well as identify any gaps in their understanding. In addition, students are sometimes able to communicate with other students in ways that teachers cannot, thus helping other class members grasp concepts they might not otherwise have understood. Cooperative learning can also foster communication skills in students that are necessary in various work and social situations, and it encourages students to be responsible for their own learning and less dependent on teachers.

Examples

Tammy Allen (Spanish) encourages her students to answer the questions of other students during a Spanish-speaking exercise. This interaction allows students to assist each other in the acquisition of new language.

Beth Uhler (Psychology) gives her students worksheets that often contain problems to solve (in Statistics or Research Methods), questions that require students to apply a theory or understand a real-world situation (Social Psychology, Developmental Psychology, Introduction to Psychology), or questions that require factual answers. Pairs or small groups of students are assigned one question to answer. When all groups or pairs have completed their answers, they are asked to share their responses with the rest of the class. Other students in the class are encouraged to challenge their answers and ask questions for clarification. The advantage of their type of cooperative learning is that all students leave class with all of the answers to the worksheet.

Cathy Bishop-Clark (Systems Analysis) asks her small groups or pairs of students to prepare short presentations on particular topics. During the students’ presentations, she fills in any information that they left out. The advantage of this method is that the students in the class can benefit from the work that their peers have done.

In almost any class, students may work in groups to critique early drafts of term papers, work in pairs to practice teaching each other course content, or prepare presentations for the class. Cooperative learning may also involve class projects;
for example, class members may collectively organize studies and written materials to support a homeless shelter or wildlife preserve.

Procedure

1. Teachers may write out a step-by-step process for students to follow.

2. Teachers may spend some time talking to students and asking them to practice hospitable and effective group feedback before actually engaging a process.

3. Teachers might ask students to individually solve problems and then explain their processes to other students.
Games

Description of the Activity

Games are a way to actively engage students in classroom subject matter by using their knowledge of facts and procedures gained from the course to solve problems, visualize a process, or match their abilities with classmates. The effectiveness of gaming comes from the practical application of facts and theory to obtain a result. This active participation greatly increases long-term learning and helps students establish interconnections among various topics and different courses. Many times students become so involved with the game that they forget this is “school,” and they learn without realizing it. Gaming also helps develop pedagogical connections among students and instructors and lends itself to group projects and cooperative learning.

Games used may be as simple as quiz contests and crosswords or as involved as a three-day project. Puzzles and problems are usually used in different situations than competitive drills or contests. If the latter are used, care should be taken to prevent the competitive spirit from overwhelming the goals of the exercise. However, if students know in advance they will be competing with their peers, their motivation levels to study and prepare will be high. Classroom games may be based on familiar themes, so students need not expend energy learning new procedures but may concentrate their efforts on the subject matter and concepts at hand. The wide diversity of games permits many different types of course material to be used, and different topics are usually best suited to certain types of games.

Purpose

Games may help students organize and drill classroom material. Physical activities give them a chance to visualize processes and concepts, providing a “muscular memory.” Some games could knit a group of students together while solving a puzzle or allow an otherwise shy student to contribute something to a group. The main thrust in couching a topic or concept within a game is to reinforce and establish long-term memories. Students retain more when they actively do something rather than passively listen. Furthermore, students are empowered during game activities, giving them some possession of class material in subsequent discussions.

Examples

The following are some examples of using games in classroom from various disciplines:
From an Introductory Microbiology Course

*The Headline Game*

Students are asked to write a five-paragraph newspaper article based on an actual headline such as “Cervical Cancer Vaccination Likely.” The article should address specific facts about the epidemiology and pathophysiology of cervical cancer, explain its cause, and discuss current treatments. The principles of vaccination also would need to be mentioned along with explanations of why or why not vaccinations could be useful for this condition and what hurdles such treatments must face to become licensed in the United States.

This activity stimulates class discussions of the clinical aspects surrounding the development and testing of vaccinations. Questions arise pertaining to the disease’s etiology and pathogenesis and to control measures that may be followed.

From a Systems Analysis Course

*Sorting Algorithms*

Students stand and sort themselves by height according to the rules of different sorting algorithms. They are able to see the execution of the computer code in action and experience the way items in lists are manipulated. Physical participation in this process leaves a lasting impression on the students, and helps them envision algorithms in action when they are writing their own computer codes.

From a Freshman English Composition Course

*Identity Scavenger Hunt*

Students become better acquainted with each other by seeking out classmates with characteristics on their scavenger list. This allows students to learn more about each other and serves as a good ice-breaker early in the term. They also learn skills pertaining to interacting with classmates, an activity they will be using regularly during the semester. Thus, this activity helps prepare them for future classroom projects and exercises.

From a Statistics Course

*The Random Walk Game*

The concept of patterns emerging from a series random events, the basis for statistical methodologies and reasoning, is played out by students as they first predict an outcome, then actually conduct the procedure and evaluate the result. Initial preparation is vital for this and many other such games. Students need to be familiar and comfortable with simulation techniques and basic probability concepts. By flipping coins, rolling dice, and reading tables they become...
confident that a series of independent events will mimic the ideal or theoretical prediction. Hypothesis development and testing should also be covered in class before the Random Walk Game to provide an understanding of how data will or will not support any given hypothesis.

The game involves a player standing in the center of a line on nine positions and another player rolling a die. An even number requires the standing player to move one space right; an odd number requires moving one space left. Reaching the rightmost position is considered winning, while reaching the leftmost spot is considered losing. Students then hypothesize the probability of winning. The symmetry of the situation is intuitive, and all predict it to be 50%. Play is started, and the outcome is compared to the hypothesis.

Then the rules are changed so that movement to the right occurs only if a 1 or 2 is rolled; any other number requires a move to the left. Probabilities are once again predicted, and the game is played to gather data to test the hypothesis. Most predictions are near 33%, which turns out to be much too high; the moving player always loses even when the game is played a few times. This demonstrates hypothesis testing, and subsequent class periods are used to define aspects of this statistical method. Their experience from playing the game gives them a much better understanding of statistical reasoning.

From Career and Professional Development
The Ethics Challenge

This board game from Lockheed Martin is geared for the corporate world, but it presents a wide array of ethical situations in a realistic way that could occur in an academic environment. The game may be use with or without the board. The players are presented with situational questions based on case studies involving sexual harassment, interpersonal conflicts, drugs and alcohol, and other scenarios. The resolutions are mostly couched in what Lockheed Martin would want one to do, with great concern for due process and other legalistic interpretations. However, good discussions can be associated with the situations, which are quite representative of many workplaces.

From the Biological Sciences
Crossword Puzzles and “Jeopardy”

Students in the sciences are required to learn a large number of terms and names connected with different disciplines. Some memorization is unavoidable because students must understand concepts and relationships to allow them to effectively participate in lectures, self-directed investigations, and discussions. This process is tantamount to learning a new language, and it requires drilling, repetition, and associative memory techniques. Games may aid this process and also help motivate students, allowing them to have more control in their own education.
Games and puzzles using terms and names ease the tedium of the learning process and produce some enjoyment and feeling of accomplishment upon successful completion. Crossword puzzles have long been a popular pastime and are suitable for drilling students while challenging them. Commercial programs are available that generate crossword puzzles from word lists. These may be as simple or complicated as desired. The crosswords may be provided as take-home exercises or become a regular part of written lab exercises in which lab partners may work together. Simple crosswords may be incorporated into exams to replace definition or short-answer questions.

Games involving trivia have been popular for many years and are the mainstay of game shows and contests. “Jeopardy” is probably the most popular and copied format. This style of gaming may be adapted to help students drill and practice classroom material. Students may use question banks for solo quizzing (studying), head-to-head contests, or competition among multiple groups or teams of students. This method requires much preparation time, but once developed, it offers a versatile and broadly applicable way to actively engage students.

Gaming Basics: Preparation, Rules, “Do’s & “Don’t’s

Some general procedures are common to using games in classroom activities:

1. Thorough initial preparation is vital to the success of the activity. This cannot be stressed enough. Preparation time varies widely depending on the activity, but planning and preparing for gaming may be very time-consuming, sometimes requiring days to gather and prepare questions or materials. Students should also be prepared for gaming exercises by being given the scholarly tools and foundation to help them understand pedagogical objectives of the game.

2. Keep the exercises as simple as possible. Students should not become mired in extensive rules or equipment. This will distract them from the point of the exercise. If students have too many things to keep track of, the educational essence may be missed.

3. Explicitly state the objectives of the activity relative to the concept or course material being demonstrated or manipulated. Students should have a road map showing what to expect, how to get there, and how to finish. However, sometimes surprises or unexpected outcomes are part of the exercise. The activity should have planned pauses to allow students to catch their breath and review what has happened so far, why it happened, and what has been learned.

4. If competition is part of the game, with expected “winners” and “losers,” try to structure the activity so both parties learn from the experience. Do not allow students to become dejected or morose upon defeat. All participants should receive rewards for participation at varying levels. Many times the “loser” learns more than the “winner.” If one of the opponents or teams will
usually lose due to the nature of the game, be sure to have students regularly switch sides so everyone benefits from winning and losing.

5. Many times students will discover ways to modify the game. This may produce some interesting variations that are sometimes revealing and so should not be discouraged in all cases. However, some activities rely on specific structure and adherence to well-defined rules, so participants should be observed closely to assure compliance. If there is a way to cheat, students will eventually find it.

6. Attempt to design games that may operate at different difficulty levels. This will allow less able or developed students to fully participate while still challenging more apt or advanced participants.

7. Quizzes and other evaluative instruments should be used soon after games to permit assessment and demonstrate to students that they have learned something. Such reinforcement is a cornerstone for establishing long-term memories and renewing motivation.

**Pros**

- Students will generally respond favorably to games that are simple, are easily grasped, and produce definite outcomes. This initiates and promotes interest and self-motivation to learn more so the game may be played again, perhaps at a higher level.

- If students find they are learning, they will attend class more often and with more interest and attention. Success recruits enthusiasm.

- If games operating at different knowledge or skill levels are used, all students in classes composed of diverse aptitudes may be kept interested and challenged.

- If learning is fun, then retention is increased manyfold. Students are empowered. Their motivation to study and learn is increased by anticipation of competition with peers.

**Cons**

- The potential exists for some students to become too competitive and lose sight of the objectives. In some instances, aggressive behaviors may appear.

- Some students may find the games boring or useless. Explicitly stating goals and providing tangible rewards could help prevent this. Not all games appeal to everyone, but if classmates are engaged and enjoying the activity, this may be contagious to those peripherally interested.
• Students may become frustrated and withdraw if they cannot grasp the rules or fundamentals of the game. Having clear, simple, and concise rules can prevent this.

• Cheating is always a possibility. Avoid providing opportunities or lapses in activity structure where this could occur.
Group Projects

Description of the Activity

In group project activities, groups of students are presented with some type of learning goal requiring that all members of the group participate to successfully achieve the goal or meet the learning objective. These types of activities are valuable because they encourage students to use skills that they already have or develop skills that they might not have had. For example, group projects may require students to be able to communicate well with others, communicate well in writing, possess technical skills (e.g., how to use Powerpoint, how to design a Web page), or possess research skills. Many instructors believe that group projects encourage inquiry-based learning because they require students to work at length and in depth on one particular project. Group projects also encourage cooperative learning.

Purpose

One purpose of group projects is to gain experience in collaborating with others. In group projects, students are required to listen to, learn from, and teach their fellow group members. Another purpose of group projects is to encourage students to take risks and make grander inquiries, which they might not otherwise do in individual projects.

Examples

Psychology (Beth Uhler)
In a Research Methods course, students are required to complete a research project in which they test a hypothesis about human behavior. Although students are not required to work in groups, they are encouraged to do so (and most students opt to complete the project in a group). At the end of the semester, students are required to turn in an APA-style manuscript and a Web page describing their project. This semester-long project not only requires students to learn a great deal about the topic they are investigating but also requires them to learn a great deal about research methods. Additionally, by working in groups, they gain potentially valuable interpersonal experiences.

Zoology (Jim Janik and Al Cady)
Students in their classes are required to complete group projects that involve collecting, analyzing, and interpreting data. These projects require students to understand the material in great detail and depth. In order for these projects to be successfully completed, it is essential that students work together.
Nursing (Jean Vanderbeek)
Case studies are used to help students learn to apply complex content. Each group of six or seven students is given an aspect of a case to work on in class. This approach works especially well because students have a vested interest in other groups' work.

Procedure

1. Identify a learning objective or goal that is best met by students working in a group. Ideally, these goals are ones that require the use of various skills to achieve (e.g., library research, effective World Wide Web searching, writing).

2. Construct a clear set of guidelines and instructions for students to follow. Ideally, this should include the learning objective, ideas and hints for achieving the learning objective, and guidelines for successfully meeting the learning goal.

3. Show students how to work in groups. Many students dread group work because other group members may loaf or not meet minimal expectations of fellow group members. Many students need to be given guidelines explaining how to work in groups.

4. Randomly assign students to groups. If this is intended to be an activity in which students truly learn from one another, then it is beneficial if they work with people they are initially unfamiliar with.

5. Monitor students' progress. If this activity has a short timeline, then groups' progress can be monitored by frequent inquiries. If this activity has a longer timeline, then groups' progress can be monitored by requiring them to complete the various stages of the project by a certain deadline.

6. Have students present their projects to others in the class. This step allows students to share their learning with others in the class.
Guest Speakers

Description of the Activity

The use of guest speakers in the classroom needs little clarification. In many classes at the collegiate level, especially in a regional campus setting, guest speakers can add diversity and local interest to the course content. The instructor should select guest speakers carefully to ensure that the speakers have good communication skills combined with knowledge of the subject. The instructor should provide the speaker with necessary background material, parking and room instructions, visual aid equipment, etc. Students should be prepared for the speaker by reading appropriate text material, knowing something about the business/company/background of the speaker(s) and perhaps discussing and even writing questions in advance for the speaker.

Purpose

The purpose of guest speakers is to complement and reinforce course objectives. The guest speaker should increase interest in the course material and provide a real-life, professional interpretation of the practical need for the subject material.

Guest speakers can reinforce the need for professional attitudes, ethics, and personal characteristics. They speak directly from everyday experiences about the importance of knowing and applying the subject material. Local speakers may be graduates of a Miami program, perhaps even the one represented by the course, and thus add personal credence to the importance of the subject material. Speakers provide a first-hand account of what is needed to be successful, whether it be in life in general or in a specific business/industry.

Examples

The departments of Business Technology, Chemistry (Chemical Technology), Communication, and Engineering Technology submitted summaries of guest speaker utilization. All commented on the added interest and complementary knowledge that guest speakers bring to the classroom. For example, in Engineering Technology a former student and now director of Magnode Corp. testing laboratories spoke on the production and testing of aluminum extrusions. The discussion clarified textbook descriptions of these activities and emphasized their industrial importance.

The technology-related departments benefit from guest speakers’ first-hand knowledge of possible employment opportunities. Technology students are reminded of the importance of job-related course work.
The Communication instructor was fortunate to be able to invite visitors from Northern Ireland who were traveling in the area. A lively discussion of their homeland's internal conflicts and possible means of resolution opened the eyes of many students to the struggles occurring in far away places. Cultural diversity was certainly highlighted. A possible spin-off is for an ongoing faculty exchange with Northern Ireland colleagues.

**Pros**

The use of guest speakers is a relatively simple approach with multiple benefits:

- Can be a lead-in to tours of local businesses/industry sites.
- Students with little or no work experience can benefit from the first-hand knowledge of current professionals.
- Students gain an understanding of job employment opportunities.
- Students have the opportunity to observe well-planned and carefully delivered presentations.

**Cons**

Hosting guest speakers poses little downside if appropriate preparation time and speaker selections are carried out effectively.
Individual Problem-Solving

Description of the Activity

Active, inquiry-based learning activities do not necessarily include group work. In fact, several faculty use techniques that can be classified as individual problem-solving. These activities often involve discussion with other classmates, but the primary activity is done on an individual basis. For example, students may create and give presentations, solve a problem independently, or be asked to come up with individual examples that illustrate a textbook theory. In all cases, the student is asked to do work independently, and that work is then woven into a class period.

Purpose

The purpose of individual activities is to help students become personally connected to class topics and actively participate in their learning. A short in-class problem can be an excellent tool not only to actively engage students but also to assess the students understanding of a particular topic.

Examples

Computer Science and Systems Analysis

In computer programming classes, an individual student puts a preliminary program design on the board such as a flowchart, a hierarchy chart or pseudocode. The class then discusses and critiques the design. The design is used to discuss the issues that affect how students create programs—issues that mean little in lecture but have a very different meaning when students actually experience the issue. This activity helps students evaluate their design, consider alternatives, and determine whether they missed any large pieces.

Sociology and Anthropology, Jean Lynch

Students read and report on articles in sociological journals in order for them to perceive the gap between public knowledge and tested and supported knowledge. In their presentations they compare the two realities.

Psychology, Beth Uhler

Students are assigned questions (often more analytical in nature) in which they are typically asked to apply theory to a real-life situation. For example, a question may be, “Think of a volunteer organization and then use the theories in the book
to explain why individuals would participate in this organization." Students then complete the discussion questions individually and out of class. At a later class session, students informally present their ideas to the class. Students apply "textbook theory" to real-life situations.

Procedure

1. Identify a realistic yet challenging activity that would be useful for students to work through individually. This could be a problem that requires some significant thought and requires out-of-class time, or it may be a shorter activity that can be done in class.

2. Identify an appropriate place in your class session in which it would be useful to the class for students to present their individual work. Notice when students appear ready for an in-class activity (i.e. attention wanes, looks of confusion, etc.)

3. During the discussion of the individual work, be sure the conversation is not too negative, causing the student to become defensive. The point of sharing work is to help others as well as the presenter to learn. This process involves pointing out strengths as well as carefully identifying weaknesses.
# Journals

## Description of the Activity

Through journals, students keep a written account of their engagement with and application of subject matter. These journals can reflect students' objective descriptions of course matters and/or their subjective accounts of their interests and concerns regarding these matters. Depending on the course, students may use journals to reflect on the class and their classmates; to ask questions of their teachers; to reconsider and revise class notes or assignments; to respond to readings; to explore other things that may be affecting them at school, home, or work; or to relate the idea they have considered in class to their lives outside of school and to broader cultural and social issues.

## Purpose

Writing aids learning, so students often better digest material about which they have written. Journals can also help students deepen and extend their understanding of subject matter. All in all, journals make students' learning visible and offer teachers opportunities to monitor and intervene in that learning. They also supply teachers with feedback concerning students' understanding of and feelings about curricula.

## Examples

Cynthia Lewiecki-Wilson (English) includes a variety of journaling strategies in her classes. In some courses, she gives students a choice of questions for them to think about as they study assigned readings, and she asks them to compose journal entries in response before they come to class. In other courses, she requires that each student keep a reading journal to record factual elements of their readings (e.g., characters' names and backgrounds, plot lines), reflect on those elements, and rely on this journal during in-class examinations. Cindy also uses journals to encourage students' applications of subject matter. In her Women's Studies course, for example, she assigns students the task of scrutinizing images of women in magazine advertisements. She asks them to clip various advertisements and to include and write about them as part of their journals.

## Procedure

1. Teachers can ask students to write on a given prompt before, after, or during a class. They might also ask students to develop their own topics (relevant to the course) to reflect upon.

2. Students are asked to keep all of their journal entries in a single notebook, binder, or folder.
3. Teachers usually collect and respond to journals on a daily, weekly, or monthly basis.

4. In their written and/or oral replies to journals, teachers may affirm students’ observations, question their assumptions, help them to clarify their views, express sympathy toward any hardships they describe, offer suggestions and encouragement on projects, or respond to criticisms of the course.

5. Students may have the opportunity to respond to teachers’ comments, thus extending discussions and dialogue.
Myers-Briggs Type Indicator

Description of the Activity

Students are given the Myers-Briggs Type Indicator (MBTI), an instrument that describes individual preferences for taking in information, making decisions, and communicating thoughts and feelings. Students are given a packet of information about themselves as part of a presentation about the results (can be given by the Career Services office). MBTI feedback is geared toward the most useful aspects of the information as it relates to the subject matter of the course.

Purpose

The MBTI helps students understand how they prefer to function in the world. These preferences have implications for how students learn, how they relate to others, how they organize their work, how they process information, how they work in teams, how they appreciate those who function differently, and how they view themselves. The self-knowledge applies to their role in the classroom, workplace, family, community, and society.

Examples

Computer Technology

Students in a 100-level Systems Analysis course are given the MBTI. The instructor explains the types and preferences and gives students their results. The instructor includes discussion about how a student's MBTI type may influence his/her approach to programming. The instructor then shares research findings that she compiled about computer science majors/programming and the MBTI.

English/Technical Writing

Each semester, students are given the MBTI. The feedback session focuses on helping them understand themselves, appreciate the strengths of others, form effective work teams, recognize individual learning styles, and learn how to write for audiences with differing perceptions. The students are asked to give their MBTI types to the professor, who shares hers with the students and keeps their information in mind when giving feedback about projects and assignments.

Professional Development/Career Development

The MBTI is used to give students a sense of their strengths and weaknesses, their role in a team, how to appreciate those who work differently, and how to describe themselves in an interview. The MBTI can also help with the career decision-
making process, particularly regarding the type of work environment that would best "fit" the student.

### Procedure

1. A faculty member who does not currently use the MBTI contacts a certified trainer on the campus (Ernsting, Bishop-Clark).

2. The trainer gives the MBTI to the faculty member with instructions about how to give the MBTI to the students, or comes to class to administer it.

3. The instrument is then scored (by hand or self-scoring). Students are given packets of information about their own types.

4. The presentation about the MBTI is tailored to the needs of the instructor/class (by the trainer).
Open-Ended Analysis

Description of the Activity
Inquiry-based learning is open-ended when there are no prescribed answers/solutions to an assigned problem or course exercise. In such instances, students must develop their own commentary on a particular problem or event after they have conducted an inquiry. Teachers help students find and develop tools for inquiry, such as interview techniques, data resources, and writing strategies.

Purpose
In a sense, open-ended analysis authenticates class work for students—they work creatively and critically to develop real answers to real events, as opposed to searching for definitive answers that have already been developed by their teacher or previous scholars. Such analyses situate students at the center of the learning experience and indicate to them the effect their coursework might have on their own lives and the lives of those around them.

Examples
Margie McLellan (History) asks students to construct oral histories. After devoting a session to developing their interview strategies, students interview people in the community and relate the information they obtain to historical backdrops. This project allows students to connect their history learning to local events and citizens as well as to use their local knowledge to challenge and/or augment historical knowledge as it's presented to them in class.

Ellenmarie Wahlrab’s English 111 class investigates work situations, often related to their own career aims. Her project requires students to use creative writing, library research, interviews, and on-site observations to inquire into their chosen field.

In general, in an open-inquiry students may research a particular problem in their neighborhood, such as poor sewage, investigating economic and social causes and effects of the sewage problem and developing possible solutions. Or students might be asked to apply course readings to their own lives; for instance, examining the ways their gender, race, or class backgrounds have affected their education and vice versa.
**Procedure**

Steps may vary, but the following elements will be present:

1. The activity begins with open-ended questions, usually those teachers bring to their courses or those that arise during a semester.

2. Teachers and students discuss issues that these questions raise.

3. Students determine ways to conduct research, such as interviewing local residents, revisiting key sites, obtaining government documents, combing indexes, and searching the Internet for relevant sources.
Paired Problem Solving

Description of the Activity
Paired problem solving is a technique that several faculty have used successfully. In these cases, students are paired with another student when solving a problem, whether it be a mathematics problem or a psychology problem. Students will typically immediately seek help from the instructor when they face any kind of difficulty solving in-class problems. Faculty can work to get the students to help one another before immediately seeking help from the instructor. Students get the benefit of two minds instead of one, and students are more likely to successfully solve a problem when they are working with another person.

Purpose
Working with partners helps to create a sense of community. Students no longer feel isolated; they are part of a larger learning community. Students gain this sense of community by connecting with at least one other person in the class. They begin to feel responsible not only for their own work but also for the work of their partners. Besides building a sense of community, working in pairs provides other genuine benefits: it is more like real-world problem solving, students get different perspectives on the same problem, and it can alleviate some of the frustration some students feel when working alone.

Examples

Spanish (Tammy Allen)
The instructor uses paired activities or small group activities in almost every class session. She feels it breaks up the monotony of a lecture, and since she grades on participation, students seem more motivated. Typically, students work in pairs to implement vocabulary and grammar constructions that have been presented in class and in their text. Students interview one another, practicing a specific vocabulary word. After the pairs interview one another, one or two groups model what they did (ie, have the discussion in front of the class). In addition to oral paired activities, the students individually write structured composition. They answer in writing three or four questions and then share the answers to those questions with a partner.

Computer Science and Systems Analysis (Cathy Bishop-Clark)
After discussing a particular computer programming technique (such as sorting), she organizes the students in pairs to work on a related problem, which she has designed. By working in pairs, they are often able to come up with a single
solution. Students make comments such as “What if we try it this way?” or “No, that solution won’t work because of this.” A non-working solution can be just as much of an educational experience as a working solution. Working in pairs at a computer screen has the added benefit of reducing the stress that some students still feel when using technology.

Political Science (Mel Cohen)
Dr. Cohen placed students in pairs and then had each pair create Web pages that they felt would contribute to the development of high-quality participants in the democratic process. Students created democracy web pages and presented their work to the class. Students were able to show concrete results relatively quickly. They were active learners, and they needed to be critical thinkers when deciding what information they wanted on their pages. The web pages students created were provocative and reflected a level of thought that was quite refreshing. Students understood that, in many cases choices represented personal ideological choices and that the websites were not simply neutral repositories of information.

Microbiology (Kelly Cowan)
Dr. Cowan has used partnering in different ways. For example, when dealing with detailed subject matter, she divides the class into pairs and asks each student to write a multiple-choice test question. As much as we know about multiple-choice questions NOT using critical thinking skills, the situation is different when students have to WRITE one. Each student then spends a few minutes writing the "perfect" multiple-choice question. Then partners exchange questions so that they can edit each other’s question for clarity and non-ambiguity. The partners give back the questions and continue to work and edit them until they are, in fact, "perfect." It shows students the dark corners of their shadowy thinking (a side benefit is that they have a better appreciation of how difficult it is to write a good question).

Procedure
1. Identify an activity in which it would be useful for students to work in pairs. This will probably require significant thought.

2. Identify an appropriate place in the lesson to do the activity. It may be useful to have the students work in pairs to solve a problem after a lecture on that problem, or it may be useful to have the students attempt to solve the problem before having any preconceived notions about how to solve it.

3. Either allow students to select their own partners or assign them partners. Paired problem solving presents problems when either two students are very
bright and are finished much earlier than their classmates or when two very weak students are paired and are unable to make progress.

4. Monitor students as they work through a problem. If students ask you for help, make sure they have discussed the problem with their partner first.
Projects and Presentations

Description of the Activity

Projects and presentations add significantly to the learning process by allowing students, either individually or in groups, to explore topics in greater depth, to synthesize their own approaches to the collection and analysis of information, and to present their findings in a manner that is understandable to their peers.

In this strategy, a wide variety of project and presentation techniques are presented. Many can be adapted for use as either individual or group assignments. Instructors should also consider combining one or more techniques to address special needs. Where advantageous, many of the techniques rely on web-based and software-driven approaches in an effort to enhance students' knowledge of and comfort level in using these technologies.

Purpose

Projects and presentations enable the instructor to assess how well students are assimilating the lecture material and applying it to new situations that are often beyond the basics of the course. Students' ability to perform self-directed work is enhanced, as is their ability to communicate orally and in writing. Projects and presentations expose students to a very broad range of research tools and, in many cases, multimedia presentation techniques. The end product of the research effort can serve as one of many routine graded modules within the course curriculum or, depending on scope, as a final project at the end of a semester.

Projects and presentations provide opportunities to work cooperatively with other students in a team-based learning situation. Such assignments develop students' ability to self-assess the progress of a project and provide updates to the class or a business client. They also teach basic peer evaluation skills. If structured well, assignments will encourage students to learn how to incorporate more than standard text-based materials into their presentation styles through the use of the library, Internet, and other research sources. This approach requires coaching students on how to critically select and evaluate research materials. Students with lower levels of computer skills may also require remedial assistance in the early stages of research and/or presentation design.

Examples

Use projects and presentations to bring student-originated materials into the course curriculum while building presentation skills. Student-led discussions provide a rich source of material for use in subsequent course writing assignments. To enhance the immediate relevancy of the assignments, structure projects and/or presentations to require students to investigate outside companies,
industries, or community service agencies as a means of exposing students to the real-world aspects of organizations, in either technical or non-technical fields.

The following are project and presentation suggestions from several different disciplines.

History (e.g., History 111 and 112 or American Studies 101)
Research Findings in Class or Online: Have students read one or more selected writings from the literature and respond online to a series of questions posed on a group listserv. Then, instruct students to critically analyze and respond to other students' writings, forming their own opinions on the main issues of the text(s). Finally, have students write a personal essay on the literature, using and citing material from the listserv.

Business Technology (e.g., Introduction to Marketing, BTE 105)
Research Findings in Class or Online: Have students examine a brief marketing research survey posted on a group listserv and identify areas in the questionnaire that need improvement. Students suggest alternative wordings for the problematic questions and respond to the suggestions of other students. Based on the listserv discussions, have students develop their own questionnaires covering the same topic and present these revised questionnaires in an in-class discussion.

Basic Science (e.g., Chemistry 115, Foundations of the Chemical Process Industry)
Explore One Company in Detail: Examine a variety of companies in the Cincinnati-Dayton-Indianapolis area by asking each student to choose a single firm that is of particular interest. As topics related to various resources, processes, managerial styles, or marketing strategies are discussed in class, have students apply the information to their chosen companies. Give students an opportunity to make a summary oral presentation the last day of class.

Introductory Finance (e.g., BTE 103, Introduction to Finance)
Explore One Company in Detail: Ask students to select one or more companies at the beginning of the semester (a set of five companies provides a good base). Have them use a combination of spreadsheet and graphics software to track the stock price performance of each company over the next ten weeks. As concepts are discussed in class, such as the calculation of key financial ratios, have students apply these concepts to their companies. Use a final report at the end of the semester to tie all of the information together.
Technology (e.g., Engineering Technology or Computer-Aided Manufacturing)

**Internet Research Assignments and Multimedia Presentations:** Help students select a topic covered in class that is of interest to them. For a simple assignment, ask students to do an Internet search and to prepare a multimedia presentation for the class. Use Microsoft PowerPoint® as the preferred medium for constructing the presentation. For a more complex assignment, suitable for use as a term project, assign students to work in teams. In this latter case, both the scope of the research and the innovation/creativity used in the multimedia presentation should be significantly greater.

Basic Science (e.g., Biology or Chemistry)

**Internet Research Assignments and Multimedia Presentations:** Assign students to research topics that will reveal substantial numerical data and/or visual images from sources on the Internet. Once the basic research has been completed, have students analyze the numerical findings and develop graphical or pictorial representations to illustrate their findings. These images are then used to form the basis for a multimedia presentation, again based on Microsoft PowerPoint.

Current Events (e.g., Political Science Courses)

**Student Web Page Projects:** Ask students to survey the World Wide Web for current and historical information on a topic discussed in class. Once appropriate materials have been located, have students design their own web pages to organize and provide access to their selected materials. As an extension of the assignment, have students present the designs for their web pages in class, and have class members critique each other's web site for content and clarity of presentation.

Economics Principles (e.g., Economics or Business Technology)

**Student Web Page Projects:** Ask students to select an aspect of the economy that is under public scrutiny today, such as inflationary/recessionary trends, interest rates, or unemployment. Then have students design a web page to capture existing information on the topic and to provide a forum for receiving and integrating new information from the government and/or popular press. A well-designed web page could then be used as a thorough reference work for a major course paper on the topic of choice.

Communications (e.g., English 215/313/315, Technical Writing)

**Planning and Managing a Project:** Have students identify a real-world client in need of technical writing assistance. Following an interview and needs analysis, ask students to prepare an outline of the project using Microsoft Project 98 software, obtain client approval, and then perform the work. Complete the
assignment by making a videotaped progress report to the client at the end of the project.

Management (e.g., BTE 111, Introduction to Management)

Planning and Managing a Project: Assign students studying management processes a business project to manage. Use a comprehensive project that involves scheduling manufacturing, marketing, and distribution activities. Have students use Microsoft Project 98 to create a project plan and then examine how changes in one aspect of the overall process can cause unexpected delays or problems down the line.

Engineering Technology (e.g., ENT 152, Computer-Aided Manufacturing)

Analyzing a Simple Engineering Project: Divide students into small groups and have them select a simple manufactured product (such as a hammer) and analyze it for reliability and possible redesign. Require a final presentation to the entire class detailing the findings of the work.

Procedure

1. Begin by identifying the learning goals to be achieved through the use of projects and/or presentations. Consider factors such as the need to expose students to outside research sources and practices, the need to build group interaction skills, the need to expand critical-thinking or analysis skills, etc. Also, identify logistical parameters such as how much class time will be devoted to projects and/or presentations, how much of a student’s grade will depend on these activities, and how much involvement from other individuals besides the instructor will be required.

2. Identify and confirm the availability of any outside resources required, such as assistance from Career Services, the computer laboratory, guest speakers, library personnel, etc.

3. Select specific concepts from the course material that are to be explored in depth by students conducting project and/or presentation assignments. Look for concepts that provide significant opportunities for independent study and analysis yet are likely to be covered in a broad base of reference materials.

4. Become personally familiar with any software products, specific websites, or other electronic data analysis or information sources that will be recommended for student use. (For example, an instructor considering the use of Microsoft Project 98 for a project management assignment should spend ample time reviewing the software and practicing with a personal project example. Similarly, an instructor recommending multimedia presentations should be personally familiar with Microsoft PowerPoint.)
5. Early in the semester, define the exact project requirements for students, allowing them to begin thinking about their research topics and presentation approaches. Facilitate the formation of student teams or work groups if the projects are not to be done individually.

6. Have students draft very brief statements of their research interests, and approve these for scope and complexity before actual work begins.

7. Provide in-class training on any specialized software or research techniques that will be required to complete the assignment. This is also an excellent time to provide supplemental training on library and/or Internet usage if required.

8. Structure the assignment(s) to provide interim checkpoints or preliminary feedback for students so that the entire grade does not hinge on one report or presentation to be delivered at some point in the future. Regularly follow up to be sure that students are making progress toward their goals. (For example, the use of a group listserv to foster discussions between students is an excellent way to keep a discussion going over a period of time.)

9. Facilitate contact with outside industries and businesses as needed.

10. Provide classroom time for final presentations where required. Set final oral presentations for the end of the semester. Evaluate students’ work in terms of both the presentation and the interim graded assignments, if any. Evaluation of the presentation by student peers may be included as a supplemental factor in the grading process.
Research Writing

Description of the Activity

Research writing is perhaps the most evident inquiry-based practice on campus. A research project typically involves locating and scrutinizing a variety of secondary and primary sources (such as interview subjects, periodicals, websites, archives, etc.) and then orchestrating these sources to create some finished project.

Purpose

To introduce students to the ways knowledge is constructed and conveyed in various disciplines and to deepen their understanding of course materials.

Examples

Oral histories, interpretations of literature, research into botanical sites

Procedure

1. Teachers present topics to students, sometimes mapping out stages in research for them (or students might choose an area of research on their own and identify pertinent indices through which to carry out their searches).

2. Students might freewrite on the topic to establish their own voice before undertaking research.

3. Students make a short list of possible resources, obtain and study these sources.

4. Students expand their list of resources as they encounter initial sources.

5. Students conference with teachers concerning the direction and focus of their projects.

6. Students share early drafts with peers, offer and receive direction toward additional research venues, and work to clarify papers.
Experiential Education

Description of the Activity
Experiential learning at Miami University is a form of inquiry-based learning that takes place in the workplace. The term covers a broad range of experience and intensity, from field trips that are local and take several hours for students to complete to practicums and cooperative jobs that last for an entire semester. Typical learning assignments include community internships and practicums for health-related careers, co-op job opportunities for a variety of fields, internships with employers for credit, and volunteering in public-school programs for education majors.

As a learning strategy, experiential learning in the workplace has important characteristics for teachers and students. Because the experience takes place at work and is career-oriented, students see these programs as highly relevant and are quickly engaged in the learning process. Student interest drives these kinds of assignments. As a strategy, experiential learning is learner-centered by nature (with short field trips as the only possible exception).

For teachers, experiential learning as a strategy is entirely in sync with modern views on how students learn best. Its chief strengths are as follows:

- It is learning within a context: the context of work and careers.
- It is authentic learning—it revolves around the solving of real-world problems.
- It can result in a tangible end product for students—one with value in the workplace.
- It is authentic assessment in that community members and professionals are involved in student evaluation.
- It lets students see how experts solve problems and helps students model expert problem-solving strategies.

Examples

Practicums
Gary Bowyer (Physical Education)

Practicums are a required part of licensure programs in physical education. The field experience consists of 30 hours spent at schools and social service agencies. Practicums allow students to practice instructional, diagnostic, prescriptive, and
evaluative processes in physical education, health, sports studies, and athletic training. Students keep weekly journals, meet in a weekly seminar with the instructor, and write a final reflection paper on the experience.

Students find that working with "the people factor" is more complex than they anticipated.

Cooperative Education

*Kim Ernsting (Student Affairs)*

Students in the two-year technical programs and in the four-year option are encouraged to participate in cooperative education; i.e., a "co-op" job. Co-op positions typically last for an entire semester. Web pages and listservs are used to publicize co-op positions to students. Most students work 20 to 25 hours a week. Typical end products for the experience include special projects, research papers, presentations, portfolios, journals, and reflection papers.

Benefits for faculty include feedback from students about technical skills needed in the workplace. Benefits for students can include a permanent offer of employment at the co-op job site.

Internships

*Susan Marine (Chemistry and Biology)*

Students in the chemical technology program often spend a semester working as interns at a chemical process company. The students are required to learn and demonstrate new skills, look for applications of theory in the work setting, and become aware of how the organization operates.

Students submit weekly reports to the instructor electronically, via Blackboard or e-mail. These reports are evaluated for content, depth of perception, depth of experiences, chemical accuracy, and response to suggestions. Students report they enjoy seeing first-hand applications of the classroom material. Students enjoy discussing workplace issues such as behavior and dress, as well as the "fit" between the classroom and the workplace experience.

*Marjorie McLellan (History and American Studies)*

Students may enroll for 3–6 hours of internship credit in History or American Studies. Students follow up on faculty contacts and use their own initiative to set up semester-long internships. The faculty advisor consults with the workplace supervisor at the outset, during the semester, and at the completion of the internship.
Interns have worked with the Cincinnati Historical Society, the National Folk Festival, the Oxford Museum Association, and other non-profit organizations. Internships typically include a specific project as well as experience across the organization. An important element is student participation in staff meetings and committees. Students keep in touch with the faculty advisor through weekly email journals. The internship concludes with a final reflective essay.

Volunteers in Schools
Larry Greeson (Educational Psychology)

Larry Greeson offers his educational psychology students extra credit for participating in volunteer opportunities in the public schools. The students work with teacher mentors, assist particular teachers for a semester, tutor, and help with special projects.

End products for the experience include journals and reports. Students gain the experience of "trying out" their career interest in teaching, and they gain classroom experience, which is useful for future job interviews.

Field Trips
David Young (Engineering Technology)

Engineering technology students make a local field trip each year to a materials laboratory to observe the testing of mechanical properties such as strength and hardness. The field trips are usually two hours long. Students get to see experts at work in their field and to apply course content to a career setting.

End products of the field trip include class discussion and written analysis of the experience.

Procedure

1. Contact the employer, work site, laboratory or school.

2. Schedule a visit, an internship, or a co-op job experience.

3. Create and/or fill out the necessary paperwork for the first two steps.

4. Establish ground rules and expectations (by students and employers) for the experience.

5. Publicize the opportunity with students. Deal with the logistics of directions, schedules, parking, work site expectations for dress and conduct, etc.

6. Prepare students for the experience by discussing how the career activity complements their understanding of course materials. Generate questions...
about the experience with students. Encourage students to take notes and ask questions.

7. Conduct post-experience debriefing and summary activities, such as class discussion, journal assignments, follow up on the pre-experience questions generated in class, final written reports, and quiz or exam questions.
Applying Topics to Real-Life Situations

Description of the Activity
Real-life situations from current events (newspapers, headlines, magazines, professional journals, and actual business data) and students' personal experiences are used to show students the relevance and applications of concepts and information learned in class.

Purpose
Students understand concepts when they can relate to them. Challenging students to apply learning to situations, case studies, current events, or actual data makes the concepts real and increases their understanding. Students gain experience in gathering, interpreting, summarizing, and presenting business data.

Examples

Business Technology
The students are given a four-part project to analyze employment statistics:

1. The students extract statistical data from a government-published report (i.e., Department of Labor).

2. The students draw conclusions based on the data and answer questions pertaining to specific details from the published report.

3. The students evaluate their findings and answer specific questions.

4. The statistical data are charted on a graph for a visual presentation.

English/Women's Studies
In the English class, in preparation for writing argumentative, researched position papers, the students choose a school-related topic as it is covered in the media (e.g., school finance reform, school uniforms, violence in schools, attitudes toward two-year colleges). The students find current newspaper and magazine articles that track the problem. Students clip out an article, put it in their journal, write about it, and bring it to class prepared for discussion. For example, one of the issues was about school reform. Students discussed their articles related to the following kinds of issues: How are issues of school reform treated in the local press? What language is used? What arguments are made? What groups are given
representation (who is included and who is not included)? This type of in-class discussion stresses collaborative inquiry and debate.

For the Women's Studies class, students clip advertisements and articles in newspapers and magazines that depict women. For example, students may choose ads or articles about women in sports. The aim of this pedagogy is to help students understand and apply theory to life outside the classroom and learn to analyze public issues using feminist theory.

During the in-class discussion and the sharing of information from the articles, the students hear the complexities of the argument and have a source for information.

They then break into groups with shared interests and make plans to share their clippings by signing up for copies. Students are responsible for bringing requested copies to the next class session. Students then individually write researched position papers.

English
This unit deals with reading and writing about work. The instructor developed a questionnaire related to students' experience with work as a beginning point for brainstorming ideas for an essay on a work site. Students developed their papers through readings on work-related issues, on-site observations, interviews, and library research. Students explore the nature of work—its economics, satisfaction, psychology, politics, ethics, aesthetics, purposes, etc. Students work collaboratively (identified as a common feature of many work situations) in small groups, each group selecting a work site to research and analyze, focusing on a theme that stands out for them in the situation. Students often select sites related to their career aims though this is not required. All students write about their findings, organizing their papers around a controlling idea that they identify through the results of their research. The emphasis is on knowledge-making, where students make meaning out of what they find.

History
Students planned, researched and produced an exhibit for the National Folk Festival about how hard-hat workers decorate their hard hats, lunch boxes, and tool chests. Another semester, students studied a union, including the union election and a local initiative.

Microbiology
News headlines are used to stimulate class discussion. Students are provided with an actual headline from the newspaper, such as "Cervical Cancer Vaccine Likely," and are asked to write a five-paragraph story that would appear with it. They may report on such things as the prevalence or importance of cervical cancer, its causes, the principles of vaccines, why a vaccine might be useful for this
condition, and what hurdles a vaccine must overcome to become licensed in the U.S. News articles and television news programs often provide fodder for spontaneous class discussions related to class concepts (often student-initiated). For example, a news program about *E. coli* and restaurant breath mints included the following discussion questions: What disease was seen in afflicted individuals? What characteristics of *E. coli* suggest that it could be the cause of that disease? How was *E. coli* linked to the breath mints? What characteristics of breath mints promote microbial growth? What control measures should be taken? What control measures are being taken?

**Nursing**

To help students understand their biases about rich and poor people (cultural diversity), the professor divides the class into two groups. One group answers the following question about the poor and the other answers the same question about the rich. Question: "What have you ever heard, felt, or believed about the poor/rich?" The student groups write down all their thoughts and impressions on a flip chart or blackboard, and then each student marks descriptions they have heard, felt, or believed. Since the question does not differentiate between beliefs/feelings and hearsay, students are relieved of the burden of having to openly admit what they believe. Thus, the discussion is less threatening and more open. It is hard for students to admit their biases, although some do on an individual basis. However, the issues usually come up in the discussion. The professor then leads a discussion about the similarities and differences in the words used in both lists, as well as a discussion about bias, prejudice, and points of discomfort.

**Sociology**

Students read and report on articles in sociological journals. In their presentations (often given in groups) the students compare the two realities of "public" knowledge and tested and supported knowledge. In the Social Relations course, students fill out a survey using national data available from several time periods so that they can better understand theoretical perspectives while having the chance to "test" hypotheses that might be derived from those theories. Issues such as deviance, romance, and family are analyzed in the media related to whether the portrayals create or reflect (or both) societal reality.

**Procedure**

1. Pick a current event, article/headline, business data or research study relevant to the class topic.

2. Identify what type of analysis of the current event/case study/research/data is appropriate relative to class topics and concepts.
3. Students are given instructions regarding the assignment(s) and deadlines for completion.

4. Students discuss and present their findings in writing, spoken presentations, visual presentations, small groups, and class discussions.
Case Studies

Description of the Activity
This activity involves creating actual or fictitious narrative scenarios about which students must answer questions directed at solving problems they may encounter in real-life situations. This requires students to synthesize information from a variety of sources.

Purpose
The purpose of this activity is to put students' learning into the context of real-life situations. Students must determine what data from the case study is relevant, analyze the data for patterns, identify the significance of the patterns, and determine the best course of action. This exercise is effective in getting students to apply knowledge from a variety of sources by thinking critically, understanding contexts, engaging with others, and reflecting to solve problems. This process results in increasing problem solving skills and perspectives students can apply when faced with new problems and challenges.

Examples
Low level of preparation: Identify one aspect of the case study upon which to focus; for example, determine what data is relevant.

High level of preparation: Develop one or more complex case studies that incorporate real-life elements: determining what data from the case study is relevant, analyzing the data for patterns, identifying the significance of the patterns, and determining the best course of action.

Procedure
1. Develop one or more case studies built around either a low or high level of preparation and incorporating the desired level of student interaction.

2. Prior to the in-class work, provide students with a handout including the case study and a template of data they are to process.

3. On the day of the in-class case study, divide the class into groups with three or four students per group.

4. Assign each group one of the case studies.
5. Have each group work through the data, identifying which is relevant and which is irrelevant.

6. If there is more than one group per case study, have groups with the same case study share their data, critique it, and add their comments.

7. Have each group present their work to the class. Each student can use the template to record each group’s work so that they have complete notes on all the problems.

8. Give the class the opportunity to respond to each group’s presentation.
Business Simulations

Description
Projects designed to model real-life business situations

Purpose
To give students real-life business functions and activities to facilitate their transfer of knowledge to the business world.

Creating an Organization involves synthesizing a company structure and management teams by establishing a company, mission statement, company goals, company objectives, company strategies and company organizational chart.

Procedure
1. Break students into groups of four or five.
2. Each group is assigned one of the management topics.
3. Students are given class time to meet and develop their project via learning groups and outside activities.
4. Students present their work through a written and oral presentation.
Job Search Process

Description of the Activity
Students preparing to establish themselves in their first full-time career positions often need assistance in mastering the behavioral norms associated with career searches, job interviewing, and professional performance on the job itself. In today's work environment, developing an action plan to address these parameters and position one's abilities is an essential aspect of differentiation versus the competition. Training provided before the student begins a job search can make the student significantly more competitive when compared to the balance of the candidate pool. In this strategy, techniques designed to prepare students for a professional job search and first career position are presented.

Purpose
Mock interviews, the study of professional development issues, and the creation of personal marketing plans require students to develop a personal style and approach to career topics that will heighten their awareness of what employers expect to see from entry-level applicants. Through role-play scenarios, presentations, and outside research, students gain the confidence and presence to meet new people in a professional setting and conduct job searches effectively. When used in conjunction with a basic marketing course, students involved in the personal marketing plan activity will gain the ability to design comprehensive plans to address their own career goals, including the ability to design professional documents such as resumes, cover letters, etc.

Students are highly supportive of job search process instruction and remark that such professional development work should be a requirement before graduation. To be successful, job search process techniques require very high involvement on the part of the instructor; small class sizes or groups are most effective. Still, some students are simply uncomfortable planning a marketing strategy for themselves. Significant encouragement from the instructor may be required.

Examples
Use job search process techniques as broadly applicable models to illustrate how students should conduct themselves in professional career settings. Adapt personal marketing plans for use in a variety of course settings, provided that students have a background in marketing fundamentals. These techniques are, by design, highly interactive and involve strong student participation in all activities.

The following are job search process suggestions from several different disciplines.
Career Development (e.g., BTE 221, Professional Development or JH 1)

Mock Interviewing: Expose students to mock interviewing through behavioral-based interviewing (BBI) in which interviewees provide examples to support their responses to questions. After each student has had the opportunity to research his or her chosen field of interest, videotape a mock interview with the student playing the role of the interviewee. Provide feedback on the student’s performance during the interview. If the mock interviews are conducted in a classroom setting and time permits, give students the opportunity to try their hands at being the interviewer as well as the interviewee.

Business Technology (e.g., BTE 221, Professional Development)

Professional Development Issues: Through lectures, research assignments, and guest speakers, explore a broad range of professional development issues including professional etiquette, informational interviews, ethics and legal issues, diversity in the workplace, job search approaches, resumes, interviewing, and attitudes/office politics. Assign each student to perform a real-life informational interview and prepare a verbal and written report. Additionally, guide students in researching their chosen career fields throughout the course. Use a final written summary as a graded activity to pull all aspects of the course together.

Marketing (e.g., BTE 105, Introduction to Marketing)

Personal Marketing Plans: Assign students the responsibility of developing their own marketing plan to target potential employers of interest. Present various forms of research materials and research techniques to the students in order for them to make sensible choices in collecting the information they will need. Evaluate students based on a written report at the end of the project.

Procedure

1. Prior to the beginning of the course, outline what will be expected of the students participating in each type of job search process activity:

   a. Mock interviewing: Establish the format for conducting individual interviews (on tape, in front of a class, at the Career Services office, etc.). Career Services staff members are available to assist in the development and execution of interviewing modules.

   b. Professional development issues: Select specific topics to be covered and secure any needed reference materials. Professional development issues can constitute the backbone of a course or serve as an effective “mini course” or teaching module within another course curriculum.
c. Personal marketing plans: Design the project to blend with the course curriculum; i.e., be sure that necessary marketing fundamentals have been covered or will be covered in conjunction with the assignment.

2. Schedule any outside presenters ahead of time so that time conflicts can be avoided. Guest speakers from business, industry, and/or community organizations may all prove beneficial, as outside perspectives can add significantly to the information provided by the instructor. Also, secure support from the Career Services staff.

3. Schedule at least one class period to familiarize students with the available research literature and electronic search techniques located at the library and Career Services office.

4. Conduct periodic in-class discussions for students to use in bringing up issues raised during their research. Such a forum will encourage sharing of ideas and keep all students moving ahead with their plans.

5. Allow class time for students to practice the techniques they are studying, and provide feedback and encouragement for their efforts.

6. Establish a set of reliable assessment standards that may include peer feedback as well as instructor evaluations.

7. For the personal marketing plan option, consider adding a mock interview near the end of the project to give students an opportunity to use a draft of their marketing plan in an actual situation.

8. Conduct a wrap-up discussion of the assignment when all students turn in their plans for final evaluation.
Work Ethic

Description of the Activity

Students in business-focused disciplines need to develop an appreciation of the standards that will be applied to their work within an actual business environment. Developing this type of self-awareness before entering the workplace will assist students in delivering the caliber of performance that will move them forward in their chosen careers. In this strategy, a homework grading standard designed to build this self-awareness is presented.

Purpose

Standards for homework grades serve to alert students to the performance norms that will be expected of them in business and/or industrial careers. By establishing career-focused standards early in the semester and adhering to them for all evaluated work, students become accustomed to working at an expected level of performance at all times. Additionally, standards develop student accountability for “business style” performance and provide a forum for discussing appropriate business and/or career standards throughout the semester.

Standards work particularly well in more advanced “career-related skills” courses in which students are performing tasks similar to those that might be encountered on the job. Initial difficulties in performing up to the standards usually are superseded by admirable performance after several weeks of practice and application. The technique does not seem to work well in a first-time freshman course in which students have not yet adjusted to college expectations, let alone employment expectations.

Examples

Use standards for homework grades to illustrate acceptable performance in any course that requires a series of graded assignments. For courses outside of the business discipline, adapt the standards for homework grades by describing performance standards in the language appropriate for careers in the alternative fields.

The following are work ethic suggestions from several different disciplines.

Business Technology (e.g., BTE 282, Computer-Based Business Analysis)

Business Standards: Introduce students to business standards that would typically be applied to their work in an actual career setting. Discuss the requirements and have students apply the appropriate standards to all homework.
assignments across the semester. Facilitate classroom discussions to reinforce the correlation between work done correctly the first time and value as an employee.

Science or Engineering (e.g., Chemistry, Biology, or Engineering Technology)

Technical Standards: Introduce students to the concept of control charting with upper and lower control limits set by one or two standard deviations above or below the mean, respectively. Using instructor-derived values for the control charts, give students the acceptable range for homework assignments, including the range for repeating an assignment if necessary. Apply the stated standards to all assignments given during the semester.

Procedure

1. Develop a clear and succinct description of the standards that will be applied to all homework grading over the course of the semester.

2. Go over the standards for homework grades with the students before the first assignments are made in class. Provide illustrative examples of assignments that fall into any category described in the standards, i.e., a fully acceptable assignment, an assignment that could be acceptable after rework, and an assignment that is clearly off target.

3. Describe policies for averaging grades after resubmission of assignments or any other policies that will be applied.

4. Periodically throughout the semester, refresh students’ focus on the performance standards by discussing the correlation between the standards used in class and the analogous work performance standards of the career field of interest.
Description of the Activity

Audio and video tapes have become deeply enmeshed in society and education. They provide ways to see and hear things that cannot be experienced any other way and permit vicarious travel just about anywhere. They provide a powerful pedagogical tool, but they also may be abused and overused.

The most common applications of audio and videotapes involve demonstrating specific information, processes, or a skill set. Students or instructors may videotape themselves to assess their performance. Segments of television programs may be taped during the preparation of a critical analysis. Students may use audio tape to record lectures for subsequent reinforcement, verification of lecture notes, or transcription. Video and audio projects may be developed.

Purpose

Magnetic media bring the lives and cultures of others into the classroom, demonstrate dynamic processes, supply views and sounds generally not available in classes, and provide data storage for subsequent analysis and retrieval. Audio and video tapes provide an unambiguous and sometimes brutally honest method for critiquing ourselves. Analyzing differences and identifying areas for personal growth and improvement promote and enhance the learning process.

Examples

English (Cindy Lewiecki-Wilson)

Students in a composition course enhance their analytical writing and revisions by videotaping a television program that they wish to analyze. After watching the video clip selected by a student, the class asks the student the following kinds of questions: How will the concept be framed and tested? What details in the taped segment are significant and why? What do the details show and how do they relate to a hypothesis? Next, the student drafts an analytical paper, which is then reviewed in a small group for level of content (is the thesis clear and interesting, is the description of what is being analyzed "thick," is the conclusion credible and persuasive, is the arrangement interesting?) Students are then invited to rearrange the structure/order of their papers; students revise their papers several times before a final draft is complete.
Nursing (Carolyn Mason)
Students utilize videotaping to demonstrate skill proficiency that is then evaluated by the faculty. For example, to prove proficiency in catheterization, the students are put into groups of three or four. Their assignment is to videotape each student doing the "perfect" catheterization. To attain this goal, the students practice and critique one another, working collaboratively. This process also allows each student to critique his/her own performance. Faculty then grade the videotape, which reduces the amount of time spent on assessing the skill development.

Spanish (Tammy Allen)
Students use video and audio tapes to see and hear native speakers of a foreign language in a more natural environment. These learning strategies are vital for specific teaching goals regarding aural learning and pronunciation. Many activities are planned for the viewing and listening segments of class. Students learn the value of "pre-listening" and "pre-viewing" activities. Then, students have specific activities to do while they listen and observe. The post-listening activities synthesize what the students have done in the previous exercises.

Political Science (Mel Cohen)
Carefully edited and sequenced audio and video clips are compiled to show historical perspectives and aspects of political contexts. Past and present political figures may be brought to the classroom to stimulate discussions.

Biology (Jim Janik, Alan Cady)
Videotapes showing dynamic processes at microscopic or molecular levels via animation or photomicroscopy give students a vision of event sequences that may occur over days or seconds. Audio tapes of animal vocalizations or heart sounds allow recognition training. Videotapes of endoscopic or laparoscopic procedures permit views inside living bodies, providing a novel perspective of anatomy and physiology.

Procedure
1. The most effective use of the videotape/videotaping process is selected.
2. Faculty member purchases videos or informs students about what they need to do using a videotape and VCR.
3. Students are given ample time to procure/use the videos.
4. Students receive feedback about their videotaped performance.
5. Students provide written feedback to the professor about their experiences.
Pros

• Tapes may be available at a central location (e.g., library reserve) for use outside of class time. These may provide feedback over long periods.

• Tapes may be reviewed repeatedly (e.g., listening again to lectures while driving), and videos may be dissected frame by frame to observe rapid actions. One picture may be worth a thousand words.

• The technology is inexpensive and widely available. Most students possess personal audio or video recording or playback devices. The magnetic media are reusable.

• Today’s students have been reared in a culture where audio and video are considered part of life. They are familiar with it and understand its operation and power.

Cons

• Much preparation time may be required to review, assess, and assemble audio and video media to be used. Precious class time is sometimes required for students to view or listen to tapes.

• Taping classroom events for performance analyses should be used only to assess and support other methods of evaluation. They should never be the sole evaluation tool.

• Tapes should be used mostly to augment and enhance course material. They cannot be expected to do the teaching. A danger of using tapes in classes is that some instructors may become “lazy” and spend more time “showing movies” rather than instructing.

• Students may come to rely too heavily on the tapes and not their own motivation and enthusiasm.
CD-ROM/Videodisc/Laserdisc

Description of the Activity

The use of interactive CD-ROM, laserdisc and videodisc technology is effective both inside and outside the classroom. It can be used in various ways to introduce students to new concepts and visions, to reinforce material and concepts previously introduced in classroom discussion, or to serve as an aid for student review. The availability of these media are wide and varied from educational CD-ROMs and videodiscs made for general public consumption to highly specialized CD-ROMs and disks produced by textbook publishers which utilize direct references and links to their own books. Indeed, many textbooks are now packaged with CD-ROM student guides which have replaced the print versions offered in the past. Additionally, these media allow for self-paced learning outside the classroom.

Purpose

The use of interactive CD-ROM, laserdisc, and videodisc technology offers many valuable benefits to students. Their use enables self-paced learning, especially with students able to work more independently outside the classroom. Interactive media can address multiple learning styles, providing independent, individual access to new kinds of visual data (including three-dimensional imaging and animations). They are useful for drilling and skill development as well as for multimedia demonstration purposes. Additionally, instructors have noted that students seem to perceive working with a computer to be more active than reading or writing, and thus they appear to be more receptive and motivated to participate in learning activities that incorporate these types of technologies. Many students become more animated and develop both increased class participation and improved interaction with other students as a result of group-based use of these technologies.

Examples

The following are examples of the use of interactive CD-ROM, laserdisc, and/or videodisc technology from several different disciplines:

Business Technology

*Principles of Marketing: An Interactive CD-ROM Assignment*  
(Rhonda Proctor)

In Introduction to Marketing (BTE 105) each student is individually assigned to complete the interactive CD-ROM that supplements the textbook, *Essentials of Marketing*, by Lamb, Hair, and McDaniel. Students are required to complete two
areas. First, they are to create a complete and detailed outline of the CD-ROM presentation. Second, they are to provide comprehensive answers to questions developed from the interactive CD-ROM.

Students are directed to supplemental computer lab guides from the Computer Center for instructions on accessing the network from campus. Additionally, they receive detailed operating instructions with each interactive CD-ROM. For students who are not yet comfortable with computers, the instructor is available for one-on-one computer assistance.

From this exercise, the students gain a valuable awareness of the interdependence of marketing and its functions via the game simulations within the CD-ROM. They also gain insight into the learning experience. Many of them will play the games several times, reinforcing the idea that many people “learn by doing.”

Chemistry

*Interactive CD-ROM Learning Tools from PACT (Susan Marine)*

PACT (Partnership for the Advancement of Chemical Technology) with funding from the National Science Foundation (NSF) has developed an interactive learning tool entitled *Chemical Technicians in Industry*. This CD-ROM includes four major areas: steel products, paper mill, aspirin precursor, and model systems.

In Chemical Technology II (CHM 215), two of these scenarios are used as project assignments. Students work through the topic, viewing process equipment and operations, the insides of complex tools and instruments, and a tour of the plants and labs. This moves them directly into the realm of the workplace. Video clips show the machinery in operation in much greater detail than is actually possible in person due to safety restrictions. Each student answers a series of questions as he or she progresses through the CD-ROM and writes essays covering the material presented.

The students have therefore been able to “tour” a variety of different industrial operations in a safe and convenient manner. They have been exposed to and learn about a wide variety of industrial techniques and processes that could not be otherwise demonstrated in the classroom.

Nursing

*The DINE Project (Jean Vanderbeek)*

In Theoretical and Technical Foundations for Nursing Practice (NSG 106) students are required to record all their food consumption for one day. They then enter this data into the DINE CD-ROM computer program and follow steps to analyze their diet. They spend approximately one hour on this data entry and analysis. They then review the results of the analysis and plan dietary
modifications to correct any nutritional problems that have been identified in their diets.

The interactive aspects of this project cause students to confer on a more regular basis in the Nursing Resource Center. This group work enhances and facilitates the learning process.

*The EKG Interpretation Project (Jean Vanderbeek)*

In Life Transitions I: Promotion of Health and Self-Care in Adult Life Transitions (NSG 116), students work with an interactive videodisc that helps them interpret and analyze electrocardiogram (EKG) recordings. After working with the videodisc for approximately an hour the students are required to run a heart rhythm strip from an EKG monitor. Then they take another one to two hours to analyze the EKG recording and clinically interpret the results.

The interactive technology helps to increase student comprehension of the electrocardiogram recording. The EKG program requires students to interact with actual EKG equipment and reduces their anxiety about working with this equipment in a clinical setting.

*Zoology*

*Graphic Brain: Neurophysiology CD-ROM (Alan Cady)*

In Pathophysiology (ZOO 325), students utilize CD-ROM software called *The Graphic Brain* for individual drill and practice that helps them to better understand the key concepts of neurophysiology and experience the tremendous variability inherent in physiological systems.

The students receive a handout describing the software and the operational codes for different simulations. This is followed by a short session in the computer lab to demonstrate the software. It is then up to the students to drill on their own, which allows them the freedom and flexibility to work at their own pace and around tight personal and professional schedules, as most students in this class are already practicing registered nurses continuing on for a more advanced degree.

*Data Analysis and Graphing Software (Alan Cady)*

In Animal Physiology (ZOO 305) students collect neurophysiological data, analyze it, and relate their lab inquiries to the principles of nerve physiology. They gain experience in using oscilloscopes, stimulators, and computer graphing packages.

Students are asked to determine various benchmarks from a frog sciatic nerve preparation and experiment with the relationship between stimulus strength and duration, and amplitude and velocities of the resulting action potentials. Students
assemble the proper electrical connections between the stimulator, nerve prep, and oscilloscope. These data are then analyzed using graphic methods on computers and included in a complete lab report discussing the results relative to the neural principles covered in the lecture. This exercise brings together many aspects of nerve physiology for the student and is central to understanding of the topic.

Visualization of Anatomical Structures and Physiological Concepts (James Janik)

Both videodisc and interactive CD-ROM technology are utilized in the teaching of Human Anatomy and Physiology (ZOO 171 and ZOO 172). The videodisc technology demonstrates various anatomical structures and physiological processes that are not usually observable in a typical undergraduate biology laboratory. The interactive CD-ROM technology is used both to introduce students to new concepts and to serve as an aid for student review. These multimedia approaches enhance the students’ ability to better visualize some of the more complex and difficult concepts in anatomy and physiology. Since students often have a difficult time in relating some of the abstract concepts discussed in class to the real three-dimensional world of the human body, these materials help them to better visualize anatomical structures and comprehend the three-dimensional nature of the body’s physiological processes.

A set of interactive CD-ROMs from the ADAM interactive physiology series is used to illustrate many different physiological processes and concepts concerning several different body organ systems. For example, the students use a CD that covers the anatomical structure of the nerve, using text and animation to explain the molecular basis of neural transmission. They also use CDs that describe other such processes in the cardiovascular, respiratory, muscular, and urinary systems as well.

The students go through the interactive exercises on the CD-ROM before the concepts are introduced in the lecture portion of the course. This gives them a flavor for the topic and some background and basic vocabulary, even before the topic is discussed. Later, the students go back to the CDs to review the topic and also to take interactive self-quizzes about the material.

The students use a CD-ROM for interactive anatomy as well. They can visualize several different anatomical systems in a three-dimensional, dissectable format. The CD allows the students to study each anatomical system (e.g. bones, muscles, circulatory patterns, etc.) separately or integrated with the other systems. The ability to isolate various anatomical systems and then observe them in context with the others is a key feature of this program.

The use of CD-ROM and videodisc technology enhances student learning in several ways. Students are better able to visualize complex three-dimensional structures in the body. They are able to visualize cellular changes and dynamic physiological processes that cannot be duplicated in the lab because of the lack of
equipment, time, expense, or expertise. These approaches also seem to capture the interest of the students in a way that makes them want to explore and learn more about the physiological systems being studied. Additionally, the students seem to be able to retain things better after seeing it in several different modes. Most of the CD-ROMs have self-quizzes with immediate feedback. Therefore, the students can do a form of self-assessment and then go back into the program to review material that was not clear to them.

**Procedure**

1. The instructor first needs to identify CD-ROM software, videodiscs, or laserdiscs that are appropriate for classroom use. While there are many sources for these types of media, careful screening is required to identify CD-ROMs and disks that are pedagogically sound and meet the specific needs of both the instructor and the student. Some sources for evaluated or rated materials include the following:

   a. Textbook Publishers: Many publishers now distribute CD-ROMs and videodiscs to instructors for free with the adoption of a particular text. These CD-ROMs have usually been rigorously evaluated and are generally pedagogically very sound. Also, many texts now come with prepackaged student learning guides on CD-ROM.

   b. Professional Organizations: Many professional organizations provide their members with lists of multimedia technology that has been approved by the organization for use in the classroom or has at least been reviewed by members of the organization.

   c. Library Review Publications: Most academic libraries subscribe to review services that highlight and review new publications and new multimedia.

2. Consider several factors when evaluating a CD-ROM, laserdisc, or videodisc. The following are some of the questions to ask when evaluating these media for use in the classroom:

   a. Is the CD-ROM, laserdisc, or videodisc pedagogically sound? Does it meet the specific needs of the instructor, the student and the course?

   b. Do I have the proper equipment to utilize the technology? Is a videodisc player available for use in my classroom? Is one available for use in the library or somewhere else on campus where the students can view the material on their own?

   c. Do I have the proper computers for the CD-ROM software I intend to use? Is the software available on dual platforms (Mac and PC), so that students will be able to use it no matter what computers they have access to?
d. What is the cost of the software or disk? Is it inexpensive enough for students to purchase and use individually, or must it be made centrally available (e.g. in the library) because of cost?

e. Is the software easy to learn and navigate? Can students sit down with the program and start to interact right away, or must they spend time reading instructions and learning commands before they can utilize the CD-ROM effectively?

f. Does the program contain sufficient self-help functions to keep students from getting frustrated as they progress through their exercises?

g. Is the CD-ROM or videodisc truly interactive? Does it contain quizzes or drills for students to self-assess their progress with the material?

h. Does the CD-ROM or videodisc address the multiple learning styles of students? Does it have sufficient audio, video, and/or animation to clearly address the topic and fully utilize the capabilities of the media, or is it basically just an electronic textbook?

3. Once you have settled on the particular CD-ROM, videodisc or laserdisc to be used in the course, personally and thoroughly test it. Look for any potential pitfalls, flaws, or dead ends in the software or videodisc that could sidetrack or frustrate the student trying to complete an assignment with this technology. The instructor needs to be aware of any potential problems that may arise and try to warn or advise the students about it beforehand.

4. Unless the CD-ROM or videodisc is designed to be completely self-guided, construct guided questions or prompts utilizing the strengths of the CD-ROM or videodisc. These should be designed to keep the students focused on the topic and to prevent them from getting lost in the technology. It is important in designing an exercise to allow the students sufficient time to familiarize themselves with the software and to complete the assignment without feeling rushed or overwhelmed. This can lead to frustration and a negative experience for the student.
Computer Lab Projects

Description of the Activity

In computer lab projects, students are required or encouraged to use computer technology to complete part of a project or an entire project. These projects might require the use of statistical software, word processing software, Web-publishing software, or the Internet. Some projects require students to complete the work individually, while others require or encourage students to work in groups or with others.

Purpose

One purpose of computer lab projects is to make the process of completing the project more efficient. For example, if an instructor wants students to locate and analyze real-life examples of statistics or human behavior, it might be more efficient for students to locate those examples via the World Wide Web instead of listening to the news on television or reading print versions of examples. Another purpose of computer lab projects is to expose students to elements of technology that they will likely use in their future jobs.

Examples

Mathematics (Amy Fisher)

Computer lab projects are used to discover calculus concepts in Math 151. Students are provided with a detailed worksheet and are encouraged to work in groups. The worksheet contains instructions and thought-provoking questions for subsequent discussions. Students use statistical software to view various graphical representations. They are required to perform some calculations, discuss with their partner how the calculations and graphical representations are related, and write a summary and analysis of their observations and experiences.

Psychology (Beth Uhler)

Students in Social Psychology (PSY221) are often asked to locate examples of human social behavior on the World Wide Web. For example, during coverage of interpersonal relationships, students are asked to search the World Wide Web for personal ads. Specifically, they are asked to analyze the content of personal ads and determine whether it is consistent with social psychological research about the types of characteristics that people look for in a partner. At other times, students are asked to search online newspapers (e.g., USA Today, New York Times), magazines (e.g., Newsweek, Time), and broadcast stations (e.g., ABC, CBS) for examples of real-life social behavior. This procedure allows the class to analyze current examples of human social behavior.
Political Science (Mel Cohen)
To help students learn about democracy and citizen participation, students are asked to create Web pages that would facilitate the development of high-quality participation in the democratic process. Students work in pairs to create their democracy Web pages. They are also asked to present their work in class and write a paper discussing the choices they made in constructing the site.

Art (Gary Wheeler)
To encourage students to learn about material on the Internet and gain experience in critically evaluating that material, they are given specific URLs to examine (such as a tour of a cathedral or an exhibition), asked to participate in a “treasure hunt,” given a particular issue to research or question to answer, or asked to do background research on a particular object in preparation for a field trip.

Procedure
1. Identify a learning objective or goal that is best met by the use of computer technology. For example, a learning objective might be to explore current, up-to-date information on the Internet about a particular topic in the course.

2. Construct a clear set of guidelines and instructions for students to follow. These guidelines should give students a clear sense of the learning objective and a rationale for why the use of computer technology is the best way to meet the learning goal. For example, if students are asked to critically evaluate information on the World Wide Web, they might be asked to first complete a tutorial that describes the rationale for critically evaluating Web-based material and then given a set of criteria for how to be critical in their evaluation of Web-based material.

3. Show students how to use the computer technology. If the use of computer software is used, give students a tutorial about how it should be used. If students are required to search the World Wide Web, they should be given a tutorial about effective web searching.

4. Ask students to describe and analyze what they learned and how it met the learning objective. For example, students might be asked to write a paragraph describing what they learned as a result of completing this activity.

5. Have students present their projects in class. This step allows students to share their learning with others in the class. For example, students might be asked to prepare a Powerpoint presentation of their project.
Distance Learning

Description of the Activity

Distance learning at its minimum occurs when the teaching/learning process involves physical separation between the teacher(s) and student(s), and use of technology (video, voice, computer, etc.) facilitate the instruction. Distance learning has the potential to remove barriers between students and the process, such as job requirements, family obligations, disability, and geographical location. The increased lifetime learning requirements of business/industry will accelerate the need for alternative methods of course delivery; distance learning again has the potential to deliver. A question to be answered is whether distance learning can be as effective as traditional, face-to-face education.

Departments and faculty interested in initiating distance learning courses should take advantage of existing support provided by experienced faculty and technical personnel on all of Miami’s campuses. Interested faculty must develop a working understanding of the delivery technology and any special needs of the distant students while functioning as an effective instructor/facilitator. Support personnel are required to assist in the many details associated with the successful delivery of the distance learning approach. As with any new endeavor, one should investigate, read, discuss, and otherwise prepare prior to undertaking.

Purpose

As with any educational approach, the purpose of distance learning is to meet the needs of the students and society at large. The unique purpose of distance learning is to provide education to those who probably could not be reached by any other approach. Educational institutions should use technology as appropriate to meet the needs of the student and the course content.

Secondary purposes include improving the cost-effectiveness of course/program delivery, assisting in promoting economic development within the service area, and promoting cooperation among area institutions in delivering courses/programs.

Examples

Only one department (Engineering Technology) responded at the time to utilizing distance learning technology. However, several other departments on campus, including Mathematics and Nursing, are now involved, with most other departments showing increased awareness and interest.

All of Engineering Technology’s full-time faculty are experienced at offering distance learning courses, the first being offered between Middletown and
Hamilton in the spring semester 1996-97. The ENT department’s most extensive use of the technology has been to offer its new Plus-2 baccalaureate program to Columbus State Community College. Since this program has been well documented, an assessment of it alone will follow.

Not long after ENT’s baccalaureate program in Electromechanical Engineering Technology was initiated in the fall of 1996, discussions began with Columbus State Community College to develop a distance learning program. Columbus State has more than 20,000 students enrolled with no area university offering a transfer program in engineering technology. The first course offered by ENT to Columbus State using Interactive Video Distance Learning (IVDL) was in Fall 1998. Fifteen students were enrolled at Columbus, and nine were enrolled at Middletown. The model used was for the Miami instructor to alternate teaching weekly between Middletown and Columbus. This was needed to ensure that labs went smoothly and also to facilitate advising for the many Columbus students interested in our new program.

The Engineering Technology department plans to increase the use of IVDL as appropriate, not only between regional campuses but also for off-campus sites other than Columbus State Community College.

**Procedure**

1. Discuss distance learning activities with experienced faculty and support personnel.
2. Study distance learning research findings (the Internet is a helpful tool).
3. Obtain hands-on training with the distance learning delivery system.
4. Analyze and understand the strengths and weaknesses of the delivery system.
5. Know whom to call in case of emergencies with the equipment.
6. Organize and carefully prepare the syllabus, handouts, and other reading and reference materials.
7. Check and review your course materials for content and presentation ideas.
8. At the beginning of class, discuss rules, guidelines, and expectations with students; provide for and respect student feedback, including e-mail, etc.
9. Remember that technologies are merely tools and that no one tool is good for everyone involved.
10. Expect the unexpected.
E-Mail (Electronic Mail)

Description of the Activity

E-mail involves the transmission of messages over computer networks. The messages can be notes entered from a keyboard or electronic files stored on disk. Most e-mail systems include a rudimentary text editor for composing messages. Messages that are sent are stored in electronic mailboxes until the recipient retrieves them. (from Webopedia)

Various kinds of files can be sent with an e-mail message. These files are called attachments. Perhaps the most common kind of file attached to an e-mail message is a word processing file, although graphics files, sound files, and Internet links may also be attached.

In any course, it is important to establish an effective mode of communication between student and instructor and between students themselves. E-mail allows any two individuals to exchange messages, but it also allows a single user to send the same message to a number of people either by the use of multiple electronic addresses or via a listserv. E-mail is clearly one of the most used technologies in many courses.

Purpose

E-mail is used in several ways in a learner-centered environment: instructors can communicate with students in order to assess their work, instructors can give course assignments, students can “visit” their instructors via computer in lieu of seeing them during office hours, students can confer with each other about assignments and exams, and students can work on projects together. From the perspective of a non-residential campus, e-mail brings many advantages to students who either live some distance from campus or are attending school on top of job and family responsibilities.

Examples

English (Ellenmarie Wahlrab)

E-mail letters are required from this instructor's English 111 students each week. The students write a summary of their participation for the week, which includes the 'basics': attendance, work done on time, etc. Students are also asked to use this forum to ask questions, talk about their writing in progress, comment on class processes, and make suggestions. Some benefits of this approach have been that one-to-one relationships with students are enhanced and the instructor can more closely monitor the class, addressing concerns, confusions, and opportunities as they arise.
The instructor responds briefly to each e-mail. In this exchange, students can be taught more about common writing problems, such as unsupported statements. The instructor also writes a weekly e-mail to all three sections of the course, addressing common concerns in more depth and previewing the next stages of the class.

**History (Marjorie McLellan)**
Students use e-mail to contact the instructor about their grades, to ask questions about assignments, to inform the instructor about delays or absences, and to submit assignments (usually as attachments). E-mail is also very useful for students in classes that meet only once a week. The instructor uses e-mail tools in Blackboard to send messages to students. The students are given feedback about grades and missed assignments as well as class reminders and announcements.

**Nursing (Carolyn Mason)**
The instructor communicates with her students, and students communicate with each other. The principal benefit perhaps has been the ability to communicate via e-mail concerning clinical work that the instructor sees once a week.

**Political Science (Mel Cohen)**
E-mail is used to assign preliminary writing that will lead to a longer assignment and to allow continuation of in-class writing assignments when class time is insufficient. The instructor believes that e-mail is very useful for coordinating class activities, especially in courses that meet infrequently. Students tend to be more timely in submitting completed assignments when e-mail is an option.

**Spanish (Tammy Allen)**
E-mail is used for interaction between the instructor and students outside the classroom—e.g., for submitting homework assignments.

**Zoology (Jim Janik)**
E-mail is used among students when they are working on group projects. Most of this e-mail activity involves the exchange of data and other information associated with their diagnosis of endocrine imbalances. The students request specific tests and then are given the results by the instructor.

The instructor also does some coaching via e-mail to help guide students toward the best diagnosis.
Implementation Steps

1. Determine what kinds of e-mail communication are desirable for the course.

2. Make certain that all class participants, including the instructor, have valid user names and passwords set up through the Middletown Campus Computer Center.

3. Include information on the specific uses of e-mail in the introductory session of course and in class syllabus.

4. Demonstrate how e-mail works.

5. Request each student's preferred e-mail address and emphasize the role of e-mail in successful completion of the course.
Increasing Computer Skills with the World Wide Web

Purposes

• To learn contemporary computer and Internet applications for work
• To help students gain an awareness of sources of information
• To help students learn how to navigate various information systems
• To integrate computer skills with course content
• To develop skills needed for future research or other Web activities
• To access valuable, up-to-date material and information

Examples

Creating a Web Page
1. This assignment is given early in semester as a final project.

2. Students use Netscape and PowerPoint.

3. Students work alone or in teams of two.

4. Students may be required to present their Web page to the class.

5. Students may be required to write a paper describing their site and defending their choices for their site.

Navigating the Web or Specific Web Sites
1. Review the electronic resources appropriate to the assignment goal.

2. Have students work through a series of exercises designed to make them think through the process of using online information systems.

3. Review exercises before the assignment is made in subsequent classes.

4. Work the exercises as a group in class so that everyone succeeds.

5. Have better students help weaker students with various steps in the exercises.
Learning to Use Search Engines

1. Students read several Web pages that compare different search strategies.

2. Students select two search engines and search on a class topic.

3. Students write about the searched topic and compare the search engines.
Research on the World Wide Web

Purpose

• To help students learn the excitement of discovery.
• To foster judgment about course content.
• To encourage students to seek knowledge.
• To help students better understand the problems and processes of research.

Examples

Treasure hunts
1. Students are given a list of objects or topics that they must find and describe or they are given questions to answer or issues to research.
2. Students may also be asked to research topics or places in preparation for future assignments or field trips.
3. Students may be required to work in groups.
4. Students may be asked to give either written or oral presentations describing their research.

Creating a Web Page
1. Students work in pairs.
2. Students must identify a topic or theme for their pages.
3. Students then identify subtopics and find links to other Web sites to include in their pages.
4. Students must present their work to the class and hand in a paper discussing the content, goals, and design choices of their pages.
Listserv

Description of Activity
A listserv involves a special use of e-mail. Listservs are essentially specialized mailing lists of users of common information that allow a single listserv member to send an e-mail message to all members of the listserv simultaneously.

Purpose
Listservs allow both instructors and students to send a single message to anyone signed up on the listserv. They save a great deal of time in that the same message does not have to be replicated for each recipient. Instructors tend to use listservs principally as discussion forums for their students or to communicate with their students about assignments, evaluation of projects and assignments, and course housekeeping matters.

Examples

History (Marjorie McLellan)
Listservs in this instructor's history courses accomplish several things:

1. they provide an alternative to class discussion;
2. they allow the instructor to communicate with students, even about mundane housekeeping chores of the class;
3. they allow for electronic distribution of lecture outlines and class assignments;
4. they encourage students to think about issues outside of class; and
5. they allow the instructor to track the points from a lecture that went over well and see what needs to be reiterated based on the content of the response papers to the listserv discussions. The instructor believes that listservs are an excellent way to acquaint students with communication by e-mail, to communicate assignments to a class, and to encourage thought outside of class. The instructor says that listservs allow for a sort of built-in study group and allow students to question one another about how to answer final exam questions through their conversations on the lists.

Through listservs, the instructor tries to foster online discussion. One useful approach is to have students initially post a small-group writing assignment in response to a study question. The short essay that each group sends is a synthesis of their ideas on a particular reading. Students from other groups then take turns responding to the group assignments. After two readings (e.g., the autobiographies of Benjamin Franklin and Frederick Douglass), students write
comparative essays based on the study questions addressed in the group assignments and cite each other’s contribution to the listserv.

Because students know they will write a comparative essay in which they will cite the listserv, they have seemed more motivated to engage with each other in discussion of their ideas online. This also gives students the opportunity to rehearse their analysis both in groups and individually before creating their own analysis for the paper assignment.

**Implementation Steps**

1. From the Internet, log into the University address that allows you to establish a listserv: www.units.muohio.edu/mcs/suppctr/tsr/links/index.htm.

2. At the first page of this Internet site, click on “I want to Request… a LISTSERV list for a course.”

3. On the next page, complete the application for the listserv and click on “Submit this request” at the bottom the application. If you have any questions, call 529-7900.

4. The listserv should be established within a week. If the listserv is not established within this time period, contact Computing and Information Services (MCIS).
Multimedia

Description of the Activity
Multimedia involves the use of various forms of media such as audio, video, text, and graphics either singly or in combination within a particular course. With regard to computer technology, multimedia usually involves a combination of most or all of these media forms.

Multimedia can refer to uses of older technologies, such as overheads, white boards, and slides as well as newer ones, such as videotape, videodisc, compact disc, digital videodisc, and Internet sound and video.

Purpose
The purpose of using multimedia is to vary the presentation of course content in order to engage students in a more active form of learning. Instructors and students alike speak of the tedious quality of lecture-only courses.

Examples

Anthropology (George Esber)
The instructor uses a slide projector, overhead projector, and computer applications and technologies in his classes. Computer applications have included Web Course in a Box (now updated by Blackboard) and Internet reading assignments. A computer and computer projector are used with upper-level classes to demonstrate Internet sources and electronic reserves that the instructor wants students to use. The instructor uses Blackboard’s e-mail, announcement, syllabus, forum, and electronic reserve features.

History (Marjorie McLellan)
This instructor uses e-mail, listservs, course web pages, Internet sources, Blackboard (the course computer program), slides, overheads, videotapes, videodiscs, CD-ROMs, and other kinds of multimedia. The aim is to integrate the course well, bring the parts together, and use the Internet and multimedia as threads to help weave the course together.

Within the “Course Documents” section of this instructor’s Survey of American History on the Blackboard course program, a virtual archives and Internet resource section has been set up. This section consists of Internet links and assignments on historical topics, which take the students into rich resources of primary source material, including “The Valley of the Shadow” archives of the Civil War and the “American Memory Project” at the Library of Congress.
groups, students work on research problems to be presented in class or online. The presentation may take the form of a simulated debate or of articles or editorials in a mock period newspaper.

English (Ellenmarie Wahlrab)
The instructor uses an overhead projector for multiple purposes in the composition classroom. It is used, for example, to represent ideas in a visual form with cartoons or other sources. Overheads are used to teach a mini-lesson on a writing issue, first showing a transparency on a correct writing structure, such as proper paragraph structure of dialogue. Working in groups of three or four, students attempt to restructure the writing, following conventions that have been demonstrated. Each group is given a transparency and a marker, and they write out their edited version. Then, a representative of each group is sent to the overhead to explain what the group has done. The class questions, discusses, and confirms the correct way to do a particular type of writing. These exercises can be configured for any number of teaching exercises. Other productive uses of an overhead projector are to display several pages of an essay that needs a lot of editing/restructuring or to put up transparencies of sections of current students' text that demonstrate parts of their essays that are 'working'.

Using an overhead projector to teach writing strategies involves the students quite actively, producing high-energy times in the classroom. Using a visual text that all students read and revise together demonstrates that writing is a process that takes time, reflection, choices, and revision—the most important elements of the composition class that the instructor wants her students to know.

Implementation Steps
Implementation of multimedia usually proceeds as an instructor tries various kinds of media to determine what works effectively. Some media work well with certain subject areas and not well with others (e.g., the use of photographs from history Internet links vs. examples of creative writing text from various university websites).

In some cases, instructors tend to use media with which they have experience and feel comfortable.
Part III

Courses

Designed to fit
Multivariate Calculus via Distance Learning

Amy Fisher

A Short History

During the Spring semester, 1998, I taught Multivariate Calculus, MTH 252, using the distance learning facilities between two Regional campuses, which was a challenging and interesting project. As the semester progressed, the students and I became more comfortable with the logistics of the facilities. Finally we realized that a normal lecture class was enhanced, rather than encumbered, using these facilities. The main problem I faced as an instructor was in introducing other types of learning into the classroom. I had had much success using group learning and activity-based learning in the traditional classroom, but I had returned to the traditional lecture method while using the distance learning facilities. I theorize that while the new classroom was unfamiliar to me, I reverted to a more familiar and more easily instituted method of teaching. Throughout the semester, though, I was uneasy about the effectiveness of the learning experiences of the students.

In the mean time, advances in hand-held technology have forced calculus instructors to re-evaluate the content of courses from an emphasis on skill manipulation to an emphasis on understanding concepts, critical thinking, communication skills, and problem solving skills. During the Fall of 1998, Texas Instruments released its new calculator, the TI-89. This calculator has a built-in computer algebra system that allows students to perform symbolic operations and solve systems of equations exactly. It has enhanced graphing capabilities that are useful for visualizing multivariate examples, and it has two main types of programming capability. The first is the regular type of programs found on earlier TI calculators; the second is a lone-by-line executable programming capability that allows students to see problems worked a step at a time.

Project Description and Teaching Strategies Used

After procuring funds to purchase 10 TI-89 calculators for student and faculty use, I drew up a new plan for teaching Multivariate Calculus using the distance learning facilities. The plan calls for several topics to be taught using inquiry-based group projects I had to develop to complement the reform text, Multivariate Calculus, by William McCallum, et al., and for the introduction of hand-held technology to solve complex problems. The philosophy behind this method is the belief that students learn more by doing than by listening. Because students don’t have extensive experience doing math in this active learning way, they may be anxious and frustrated at first. Usually, students take a few weeks to get used to the format.
and challenge of these activities. They must spend time in class and out working on the material.

Students begin a topic by working through an in-class worksheet or project that allows the students to discover basic concepts and develop manipulative skills. Problems in the text give additional practice with the calculator. The next day loose ends were tied up and we discussed concrete examples, formal definitions and statements of theorems. Students then worked on their scripts, which are line-by-line executable programs that allow the TI-89 to work out the grinding details of problems. They used their scripts to solve traditional problems and applications. Several times a week students work collaboratively on in-class projects with help available over the distance lines. Some of these projects are simple and expository in nature, but most are inquiry-based labs. In these labs the students follow instructions to discover the meaning of concepts for themselves. The distance learning facilities are set up so that students can show their work to the instructor using a document camera when the instructor is not on site. Finally, students write a few paragraphs describing the new concept and the method of solving problems based on the methods they have learned.

**Observed Student Outcomes and Comparison with a Traditional Course**

Students were evaluated using traditional tests and homework as well as graded on the nontraditional projects and writing assignments. Certainly, students' writing improved over the course of the semester and their maturity in being able to work through complex problems increased. The results of traditional testing mimicked the results that I have seen in a traditional course. Because of the low enrollment in the reform class, it is very difficult to judge the success or failure of the project. Only four students completed the course; one received an A+, one an A, one a B, and one a C. The two A students would probably have been equally successful in a traditional course, but I believe that the B student would have received a lower mark in the traditional course. This student had a particularly difficult time communicating mathematically even though this student was very clever and possessed great intuition. The student's communication skills improved over the course of the semester. The C student is difficult to evaluate due to personal problems faced during the semester, which resulted in a lack of motivation.

**Challenges, Recommendations and the Future**

The biggest challenge I faced early on was keeping the students on task during the inquiry-project phase. One student, who did not complete the course, was particularly good at undermining the group operation. With two students on one site and three on the other, the groups were certainly determined. This student simply did not want to bother with working on projects in class. It was difficult for the other students to work together because he used the time to ask questions that
were close enough to the point of the project that I felt I could not ignore him. I realized that a small class size is sometimes a detriment to group work. If there had been a larger class, the student might have been lost in all the shuffle of work instead of being the center of attention. The other students seemed to enjoy the projects. I fact, they all wanted more of them! At times, due to time constraints, we did not complete each step in the learning process. The students let me know that they would have liked more projects and more writing assignments. Fighting the time-constraint/content-coverage problem always exists. It was more pronounced in a distance learning environment.

I am encouraged by the results of this project so far, but, as was noted earlier, the success is difficult to determine. If teaching the same course again, I would revise projects, include more projects and writing components, and adjust the content of the course to fit the time needed for the entire project phase. This might be accomplished by having fewer topics in the project phase but have them done more completely. Instructors need to have resources at hand to help them implement new strategies that involve technology. They need to be aware of students who would like to control the teaching methods used in the classroom. It can be tiring having to fight the battle every day, and instructors need encouragement. Instructor-mentors would be helpful.

Another idea that I have developed in working with this project is to have students earn a “technology driver’s license.” Since the TI-89 can easily be programmed by either the student or his helper to compute multi-step problems, I encourage students to write an explanation of the process to convince me that they have learned the theory behind the process. In future classes, I plan on this step being successfully completed as a requisite to the student’s using the technology on any exam. In other words, each student must pass a written exam before they may “drive” the technology.

I have furthered the use of technology-driven inquiry projects with a second project. I am developing projects for Precalculus, MTH 125, and Calculus I, MTH 151, that follow the same philosophy of introducing topics by discovery projects enhanced with graphing calculators.
Computers, Computer Science and Society

Cathy Bishop-Clark

Introduction

Academic departments, including Computer Science and Information Systems departments, have long recognized the need to provide service courses to students outside their department. *Computers, Computer Science and Society*, SAN 151, is a Liberal Education foundation course in the technology area that was first offered at Miami University, Middletown Ohio in the fall of 1992. The primary objective of the course is to develop a perspective on the potential and limitations of computer science and computer technology. Topics include the impact of computing on societies, models of computation, major paradigms for the use of a computer, and legal and ethical use of computers. The course also exposes students to programming language and various computer tools (spreadsheets, presentation systems, the Internet, etc.).

For many students this course will be the only formal computing class they will have. Many students want a course that will teach them how to surf the Web, use word processors or design spreadsheets. While we have such courses, this is not the one. This course includes some theoretical, ethical, technical and practical computing topics. The class is intended to provide the student with some exposure to the breadth of computer science while at the same time develop their ability to think logically and critically. Some of the material is quite rigorous and challenging, and some students become frustrated, end up hating the course and computing in general!

During the 99-00 academic year, with the assistance of a grant, I drastically changed the way this course was taught. My goal was to create a course that is 80% active and inquiry-based. My primary reason for doing this is that I want students to feel deeply involved in the class, to learn more from the class, and to better develop skills that should serve them well for a lifetime. Additionally, since for many students this will be their only formal introduction to computing and the field of computer science, I want students to leave the class understanding more about computer science, excited about computing, and feeling more confident in their ability to solve various computing problems. I felt that some of the ways for this to occur was to change the activities of the class. I essentially revised the class so that there was no more than 15 minutes of lecture in a single 75-minute class. Specifically, my goals were to:
Make every class session include active and inquiry-based learning activities. Specifically, I would like to have no more than 15 minutes of lecture for every class session.

Make 1/3 to 1/2 of the class lab-based and modify existing labs. Most students expect computing labs to be step-by-step, how-to laboratories, and these are the kinds of laboratories provided in most books. Currently, most of my hands-on labs follow this form. While students are active, they are not required to think critically about solving problems. While this kind of cookbook approach to labs has a place in some computer courses, I wanted the labs for this course to be more inquiry-based and require more critical thinking.

Encourage a sense of community: In all the courses I teach I attempt to create a strong sense of community. That is, I want students to feel that this is their course and that they must help one another to do well in the course. I want students to feel compelled to attend and participate in class because they sense that it is their responsibility. This is much more difficult to achieve when the course is a non-majors course, when students are from variety of majors and when their motivation and interest in the course itself varies dramatically.

How the Goals Were Met

Research has shown that lecture is a highly ineffective way to teach and learn. As described above, my goal was to design a course that included no more than 15 minutes per class or lecture. To do this, a number of non-lecture activities were designed and implemented. They are described below:

Quizzes: To have educated in-class discussions, students must read the material first. Before any discussion of the chapters, they take a 10-point, 10-question multiple choice, true/false, short-answer quiz. Students are allowed to bring one full page of notes (front and back) to each quiz. The intent of the quiz is simply to provide motivation to read the material before class time. Although some students still did not do the advance reading, approximately 90% did.

Annotated Bibliography: So students feel they have something relevant to share with the class, I ask them to collect articles from newspapers, magazines, journals, and web sites. At the end of the term they are required to turn in an annotated bibliography which includes at least 35 articles which they have reviewed and related to some aspect of the class. At various times during the semester they are asked to share with their classmates the articles they have read. They are sometimes asked to post to a newsgroup set up for the class and at other times they are asked to discuss in class the articles they are reviewing. This gives the students some information that only they know and feel comfortable sharing. It also creates more informed and lively discussions.

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In-Class Small Group Discussions: Approximately 5-7 in-class discussion guides were designed and used for each chapter of the textbook. Groups of 3-5 students work together through the guide, which contains material corresponding to material in the textbook. For example, one of the topics of the course is titled *Global Applications*. This section essentially covers the Internet and Web-based applications. Rather than my giving a lecture on the Internet, students are put into groups and are asked to come up with a short presentation on various aspects of the Internet. Students use about 15 minutes of class time to pull together a 5-minute presentation. They are given transparencies so they can create some visual aides. Since they have already read the chapter, this is not entirely new material. Additionally, they are asked to pull into their presentation material from their collection of materials from newspapers, magazines, web sites, etc., which is relevant. After 15 minutes of group work, we get together as a large group and the individual student groups make their presentations. I suggest the students take notes during the presentations, and I will add any material the groups may not have covered.

I incorporated a small group discussion into almost every class period that was not in the computer lab, using a discussion guide to help the students focus their attention and conversation. A Sample discussion guide on the Internet is shown below:

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**Sample Global Application Discussion Guide**

For this class exercise you are to put together a short presentation on some aspect of the Internet. I will assign a topic to you for you to present. You should use your book and your own experiences to answer the question you have been assigned. Use the one-page transparency that I have given your group to summarize key points. Be prepared to give a 5-minute presentation to the class. You will turn in the transparency.

1. Provide a review of the growth of the Internet including current events.
2. Create a short presentation on the design of the Internet. Explain how messages are passed from one site to another and how the messages are assembled.
3. Provide an introduction electronic communications—talk specifically about E-mail and Newsgroups.
4. Provide a Basic Introduction to the WWW and Web Page Development.
5. Provide an overview of the new social, legal and ethical issues that we now face because of the Internet.

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Large-Group Discussions: I often follow a small group discussion with a large group discussion. After working in groups of 3-4 people, the groups join together and share their conclusions. When I find groups coming to a consensus quickly, I ask that group to defend the side that they do not agree with. They are forced to argue a position with which they do not necessarily agree.

In-Class Labs: There are approximately 10-12 laboratories throughout the semester, corresponding to the students’ readings. During local applications, students have labs using Excel and PowerPoint. During the weeks on global
applications, students have a lab that involves getting familiar with the Internet. During user interface design, students design their own web page. For programming, students have several labs on JavaScript. Labs are designed to provide some instruction but they are also designed to encourage students to solve problems in which a step-by-step solution is not given. For example, after an overview of Excel, students are asked to design a few simple spreadsheets. For the programming labs, students modify the programs I provide to do something slightly different. Students work in groups of 2 to 3 and they are strongly encouraged to help one another. In general, I will not provide assistance unless the entire group can not solve a problem.

Lecture Packets /Paired Problem Solving: There are portions of the class that do not lend themselves well to small groups discussion – in particular the discussion of computer science, Turing machines, and computer programming. For these topics, I have created a lecture guide. This guide includes my notes with short activities after every 15-20 minutes of lecture. The short activities require a person work with a partner to solve a problem. For instance, we talk about how to convert a number from base 10 to base 2. I provide an example and then ask the students to work in groups of two to convert a different number.

Blackboard: Blackboard is an on-line course development system that allows instructors to easily create web sites for a course. Although I do not use blackboard in its full capacity, I do use some aspects of it. The course syllabus and course requirements are on the web site. I have links to other web sites for the students to explore that relate to each chapter of the text. Students find other web sites throughout the course, and as they find relevant ones, I add them to the course links. In addition to using the web links, students use the newsgroups and the chat rooms. They use the features to introduce themselves, have an on-line discussion of various issues in the class, social aspects of computing, a video we watched in-class and various of other issues that come up as the course progresses.

Student Presentations: The last week of the class students give a 5-minute presentation on some aspect of computing that they have been reading about throughout the entire class. They design either a power-point or web-based application and use that to present their topic. Examples of topics include Internet hate groups, computing and disabilities, key women in the history of computing, computing in education, computing and scuba diving, on-line shopping, and psychological addictions to computing. The final presentations are a good review of the breadth of computing issues.

Assessment of Success of the Changes

My personal assessment is that the change in course activities has resulted in a substantial improvement in student interest and attitude toward the course. Students complete two assessment devices—one at midterm and one at the end of
the course. A total of 75 students have filled out the anonymous survey (over 2 semesters and 5 sections) at the end of the term. The survey includes approximately 20 Likert-type questions and 10 open-ended questions. To provide some focus to the assessment, I will return to the original goals of the project:

**Make every class session include active and inquiry-based learning activities.** I was successful in creating a class that was almost “lecture free.” When asked what students found to be the least useful class activity, almost 70% of the students report either paired problem solving or lecture. I think students did not understand the phrase “paired problem solving” and many of them actually associated that with the traditional lecture. In general students gave very high evaluations of working in small groups, working in large groups, and working with others.

**Make 1/3 to 1/2 of the class lab-based and modify existing labs.** Recall that labs have always been a component of this class; however, the labs were redesigned to avoid *cookbook* type procedures and create labs that require students to think critically to solve a variety of problems. When students ask me a question, I almost always require them to *figure it out themselves* while I give small hints. When students were asked in an open-ended question what they found to be the most worthwhile thing done in the class, students overwhelmingly chose labs. Eighty percent of the students report that because of the laboratories, they will be able to learn additional software package on their own. Of five class activities, almost 60% of students ranked in-class laboratories to be the most useful class activity. Ninety percent of the students interviewed agreed that working in groups on labs is a more effective way of learning than working individually.

**Encourage a sense of community.** As discussed previously, for many students this will be their only exposure to computer science. In general students perform better if they have a sense that they are in this together, that they have a *support system* for the course. I have created many activities where students work with one another and help one another. I talk in class about the student’s responsibility in small group discussions, and I encourage students to take alternate views when their groups quickly came to consensus.

Eighty-seven percent of the student report they enjoy helping others in the class and the same percentage report they learn from helping others in the class. Eighty percent of students report the class improved their ability to work with others. In the open-ended questions, student felt that through group work, specifically working with lab partners, they improve their ability to work with others. Those who found the class less difficult than other classes, found they developed patience in working with those who struggled more. Several students commented that while it was sometimes frustrating when the instructor would not directly answer questions in laboratories, they learned more from classmates and had to think harder and longer to solve a problem on their own.
When students were asked, "What is the one skill you believe this class helped you
develop the most, the class was divided between critical thinking skills and
communication skills. Many students felt that the instructor's approach of having
students work together to figure things out, as opposed to just giving them the
answer, was very helpful in developing problem solving skills. One student
commented, "This class was all about critical thinking. It seems to me that there
were never really easy answers, they all required thought." Others felt that
working with and having to depend on other students, as well as the oral
presentation and group discussion develop their communication skills.

Conclusion

In summary, I changed this class to be a more active, inquiry-based class. Students
are required to work with other students, to solve a variety of computer based
problems, to participate in both small group and large group discussions. Students
are required to take a more active approach to their education and to work
extensively with other students. My observations and student survey results
indicate that this kind of approach is excellent for most students. However, it
should be noted that some students have expressed a desire for more lecture time.
One student noted that she would prefer to miss class than work in a small group
with peers. She felt she was being cheated if she did not hear the instructor's
"expertise" in the form of a lecture. She was not the only one expressing this
concern. Students also comment that there is a tendency to get off-task during
small group work.

The instructor's role in creating this kind of course is critical. Some students get
very frustrated when I do not give them an answer. It is tricky to see when the
frustration is useful and when it becomes a hindrance to learning. I have taught a
total of five sections of this course using this technique and some sections were
much more effective than others. This kind of class requires much more maturity
from the student. While some students rise to the challenge, others do not and, in
fact, they are able to keep class discussions from rising to the next level. Overall,
the majority of the students feel the combination of small group activities, large
group activities, laboratories, and lectures are a highly effective way to learn.
Introduction to Psychology: an Online Course
Beth Dietz Uhler

Introduction

It has become increasingly important for students to learn in a technology-rich environment. First, students will most likely be required to use technology in other courses. Second, students will most certainly be required to use technology in their careers after they graduate. Third, the use of technology in education has been shown to enhance learning. For these reasons, it seems that efforts ought to be made to integrate technology into any existing course. I developed this web-based Introductory Psychology course as part of a commitment to providing students with technological experience and to inquiry-based learning.

Developing the Course

The Introductory Psychology course, PSY 111, has typically been taught as a lecture-based course. Although this approach can easily be justified (as in the case of a very large class), I believe that this course can effectively be converted to a web-based, inquiry-based learning format. This new type of course would provide students with an experience that is likely to significantly affect the way that they think about psychology. Adaptation of the existing Introduction to Psychology course to the web-based format required several developmental components. First, a web-based syllabus was developed including all the information that a traditional syllabus provides plus information that is specific to the Internet (links to other web sites, email addresses of classmates, information on using the chat room). Second, lectures and inquiry-based class exercises were put on the web. For the most part, these files were simply converted to webpages. Third, a chat room was set up so students could interact with each other. This component would take the place of in-class interactions that are often the basis for important discoveries and insights. Fourth, a mini-workshop was developed to provide students with the necessary skills to complete the course and use all of the Internet resources that are part of the course structure. The workshop includes such topics as what the Internet really is, how to use a browser, how to critically evaluate information found on the Internet, how to use email, how to use chat rooms, and how to search for information. During Summer I, 2000, Introduction to Psychology was offered as an asynchronous, web-based, distance learning course, which spanned six weeks.

Course Description

The format of this course is similar to other online courses in many ways. The
majority of the communication between instructor and student takes place online, students complete the assignments at their own pace and on their own time, and students are required to use the World Wide Web to complete significant portions of the course. Some features of the course are not typical of most online courses. Students meet with the instructor face-to-face on the first day of class, and students take their exams on campus with the instructor present.

Course Organization

Assignments are due approximately every three days. The course is divided into fourteen modules, each representing major areas of psychology. For each module, students are required to

1. Read a chapter from their textbook.
2. Using the links provided on the course webpage:
   a. Read the chapter outline
   b. Review the learning objectives
   c. Read the frequently asked questions
   d. Take the quiz and send the results to the instructor
   e. Complete the crossword puzzle
   f. Read the article, “Around the Globe”
   g. Examine as many of the suggested reading links; however, they are required to examine one of the links in detail and write one paragraph which describes what they have learned as a result of reading the material on that link. They send their paragraphs to their instructor.
   h. Do at least one of the interactive exercises.
3. Post at least one message on the Discussion Board of our class web site.
4. Complete a project and send their paper to the instructor.

One week before the course began; the instructor sent letters describing the delivery of the course. For some students, this was their first indication that the course was in a new format. At the first class meeting, students completed the first module for the course. This module consists of the following components:

1. Handouts and directions on how to access to the Internet, log on to the network and set up email accounts if they did not already have one. The instructor directs these activities.
2. Access to web sites describing the fundamentals of online learning.
3. An overview of the course web site and the structure of the modules.
4. A tutorial on how to critically evaluate information that is presented on the World Wide Web.

After the students go through the first module, they are asked to take several surveys designed to test whether the student is a good candidate for online learning. They are also asked to complete the following assignment: Given what you now know about online learning, write a paragraph describing your

Introductory Psychology Online

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expectations about this course. How confident do you feel that you will be able to successfully complete this course? What concerns or fears do you have?

Assessment of Learning

Learning is assessed in a variety of ways. First, students are required to complete a number of assignments for each module. These assignments require students to

- understand and retain the basic psychological principles presented in each module,
- be able to think critically and intelligently about the material presented in each module,
- be able to apply these psychological principles to situations and events that they are likely to encounter everyday.

To assess students' mastery of these objectives, they are asked to

- complete an objective quiz to measure the extent of their knowledge of the material presented in each module,
- review at least one approved web site and discuss how it relates to the material presented in each module,
- complete a project that requires that they apply the material in the module to a real-life problem or situation.

The instructor grades all assignments. Students receive their grades and comments via email. The grades for the assignments are based on the extent to which students meet the objectives described above. Also, students are asked to take four, multiple-choice examinations that are given on campus in the presence of the teacher. These exams are designed to assess their factual and conceptual knowledge of the material presented in each module. Each exam consists of 20 questions from each of the modules. Thus, each exam contains approximately 60 questions.

Students' assignments for each module are graded according to how well they meet each of the learning objectives. Students' performance on the assignments graded during the summer session ranged from 63.1% to 96.2%, with a mean score of 85.9 ± 10.4%. On the examinations the mean score was 75.6 ± 12.5%. The average final grade for the course was 81.2%. It is not possible to compare directly these values with those for previous sections of the course taught by the same instructor because the nature of the new course is so distinctly different from before. However, the 81.2% mean was higher than the average grades for the sections taught in a traditional manner in 1999 (74.9% and 76.5%).

Introductory Psychology Online
Comments on the Course Experience

From the Students

Most of the students were glad to know that the course would be delivered online. They expressed the belief that an online course would be more conducive to their lifestyle than a face-to-face course. Results from surveys given to the students during and at the end of the web-based course indicate that 83% of the students were satisfied overall with the course structure. Some found the technological glitches interfered with their learning, but most believed the format helped them understand and visualize concepts. All the students said they would recommend the course to others.

In most typical online courses, the dropout rate is about 57%. When this course was first taught in the summer, 2000, the dropout rate was 7% (only one student dropped the course). There a couple of potential explanations for this low attrition rate. Students did meet face-to-face with the instructor and other students five times during the six-week period. The instructor kept in constant email contact with students and encouraged them to keep up with the assignments.

From the Instructor

The largest portion of time spent on this course involved designing and building the course. Although I did not record the number of hours spent on this activity, my (retrospective) estimate is that I spent about 100 hours designing, building, and refining the course. In terms of the amount of time required to actually instruct the course, I estimate that I spent the same amount of time on this course as the face-to-face version of the course. This class was scheduled to meet for a total of nine hours each week. I estimate that I spent about nine hours grading students’ assignments and interacting with them online.

Course Web Page

The web page for the course is:
http://www.muohio.edu/~uhlerbd/psy111summer.htm.

Acknowledgement of Support

In addition to funding support from the NSF grant project, Furthering Advances Toward Learner-Centered Education, support for the preparation of this course has come from the Learning Technologies Summer Institute funds, the Alumni Teaching Scholars Program, and Faculty Development Funds from Miami University Middletown.
Our two-semester General Chemistry laboratory program for science majors consists of a series of inquiry-based investigations. The experiences are labeled inquiry because they are designed to engage students in the active investigation of material systems for the purpose of collecting and analyzing data that is used to gain understanding of chemical principles inherent in the system. The most significant difference between these investigations and the more familiar, verification format exercises, is that the emphasis on technical skill development and data collection that is usually the main focus of a verification procedure is only a part of the inquiry-based experimental process. Until meaning is extracted from data and applied to the understanding of a scientific problem or task, the work is not finished.

Throughout the semester students are given situations that allow them to practice skill with equipment and instruments and to learn how scientists make decisions about the choice of procedure, equipment and method of record keeping. Each investigation involves a set of technical skills that students need for their laboratory work. Skill development is programmed throughout the term, so that the necessary practice occurs naturally. It is important for students to understand what skills they need to have mastered each week. This encourages them to become more responsible for their own learning.

Each investigation is tied in content to some significant concept or principle that will be discussed in class. The experiments are often intended to introduce ideas. Thus, students do not have a firm understanding of the theoretical aspects of the content before they do the work. Students are expected to extract meaning from what they do, rather than from what they hear that others have done. They practice reflective thinking about the work they have done, compare their work with that of others, and apply the knowledge to answering questions about the chemical systems under study. Many of the investigations are introduced via industrial scenarios that include a question or task students must ultimately complete. As the semester proceeds, less guidance is given and more decision-making is required of the students.

The primary role of the instructor is to challenge students to think about what they are doing, or have just done, by asking appropriate questions during the data collecting process. This process helps students learn how to work with the ideas of the investigation as they learn the technical skills of data collection. The questions
posed in the written materials are discussed as the experiment progresses. This serves the double purpose of engaging the students in the act of reflective thinking and offers the instructor the opportunity to assess understanding or misunderstanding as it develops. Instructors must also take time to observe, assess, and provide feedback on each student's performance as he/she works. By sharing ideas with the students as they are engaged in their decision-making processes, one can model the types of thinking that occurs routinely in scientific laboratories.

Goals for the Laboratory Course

- to develop the confidence and competence to derive meaning from and explanations for observable evidence
- to develop skill in the use of selected equipment, instruments, and technical procedures
- to learn to ask pertinent questions and how to find answers for those questions
- to learn how to determine the acceptability of data
- to learn to analyze data and find meaning in the measurements and reactions observed
- to draw conclusions that relate experimental processes and results to theoretical principles
- to develop an appreciation for the spirit of the scientific enterprise

From early in the first semester much emphasis is put on the first goal, so that students will realize that mistakes are OK. It is fun at the end of the semester, when students are busy among themselves working on an open-ended project, to remind them just how much confidence and competence to work independently they have developed.

Assessment for these laboratory experiences relies heavily on direct observation of behavior and the written communication of ideas. Students are given the following list of performance skills.

Performance Skills

1. Manipulative skills
   - Uses, cleans and cares for equipment properly.
   - Measures accurately and precisely.
   - Appreciates precision of apparatus.
   - Obtains quantitative results within expected range.

2. Responsibility, initiative and work habits
   - Works independently or cooperatively in a responsible way.
   - Is self-reliant, perseverant, and willing to tackle problems.
   - Follows procedural and safety rules consistently, and without prompting.
   - Demonstrates interest and enthusiasm for the learning experience.
   - Shows greater concern for the quality of work and learning than with

Inquiry-based Chemistry Laboratory
the length of time spent in the lab.
~ Takes a leadership role in group work.

3. Scientific thinking skills
~ Actively seeks understanding.
~ Translates written directions into action.
~ Thinks critically while collecting and processing data.
~ Presents a clear, concise, and complete plan when designing an experiment.

4. Observation and data recording skills
~ Observes carefully and thoroughly.
~ Records data directly into the lab notebook at the time it is taken.
~ Records relevant observations and information, accurately and in an appropriate form.
~ Notes unexpected results.
~ Does not ignore errors and possible inaccuracies.
~ Keeps a well-organized notebook.
~ References, properly, any ideas not his/her own.

5. Interpretations of the data and the investigation
~ Possesses a good appreciation of the data, of error and of the limitations of the procedures used.
~ Works proactively in trying to make sense of the data.
~ Knows when information is insufficient or of suspect quality.
~ Calculates accurately.
~ Creates and/or interprets graphs accurately and logically.
~ Makes reasonable inferences from data and suggests rational explanations, using evidence to support conclusions.
~ Relates the investigation and its results to particular problems.

Each investigation receives a grade that includes feedback on all of the skills that should have been used at the time. At the end of the first semester, students are also given points for their level of growth toward meeting the course goals. This allows students who come in with a wide variety of background experiences to have a fair chance to demonstrate learning, without having to be measured against the others in the class.

Comments on this type of laboratory experience

Students usually find this type of laboratory experience intimidating at first. They are so used to being told what to do in great detail that they have little confidence in themselves to make sensible decisions. This means the instructor must give a lot of guidance, feedback and moral support, actually teaching the students how to think critically about various aspects of the work. Some simple questions interspersed throughout the written materials help the students learn what kinds of things they need to consider as they investigate the system. In general, though, by the end of the first semester the students find they understand what experimental
science is and how the information gained by actual investigation fits with the principles under study in class. They also have increased confidence in their own ability to make choices, analyze data, and communicate reasons, conclusions, and information. Students with a learning style that prefers great structure in terms of detailed instructions of what to do, how, why, and when does not mesh well with this type of inquiry-based instruction.

By the end of second semester, students move freely among the group looking for suggestions, comparing answers, checking procedures. The instructor’s role has diminished with respect to required feedback. When the students go spontaneously to one another for discussion and help, paying little attention to you, the instructor, you know the method has succeeded...even though you will miss the greater level of interaction.
Utilizing Active Learning Strategies to Integrate Math, Music and Physical Education in Early Childhood Education

Garry Bowyer  Susan Joyce  Mark de Saint-Rat

The new Early Childhood Education Program (Pre-K – 3) has been designed and sequenced to promote an integrated approach to teaching children that engages preprofessional students in classroom learning that integrates workplace reality with academic principles. As many school districts begin taking an interdisciplinary and hands-on approach to instruction, teachers are necessarily being required to work with other teachers to a greater extent and to take a more active learning approach to their teaching. As we find students and teachers responding positively to this approach, we want to provide more experiences for Pre-Service teachers in their University courses to enable them to do this more effectively. With this in mind, we have developed sixty-two children’s activities based upon the curriculum integration of the three content areas.

Each of the activities utilizes active learning strategies. For example, an activity for Kindergarten students integrates the math concepts of patterns, relations and functions, with locomotor skills from Physical Education and tone color from music. In this activity students will begin by each performing an A/B pattern using two locomotor skills, such as hop/jump, matched with two tone colors or pitches. The pattern is then extended to an A/B/C pattern and possibly an A/B/C/D pattern. The teacher could use wooden blocks, a xylophone, metal sounds, shakers, etc., as tone colors.

In grade one, an example activity integrates data analysis, fitness activities and beat. This activity involves students performing developmentally appropriate activities in a fitness circuit. After completion, students sort and group themselves according to their favorite activity. The teacher can ask the students in each group to line up so that they form a live bar graph. During the activity music is played at various tempos to promote different activity speeds. While stretching afterwards, slow and soothing music will be played.

An example activity for grade two integrates investigating the perimeter (geometry), locomotor skills, and beat. Different geometric shapes are taped onto the play area Floor. Students are divided into three or four groups, then travel round their shape to the beat of the music. They do this for each of the shapes. Students then guess which shape has the perimeter of greatest distance. They then measure the
perimeter with yarn to check their guess. The beat of the music and locomotor
skills can be varied to alter the difficulty of the task.

A number of these activities will be incorporated into the Early Childhood Math,
Music and Physical Education classes that we teach. They will provide some
concrete examples of how different curricular areas can be integrated for children
utilizing an active learning philosophy. Students in the Early Childhood Physical
Education class will also develop an interdisciplinary/active learning project
appropriate for young children using the models they experience in class. Some of
these projects may be presented in class or to local school children. Our students
have also developed an informal teaching Experience Evaluation for use during
such experiences. In addition to the materials developed, we feel the opportunity to
collaborate with each other has been very beneficial. We have gained tremendous
insight about our respective disciplines and how we might best utilize the active
learning/interdisciplinary approach to education with our students.
Composition the Dual-focused Composition Course: Work as Goal/Work as Subject

Ellenmarie Wahlrab

The work theme-focused English 111 course I designed and taught was constructed to highlight two important learning processes: using active learning strategies and integrating workplace experiences and competencies with academic principles. A primary goal of the course was understanding contexts. In fact, this Miami Plan goal, in my mind, gave meaning to the workplace focus of the course: to have students to develop and practice work-ready composing and communicating; but also lead students into an inquiry on just what this work was they were getting ready for and, hopefully, into a lifelong reflection on the socially constructed nature of work and their part in it.

So I designed the course to be inquiry-based and to integrate workplace/work-based activities into the classroom. Students would explore the world of work through self-reflection on their own work experiences, critical responses to readings, on-site research of a work situation, and interactive presentations by representatives from different work settings. The questions I would raise were: How do we construct the work we do? How has it been constructed for us? What are its satisfactions, injustices, aesthetic pleasures, ethics, politics, and purposes? To paraphrase the original proposal, the contexts for both exploring these questions and practicing workplace communication processes would include the real-world work situations of their lives, readings, film, ethnographic research, and presentations from several professionals from the wider community.

My students had multiple opportunities to speak, listen, write and read, and to use these processes in academic and workplace contexts. These workplace competencies were complicated by having to understand how the competencies are embedded in real social and historical locations. The workplace knowledge that my students brought to the classroom was validated as learning and accomplishment, and was applied to addressing communication needs in real-life scenarios. As their mid-term comments make evident, their workplace knowledge was also open to revision and improvement. In addition to four academic essays, students drafted four pieces of workplace writing: meeting minutes, memo, proposal, and instructions, selecting one to develop further and revise for part of their final course grade. The models for these writing genres were actual workplace documents--from my work here at MUM and from their workplaces.

One of the results of designing this course around the dual theme of work as goal/work as subject and around students' actual realities was the flexibility for
how the course’s goals could be met. I was able to take advantage of learning opportunities that I hadn’t planned in the syllabus but which arose from the richness of their reflection and experience. For example, I drew on their surprised and thoughtful responses to two essays on Black English to set up the situation calling for composing minutes, one of their workplace writing assignments. Their discussion explored their readings of differing views of Black English. In “Linguistic Chauvinism,” Peter Farb traces the history of Black English, arguing that Black English is a language in its own right, with structure and rules comparable to those of standard American English, and expressive of a rich, if painful, cultural heritage. Rachel L. Jones argues in “What’s Wrong with Black English?” that she doesn’t speak white but right, and that Blacks who do not become articulate in Standard American English hurt their own chances for success in a white-dominated culture.

Most of the class initially found the Farb essay daunting to read, with its interweaving of linguistic explanation, history of the development of Black English, and argument for the legitimacy and value of Black English as a language. The class met in small groups to analyze the main points of each author’s argument. Then spokespersons from each group led the class in an evolving understanding of the language issues at stake. What came up again and again was Farb’s illustrative example of a young Black girl’s ability to read fluently a story written in Black English that she could not read in Standard American English. This student would have to learn a new language while learning how to read in order to succeed in the school system she was in.

To move the discussion into their everyday lives, I asked them to form work groups hypothetically composed of parents, teachers and administrators from an elementary, middle or high school. Their task would be to develop a policy and related program for addressing the concerns raised by both authors. How would their school recognize and value the home languages of all of their students and also address their students’ needs to become fluent in the dominant culture’s language? Their added task would be to write minutes of their meetings, which came to be numerous. They formed three working groups, two for high school and one for elementary school, and became so involved in their discussions and research that I organized time at almost half of weekly class meetings for the issue groups to continue to meet. Some researched what their school districts were doing concerning language issues and brought back what they found to their issue groups.

When the groups had their final meeting several weeks before the end of the semester, they presented rough drafts of their plans. When they critiqued each other’s plans, they were all dismayed to realize that they had reduced the language issue to one of deficit, with all of their plans based on remedial instruction with just a token nod, if any, to the value of students’ home languages. Their minutes traced the circularity of some of the discussions, the research done, and the
struggle to design a policy and program which addressed the concerns raised by both of the readings, concerns that are operative now in our schools and work places. These students experienced collaborative problem solving as complicated, rich, frustrating and ongoing, and a challenge to capture in the composition of minutes.

From this experience, I was eager to bring in other real-life contexts for the remaining workplace writing assignments: a memo for calling a meeting (which I asked them to post online on the class discussion board); instructions for a process, at home or at work; and a proposal for a policy/program for their issue group. Actual workplace writing was the example used for identifying features of that genre of writing and for critiquing: a memo composed by one of the students at his work place; minutes from a meeting of the Communicating Across the Curriculum initiative at our campus; instructions I had composed for previous classes on how to join a class listserv; and the actual proposal I had written and had had approved for the construction of this course. All of these pieces of writing were presented contextually: Students read, critiqued and discussed the writing in light of the writing situations that produced them. This approach to studying and practicing workplace writing encapsulates what my students experienced in this dual-focused course. What became evident to me (and, I believe, to them) was that their learning resulted from the interweaving of work as practice and work as subject of inquiry.

My assessment of the efficacy of this course design relies on several sources: Mid-term written assessments of the class by the students, student retention/participation and work completion, end-of-term facilitated oral discussion of class, final course evaluations, and response to a presentation on course-related research at professional conference. Some of the specific comments offer insight into the feelings of the students about this experience.

**Mid-term written assessments of the class by the students**

- **Student expectations of English 111**
  - *a complete nightmare...I find it difficult to express ideas in words.*
  - *I assumed it would be more about the mechanics...I was relieved to find ...that it is more about viewing other ideas*
  - *boring and difficult*
  - *like a standard high school English course*

- **First reactions after learning the course would be based on the theme of work**
  - *I work 40+ hours/week and now I have to spend my free time writing about it*
  - *not worried; would have preferred a different theme; glad it wasn’t about sentence structure*
  - *I wasn’t sure how an English class could be based on work. I mean really you just go and put your time in and make your money and go home.*
• I felt more at ease, this is something I would be familiar with.
• I did not think I was going to have much to write about.

❖ Current thoughts about the work theme
• It's kinda cool. It has opened my eyes to the level of work that is above just the time clock.
• The way I see my job has changed. I no longer see it as just an occupation. Instead, I view it as a big portion of my life. I didn't realize, before, how big of an impact my job and co-workers made on me.
• I found...it was very difficult to break the pattern of work type writing. Matter of fact comes easier.
• There is a sense of being constricted in what there is to write about.
• I really don't care for it still. I would rather write on things I like and know.

❖ How composition processes used in class relate to current or future communicating or writing in the work place
• I am learning about the atmosphere at a work place...I'll know...how to deal with certain situations or topics in a work place.
• It has taught me that you always need an open line of communication at work, at home and in school.
• I feel more comfortable with written communication with customers especially. I have more confidence in the professionalism of my communication skills.
• I am actually writing more and having a clearer result. Thinking it out and maybe even creating an outline has helped.
• I think I've learned to be somewhat more observant and I hope it shows in my writing.

❖ How their views of work (their own, work in general, or some aspect) has been confirmed, questioned or changed since the beginning of the semester
• I feel like before I just used to do what needed to be done and nothing more.
• I think I realized that everyone has problems with their jobs and how it affects their home life.
• I do seem to notice more of the interactions with the people around me...I can pick out my view of work in the things others do and see and also in the stories...
• I have a lot of respect for my company and really enjoy my job. I am proud to be affiliated with my company and that reality was confirmed through my writing.
• I think I have learned to look at things in a more open-minded manner. I try a little harder to...see the other person's point of view.
• Some of the reading assignments have made me realize life in the work place a little better. I try and understand minorities and women, for example, on their points of view and not on mine alone.

Student retention, participation, and work completed

Of the twenty students enrolled through the first four weeks of the class, eighteen completed the course. In my experience, this is an excellent retention rate for a class that meets once weekly at night. By far the majority of these students were employed full-time outside of the home and most would be considered non-traditional students. “Completing the class” in this case means that the student turned in all required work and earned at least a C- grade, with one lower grade exception. Eleven of these eighteen students earned an A or A- in participation, with four more earning Bs. These overall high participation grades reflect the intense involvement in and commitment to the class processes. One student reported that this was the first English class in which she had ever written all of the required essays.

End-of-term student-facilitated oral discussion of class

Students had the option of making an oral presentation to the class on a work-related subject of their choice for part of their grade. One student asked to facilitate a discussion on the perceived learning of the students in this class. Highlights from that discussion follow:

• Many students appreciated the final speaker, a personnel consultant who presented the Renewal Cycle, a cyclical model for career development from the Hudson Institute, allowing participants to locate their current location in the schemata and the related steps they might take to move to a more empowered position.

• A number of students viewed themselves as being in the doldrums. The general feedback, though, was that they now felt they had tools for learning and growth, they now felt “empowered,” that one could “change [his/her] life.”

• “I felt like I was reading about myself.” (numerous “me, too’s” echoed this speaker.)

• Students found that those outside the classroom community often couldn’t understand the importance of and opportunity for questioning that class readings and processes offered.

• Most professed to have originally thought that they “went to work for money.” Now they saw their motivations and experiences as more complicated.
• The youngest person in the class (at 17) remarked how she appreciated learning from everybody else. Several students had shared their work with their parents and found that their words touched them, “made them cry.”

Final course evaluations

Overall course evaluations were among the highest I’ve ever received. Specific comments address some of the innovative design of the course:

• The topic was excellent . . .theme-related course was interesting, insightful and a nice change of pace from traditional classes.
• Some of the readings [Ms. Wahlrab] chose were difficult but I feel it gave me a higher awareness of not just my work but work in other countries.
• The guest speakers were a good addition to the course.
• I learned a lot about writing and a lot about other people through the sharing of writing
• [The class] made me look at myself more closely and make some important decisions about my life.
I believe that student comprehension of marketing research concepts and data analysis techniques can be demonstrably improved through the use of team-based research projects performed for real, external clients. Within the scope of such projects, designing and applying marketing research databases that are capable of handling large volumes of survey questionnaire data is generally the most difficult task that students face. Team members must collaborate closely on this portion of the work in order to manage raw data efficiently and generate meaningful conclusions for the client. Based on this conviction, I began a project to implement novel methods of research project data analysis in several undergraduate marketing courses.

Project Design

The project includes two phases. In the first phase, students learn the basics of database design using a common spreadsheet program. In the second phase, students will use commercially-available survey analysis software to gain an appreciation for the different methods of data analysis and report generation commonly employed on major survey projects. Practical applications are drawn from research projects conducted with local government agencies. In work conducted to date, student reaction to Phase One activities has been positive. Phase Two activities are developed but have not yet been used in the classroom.

Undergraduate marketing students like hands-on projects. Incorporating real world surveys and other research projects into the curriculum invariably generates strong positive feedback from students who see such projects as being representative of what they may be asked to do once they have left the university and entered a career setting. Mastering the subtleties of marketing research survey design, database construction, data analysis and report generation is, however, difficult to achieve within a one-semester survey course such as Introduction to Marketing, BTE 105, without unduly compromising other aspects of the course curriculum.
The present work focuses on how to maximize the learning from outside research projects while keeping the amount of actual classroom lecture time spent on this topic to an appropriate portion of the course timeline. Novel learner-centered curriculum modules expose students to the process of survey database design and analysis in an interactive teamwork setting. As the teams work to prepare for the data analysis steps involved in large, external-client projects, new computer database management skills are developed. Initial modules rely on familiar software tools that students are encouraged to apply in a new way. Later, more sophisticated modules will incorporate custom database applications and focus more on the statistical analysis side of survey research. In each case, students manage their own learning in order to meet or exceed their clients' project expectations. The instructor acts as a coach, offering encouragement and technical suggestions when unforeseen difficulties arise.

The current plan is to limit the Spring 2001 semester classes to only Phase One modules so as to debug any difficulties in the application of the new database design requirements. Based on a successful implementation and optimization of these modules, the Phase Two modules will be incorporated into the curriculum during subsequent semesters.

**Phase One**

Phase One modules use the spreadsheet software package Excel to generate survey analysis databases for external research projects. Student teams, typically numbering three to four individuals, select a research project involving a survey questionnaire that has already been placed "in the field" for an external client. Typical questionnaires include a variety of question types such as multiple choice, ranking, single answer and open-ended that make the development of a spreadsheet-style database challenging. Through survey research guidelines and a prototype spreadsheet supplied by the instructor, the student teams design a data analysis approach to handle questionnaire responses. Once team members are satisfied with the structure of their approach and comfortable with the workings of the furnished spreadsheet, entry of data from the returned questionnaires may begin. Following the data entry portion of the work, the instructor is consulted again about appropriate data analyses and reports.

**Phase Two**

Phase Two modules will use the commercial survey database software SumQuest from SumQuest, Inc. SumQuest is a user-friendly, self-contained database application that is tailored to the tabulation and analysis of sophisticated survey research questionnaires. When these modules are used in the marketing classes, students will have the opportunity to compare and contrast their own efforts in Excel with the automated features of SumQuest. In the latter package, students will construct their own personalized databases by simply typing in the questions from
the appropriate survey questionnaire. SumQuest will create all of the required data tables in the background and then handle statistical break-outs of the data as requested by the students. The Phase Two modules will, thus, allow students to experiment to a greater degree with the statistical side of survey data analysis and gain additional experience in drawing relevant conclusions from the data.

On a technical note, it is important to state that a stepwise roll out of Phase One and Phase Two modules is necessary in order for students to gain a true appreciation for the sophisticated analyses conducted invisibly within the SumQuest software package. Only by experiencing the positives and negatives of database management tools through Excel or another similar spreadsheet program will students understand the data manipulations that SumQuest undertakes in order to generate statistically-meaningful survey results.

Student Response

Student response to the Phase One modules has been positive across three marketing classes during the Spring 2001 semester. Ninety percent of the Marketing students responding to a survey found the databases to be useful to the projects conducted during the semester. Eighty percent indicate that the course should include this type of database work on a routine basis. Students have taken the work extremely seriously because they see the database design and implementation work as being critical to the success of the entire research process. Currently, teams are beginning to enter the actual survey data and are experiencing both the positives of a well-designed database and the negatives associated with the limited statistical analysis and text-handling capabilities of Excel.

Student-to-student interactions are significantly enhanced in the real project teamwork setting used versus that typically observed in a traditional lecture-based marketing course. Similarly, comprehension of the marketing research concepts employed is enhanced because students take the real world experience as being of greater value to them over the long run. An overwhelming majority of the students view their external research projects as true jobs, with all of the associated responsibilities to the client. The seriousness of this approach generates an entirely new level of student-based inquiries into the theory and practice of marketing research. Due to the complexity of the typical projects used and the relatively short time frame of a one-semester class, students must be not only proactive but also extremely efficient in completing their work. Noting that their clients are counting on the results of the research to make real-world business decisions, the students are careful not to drop the ball.
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