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Selection Framework for Electronic Training tools in Post-secondary Blended Learning Environments.

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ABSTRACT

Industry is spending a great deal of time and effort evaluating & implementing e-learning tools. Fundamental computer/software skills are now an implied requirement for new university graduates. How can universities leverage e-learning tools and incorporate them into the traditional class room environment? This paper proposes a framework for the comparison and selection of e-learning tools for use in blended learning environments. This framework reinforces the use of pedagogical perspectives in lab tool selection. By comparing qualitative results, a best fit can be provided based on the 7 principles of undergraduate education, perceptive learning styles and Bloom's taxonomy.

INTRODUCTION

The ubiquitous desktop computer provides end users with access to a number of productivity tools. E-mail, word processing, spreadsheets and presentation software are as common today as pen, paper and phones were 25 years ago. These software tools have become the mainstay of day-to-day business communications (if not day-to-day social interactions); as such, the proper training for these tools has risen in importance. Often referring to proficiency with these tools as computer literacy, organizations have spent a great deal of time and effort to ensure that their employees can effectively utilize and leverage these software tools. In many cases, technology is used to provide training to students at 'remote' locations. This approach is referred to as e-learning. E-learning enables employees to gain new skills without the cost and inconvenience of traditional training environments. Industry appears to see value in this training approach, as evidenced by the estimates that the world market for e-learning will exceed 52.6 billion by 2010 (Jones, 2007).

To help mitigate their out-of-pocket expenses, companies now expect "new hires" to have basic computer literacy. Many educational institutions have incorporated productivity software training into their curriculums. However, new college students are not as computer literate as many would believe (Kline & Strickland, 2004). Since industry sees value in e-learning, it behooves academia to leverage these tools to meet this need for training.

A great deal of literature exists for the evaluation and implementation of e-learning strategies in industry, but it appears that little has been written on the tool selection process for blended learning environments. A framework is needed to help identify, review and compare tool functionality & capability for use in an academic environment. This paper will propose such a framework for use in the selection process of an e-learning tool. Although this framework was originally targeted toward a specific University's selection of an e-learning tool for their introductory course in Business Computing, this research should be applicable to any lab-based blended learning environment.

The motivation for this research is based on the periodic need for educators to select teaching and training tools for their courses. Personal observation indicates that tool selection is often a secondary consideration for the course. Often thrust upon the instructor, this selection can fail to consider the pedagogical needs of the students and the instructor. The incorporation of blended learning tools into a course, can occur in a variety of ways; for simplicities sake, in this paper the blended learning activities will be discussed in the context of a 'lab' associated with the course. This approach is realistic, and provides a clean delineator between the blended and traditional class room environments.

First, a review of existing literature will be made to provide basic definitions and identify the environment in which training tools will need to operate. Second, an analysis of course objectives and content will be made. Third, a model will be presented and an evaluation framework will be built. A summary and conclusion will then be provided.

LITERATURE REVIEW

Definitions

In order to define blended learning, it is necessary to first define e-learning. Pseudonyms for e-learning include online-learning, web-learning, distance learning, etc… Regardless of the term used, e-learning is the use of computer and communications technologies to deliver course content & materials across distances (Bilalis, Dalivigas, Antoniadis, Athanaski-Michalidou 2002). However, the distance need not be especially great; from an e-learning perspective, cross-campus and cross-state pose similar issues. A number of characteristics distinguish e-learning courses from the traditional classroom/training room courses.

First, e-learning is student-centric. As opposed to a traditional lecture environment, course material is provided in such a manner as to allow the student to select the time, pacing and setting to receive/absorb the content. Second, as the definition implies, technology is utilized to provide the communications and the delivery of the course content. Third, traditional face-to-face interaction with the instructor is reduced; instead other forms of individual communication are used (Bilalis et al. 2002). The student is obliged to take a more direct approach and show more initiative in their course communications. Rather than leveraging other student's questions in a lecture hall, the student must proactively seek the needed information.

Blended learning is a hybrid of e-learning and traditional lecture-based course techniques (Cappel and Smart, 2005). Certain portions of the course content are delivered utilizing e-learning tools and techniques, but the instructor/student relationship is more structured and explicit. This allows for e-learning benefits to be realized while still providing students with appropriate support and guidance.

Lab Environment

As is the case with many introductory courses in Business Computing, skill-based activities are usually addressed in lab settings. Labs are an informal environment in which students can investigate, review, and reinforce newly presented/acquired skills. In some cases, lab time may be explicitly scheduled. Other situations may call for labs to be scheduled ad-hoc, based on the course pace and the instructor's observations of the students.

An explicit lab can be seen as a formal extension of the course; as such, certain principles are expected in its implementation and operation. By association, any tools selected for the lab should support those principles (or at the very least, not impede them). A brief list of principles common in undergraduate education is provided by Chickering and Gamson. Although they appear to be derived from ‘common sense’, the proper application and adherence of these seven principles will improve the quality, content and delivery of undergraduate courses (Chickering and Gamson, 1987, 2005). In the following list, comments specific to lab settings have been added:

- Encourage contact between students and instructors: Student commitment to the course and their overall education is improved when both parties engage in sincere communication. This contact allows students to practice communications skills needed for future careers. Since labs are typically informal, this interaction is easier to initiate. If different instructors are involved in teaching the same class, it is important that both are equally available to students.

- Encourage cooperation among students: Collaboration between students is preferred over competition. Helping one another provides varying perspectives on the task-at-hand, and allows new ideas to be investigated. Reconciling the course content with different perspectives allows for a better appreciation of the subject. This is easily accomplished in a lab setting.

- Encourage active learning: Passive participation in class limits the quality of the information being presented. Activities that force the information to be reviewed and repeated allow for better recall later. On the surface, the variety of activities in a technology lab setting can appear to be limited to simply interfacing with computer keyboards and mice, yet variations in the assignment itself can provide sufficient activities to reinforce the lesson objective.

- Give prompt feedback: It is important for students to receive some sort of indication to know whether they have or have not understood a particular topic. Without this feedback, the activities mentioned above will only reinforce partial or incorrect information. Prompt feedback allows students to adjust their learning behaviors to improve their understanding. For small class sizes, this is easily accomplished in lab. However, in large classes, ‘instructor only’ feedback will be difficult. Other feedback options may be required.

- Emphasize time on task: Setting time requirements for course deliverables provide students with practical exercises to explore and develop important task and time management skills. Since labs are geared towards specific task completion, this can be easily satisfied.

- Communicate high expectations: Setting high standards of achievement forces students to invest the energy needed to accomplish the given task (and the eventual course completion requirements). It is the students’ responsibility to achieve the standards, and it is the instructors’ responsibility to communicate the standards and assess them accordingly. In a lab environment, assignments should not be considered ‘busy work’. All activities should support the course material and should force the student to stretch their knowledge to adequately address the need.

- Respect diverse talents and learning styles: All students do not learn material in the same way. It is important to understand the strengths and weaknesses of differing learning styles and provide students with a course environment that accommodates these different approaches. This can be a challenge in a lab environment, since activities are task-based; special consideration is needed for learning styles that derive less benefit from ‘hands-on’ activities.

(Chickering and Gamson 1987, 2005)

This last point merits a more detailed discussion. How students absorb, interpret, review and organize information is referred to as their learning style. Research has provided a great many different learning style models; some are extremely complex, others are relatively straightforward. Regardless of the model used, it is important to incorporate the understanding it provides into the course (Davis, 2001). For purposes of this paper, a 3-category perception based model will be used.

People perceive their environment using the 5 senses, which can be loosely grouped into three categories (visual, auditory and tactual). Individuals will use all three categories during learning, but will usually prefer one to the others (Golubtchik, 2005a). Visual Learners use images (size, color, location, etc…) to help process information; in other words, "I see it". Auditory Learners use words and sounds (pitch, volume, tone, etc) to help key in on pertinent information; "I hear it". Kinesthetic Learners (tactual) use movement and feelings to process information; "Let me do it" (Golubtchik, 2005b; Csapo 2004).

Not only do different learning styles affect how information is delivered and processed by the student, it can also affect how well students perform when assessments are conducted. Visual learners prefer written tests; auditory learners may do better with oral exams and class discussions. Kinesthetic learners prefer projects and demonstrations (Csapo, 2004). Although learning styles are only explicitly mentioned in the last principle, it is reasonable to assume that they play a large part in all 7 principles. Ensuring that these three learning styles are adequately supported across all 7 principles is very important to a lab's success.

Lab Objectives

The objectives of the course spell out the skills and understanding that is expected of the student upon successful completion. Assessments (exams, quizzes, projects, etc…) are used to determine that the objectives of the course have been satisfied; however, assessments are NOT the objective of the course. Bloom's (1956) seminal taxonomy of educational objectives has long provided a frame work for assessing student cognition. It is well established and well respected by educators (Crone-Todd, D. E., and Pear, 2001; Lovell-Troy, 1989) Bloom's six basic educational objectives can be used to validate the course objectives. Recent revisions to the taxonomy have more explicitly addressed the various forms of knowledge. However, instead of a single list of objects, Bloom's revised taxonomy is a matrix that qualifies these cognitive process dimensions with four knowledge dimensions. This matrix allows for the distinction of the knowledge type when addressing each of the six dimensions (Anderson et al. 2001). The knowledge dimension includes:

- Factual: the fundamental elements of any construct. This defines the vocabulary necessary for discussing the construct. It also includes specific detailed knowledge necessary to circumscribe the elements for a construct.
- Conceptual: the interactions of the fundamental elements and how they relate to the overall construct. This may include principles, theories or models as well as the ability to classify the elements and constructs.
- Procedural: the ability to use the elements or constructs to accomplish a specific task. This is the knowledge of specific skills, techniques and criteria to properly to complete a given procedure.
- Meta-cognitive: the understanding of cognition and the awareness and the awareness of their ability to use the varied knowledge they posses. It is the understanding of the knowledge they posses and the ability to use it strategically.

The six cognitive process dimensions are similar to blooms original list, they are:

- Remember: the ability to recall specific detailed information. This can range from terminology knowledge (in the case of factual knowledge) to strategic knowledge (in the case of meta-cognitive knowledge)
- Understand: the ability to comprehend the knowledge. The student should be able to explain what the terminology or theory actually means (as opposed to reciting the memorized definition).
- Apply: ability to use of the knowledge (and implied comprehension). The student should be able to use the terminology or theory correctly.
- Analyze: ability to review the applied knowledge. Students should be able to review their use of the knowledge and identify the terminology/theory components that could change the outcome.
- Evaluate: This addresses the ability to compare and critique the knowledge with other sources. Students should be able to judge the value of the terminology or theory.
- Create: This addresses the ability to relate multiple pieces of knowledge and create 'new' knowledge. Students should be able to combine the terminology or theories to postulate new versions.

(Anderson and Krathwohl, 2001)

When viewed as a matrix the intersection of the four knowledge dimensions and the six cognitive process dimensions identify a specific type of cognitive comprehension of a given set of knowledge.

In summary, Blooms Taxonomy and Chickering and Gamson's principles of undergraduate education are well known and respected frameworks for pedagogical discussions and requirements. Whether the pedagogical needs are satisfied by traditional class room settings, or by electronic media, the use of these frameworks is appropriate. We use Blooms' revised taxonomy to describe the end objectives of a course: What we want the students to gain from the educational experience. Chickering and Gamson (1987, 2005) identify the factors that help to best deliver that educational experience to the student. Understanding the students learning style provides the context needed by educators to actually deliver the educational experience. While these perspectives are important in any course environment, they can be leveraged to help evaluate the educational merits of e-learning technology.

COMBINED MODEL

Bloom's taxonomy, the 7 principles of undergraduate education, and understanding of a students learning style, can be combined into a simple schematic that outlines their relationship to one another (figure 1). The 7 Principles of undergraduate education and the 3 learning styles are combined to form the portion of the framework that encompasses the lab environment. As mentioned, learning styles influence how the 7 principles are manifested in the lab. The resultant actions are used to convey the course material to the student and achieve the lab objectives as categorized by Bloom's taxonomy. Any e-learning tools selected for the lab must be complementary to these 3 components.

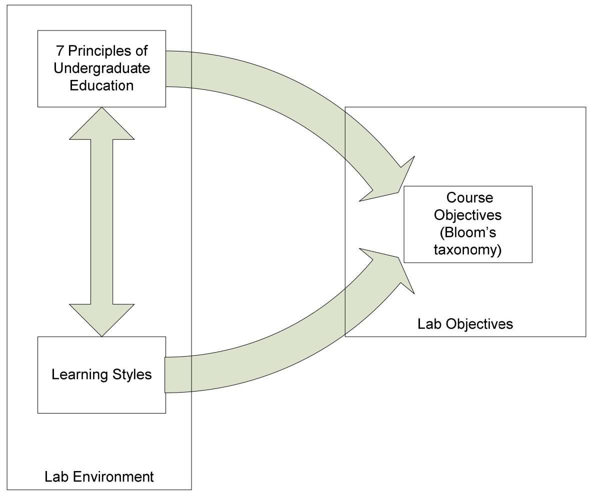

Figure 1. Relationship of learning styles, the 7 principles of undergraduate education and Bloom's taxonomy.

Explicit Requirements

For an introductory course in Business Computing, the lab content requirements are spelled out in the master-syllabus. In addition to detailing basic information such as course description, prerequisites, textbooks and the like, the master-syllabus outlines the course objectives. Using an example from a large mid-west university (see appendix A), one can see that for a typical introductory course, 6 of the 12 course objectives can be linked (at least in part) to the students' lab activities. Four of the objectives (#2, 3, 4 & 5) are generic and provide little detail as to the content to be addressed by the lab, but they do provide context for the remaining two objectives. Objective #8 outlines the productivity software to be incorporated into the course/lab. Objective #9 provides a broad overview of how the software can be incorporated via assignments.

The master-syllabus will identify the course objectives, but may or may not identify the detailed content to be delivered. Understanding the explicit functionality that is to be taught is fundamental to the tool selection. Experience has shown that evaluating e-learning tools requires a definitive checklist of functionality. All too often, delivery of the functionality overshadows the functionality itself; without a formal checklist, important functional requirements may be lost.

Incorporating Lessons Learned Through Experience

The last and perhaps most practical set of requirements come from anecdotal evidence provided by the e-learning tool users, both students and instructors. They are the audience that both purchases and uses the e-learning training tool. Their casual comments can highlight a number of potential requirements unrelated to the pedagogical components already discussed. Although space constraints prevent a detailed description, experience has shown that there are five important user requirement categories.

The first category is content. Student users want e-learning tools that focus on the requirements of the course, or the skills necessary to complete it. Extra functionality that is not relevant to the course may frustrate students. They feel that they've paid for something they are not using. 'Thin', or poorly documented content may also frustrate users. Specifying a tool, then delivering essential content via alternate methods will likely give students cause to question the capabilities and value of the e-learning tool.

The second category is technology. Assuming that the e-learning tools can be loaded onto the students' personal computers, there will be great deal of interest in the hardware and software requirements of the tool. There will also be an expectation of technical support for the tool, likely in the form of helpdesk support, software maintenance, concurrent usage, and the like.

Third, the quality of the tool is important to student-users. Response time, usefulness of reference materials, and quality of resources created using the tool (such as exams); all need to be taken into consideration. Instructor-users are equally concerned with quality. Reliable and consistent functionality is a fundamental assumption of any e-learning/training tool.

Fourth, the pedagogy needs of the instructor must be satisfied. The ability to deliver the course material via the tool is very important. Reporting capabilities (for homework or exams), and support for the various learning styles are just a few examples from this category.

The last category is cost. Both instructors and students are sensitive to the cost of software-learning tools. Any tool selection process must adequately work this (and the previous four) lessons learned into their selection methodology.

These existing course requirements (both from the master-syllabus, and from user observations of the tools themselves) can be incorporated into the lab environment as identified in figure 1. Figure 2 shows the addition of a training tool component that leverages both the 7 principles of undergraduate education and the 3 cognitive learning styles. The recursive arrow on the training tool indicates that the tool and the content it represents should be continually reviewed against itself. New functionality and/or content needs to be properly reviewed and reincorporated. Also important is a feedback loop that allows the 'results' (based on the objectives) to be compared with the tools and techniques used to achieve them.

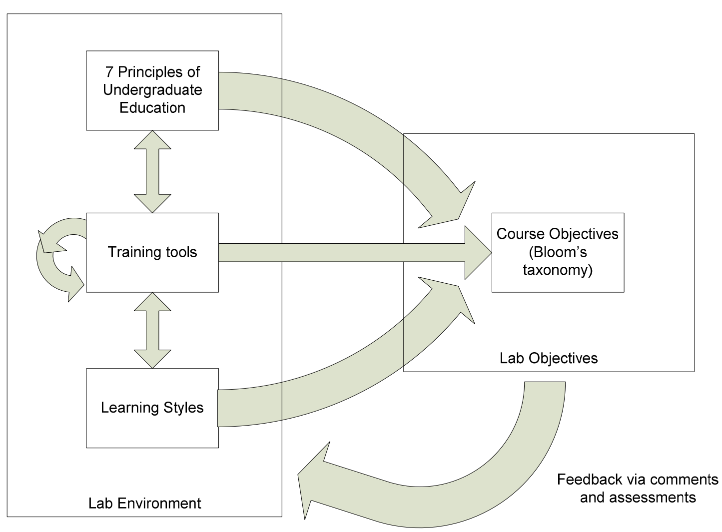

Figure 2. Addition of training tools to the overall process.

FRAMEWORK

A framework can now be constructed that addresses all of the perspectives shown in figure 2. Tool selection can be seen as similar to a candidate systems selection process that is normally performed during the feasibility analysis of a systems implementation. Although the criteria are different, this selection approach can be used when selecting training tools. Indeed, large-scale implementations of such tools should be treated as a true systems implementation.

Assumptions

Before identifying the e-learning tool criteria, a few assumptions must be made. First, although an e-learning tool is desired to provide training of skills, the labs are blended learning environments (conducted in a classroom setting). For a lab, 'distance' is not a factor in the training, but remote access is. The ability for students to access the e-learning tool outside of the classroom is critical for the completion of assignments. Second, it is preferred to assess student achievement by using the actual productivity software being trained, not via simulation (this assumes that the simulation is unable to provide 100% emulation of the productivity software). Third, collaboration (via group assignments) is not a primary requirement for a typical lab setting. Although listed as 1 of our 7 principles, assignments in most e-learning courses are intended to be completed by each individual student. Lastly, the training tool is not intended to be the only source of training. It is expected that the lab instructor will: 1) monitor the training tool to ensure it is working correctly; 2) reconcile student questions between any simulations and the actual training tool; 3) review all assessments to ensure students are receiving the proper grades from the tool; 4) augment the training tool where and when needed.

Criteria List

The list of criteria used to evaluate the training tool candidates is simply a detailed listing of the figure 2 components. Thirteen criteria are identified; they solicit qualitative input as to how the e-learning tool addresses the given criterion. No explicit weighting of the criteria is provided. Although some will be more important than others, this relative value will be influenced by a number of factors external to the selection list. For this reason all criteria are treated equally.

The 7 principles of undergraduate education make up the first 7 criteria; these address the learning environment. The 3 learning styles are used to augment the 7th criterion (respect diverse talents and learning styles). The 8th criterion is the identification of the supported dimension(s) from Bloom's taxonomy. The remaining 5 criteria address the functional objectives of the selection process and are made up of the 5 training tool satisfaction categories derived from the lessons learned from users. Each tool needs to be reviewed using the 13 criteria as context. A comparison between the tools themselves can be difficult. By ranking the tools against the category criterion, a more impartial comparison of the tools can be made.

Appendix B provides a criteria comparison worksheet. For each criterion, an assessment is made for each targeted e-learning tool. The tool that best addresses that specific criterion is identified. The reconciliation of the different criteria can be complicated based on the particular needs of the course. This framework does not select the 'winning' e-learning tool; it simply identifies the criteria needed in the selection process.

The model and criteria list are not intended to provide an all-encompassing theory or toolkit in technology selection for blended learning environments. Instead, it is intended to provide insight into the various needs of students and educators. This paper positions this need around a lab environment; however, the model can be used for most educational needs. This perspective is especially valuable to new faculty facing their first forays into course management.

LIMITATIONS

The legitimacy of Bloom's taxonomy and of Chickering & Gamson's 7 principles is well established. However, the anecdotal identification of the lessons learned, while logical and relevant, lacks the rigor necessary to cement their use in our framework. Research is needed to better understand the user requirements of e-learning tools (independent of the pedagogical needs).

SUMMARY/CONCLUSION

Office productivity software skills are now a minimum requirement in business. E-learning tools and techniques are often used to satisfy the training needs for these software skills. Educational institutions are now providing this training. Therefore, the need for a method to compare and select the most effective e-learning tools for a specific purpose is significant. Very little literature exists on how training tools should be selected for academic environments.

A selection criteria framework was proposed based on the 7 principles of undergraduate education, 3 categories of perceptive learning styles, the 6 dimensions of Bloom's taxonomy and the 5 satisfaction categories based on lessons learned. This framework allows for the qualitative evaluation of e-learning tools using these 13 items, and enables a consistent benchmark of e-learning tools against specific tool performance expectations.

E-learning tools can be easily incorporated into lab environments. This blended learning approach provides students with self-paced content that they can absorb using the learning styles they feel most comfortable with. Students not only receive the training necessary for their education, but they can also use the skills and understanding they've developed to use e-learning tools in their future careers. E-learning will not stop at graduation.

APPENDIX A

Master Syllabus Course Objectives for a Business Computing course at a large mid-western university. Objectives pertinent to lab content are indicated in **large bold text.**

1. Learn some of the societal benefits and consequences of computers and the more recent microelectronic and microprocessor revolution.
2. **Be exposed to technical, practical and philosophical ideas that they can use in future activities involving computers**
3. **Become computer literate.**
4. **Learn how to use the computer as a tool and as a social force**
5. **Complete software and computer applications in the world of work with emphasis on those that have had significant societal impact.**
6. Examine questions of violations of individual privacy, social impacts and evolving future problems and issues.
7. Learn the positive and beneficial aspects for society of the computer revolution as well as some of the danger areas abuses and vulnerabilities created by the increasingly and pervasive use of computers.
8. **Be introduced to disk operating systems (windows) and "productivity software" by completing several assignments (windows, word processing, spreadsheets, graphics and database) utilizing the IBM Personal Computer or compatible systems.**
9. **Improve his/her writing through assignments using word processing to complete an analysis/synopsis of productivity software projects, article reviews, written case analyses, quizzes and essay questions on examinations.**
10. Discuss computer issues from a multi-developing viewpoint.
11. Explore the impact of the computer on human events and social installation.
12. Examine integrative approaches and exploration of values upon which alternative views of computers are based.

(Smart, 2003; Page 2.)

APPENDIX B

Criteria	Tool 1	Tool 2	Tool 3
Lab Environment (how can the tool support …) 1) Encourage contact between students and faculty			
2) Encourage cooperation among students			
3) Encourages Active Learning			
4) Provides prompt feedback			
5) Emphasize time on task			
6) Communicates high expectations			
7) Which learning styles are supported ❖ Visual ❖ Auditory ❖ Kinesthetic			
8) Which cognitive dimensions of Blooms taxonomy are supported? ❖ Remember ❖ Understand ❖ Apply ❖ Analyze ❖ Evaluate ❖ Create Which knowledge dimensions of Blooms taxonomy are supported? ❖ Factual ❖ Conceptual ❖ Procedural ❖ Meta-cognitive			
Functional objectives (what does the tool do …) 9) Content			
10) Technological			
11) Quality			
12) Pedagogy			
13) Cost			

References:

Anderson, L.W., Krathwohl, D.R. (ed) (2001). A Taxonomy for Learning, Teaching and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives. Longman. New York.

Bilalis, N.; Dalivigas, A.; Antoniadis, A.; Athanaski-Michalidou, C.; (2002). A methodology for evaluating software tools for the development of e-learning systems. International Conference on Engineering Education, August 2002, Manchester UK.

Bloom, B.S. (ed) (1956). Taxonomy of educational objectives: the classification of educational goals, by a committee of college and university examiners. Vol 1. D. McKay Co. New York.

Cappel J.; Smart K. (2005). A Comparative Study of Students' Perceptions of Blended Learning, unpublished manuscript.

Chickering, A.W.; Gamson Z.F. (1987). Seven Principles for Good Practice in Undergraduate Education AAHE Bulletin. March 1987, pp 3-7.

Chickering, A.W.; Gamson Z.F. (2005). Seven Principles for Good Practice in Undergraduate Education. Available at: honolulu.hawaii.edu/intranet/committees/FacDevCom/Guidebk/teachtip/7princip.htm, Last Accessed May 4th, 2005.

Crone-Todd, D. E., Pear, J. J. (2001). Application of Bloom's Taxonomy to PSI. Behavior Analyst Today, 3(2), 204 – 210.

Csapo, N. (2004). Understanding the Learner: Bridging the Gap between Students and Faculty in the Classroom, BIS 620 Lecture Material. Central Michigan University, Spring 2004.

Davis, B.G. (2001). Tools for Teaching, San Francisco, Jossey-Bass, p185.

Golubtchik, B. (2005a) Recognizing Learning Styles. Available at: teachersnetwork.org/ntol/howto/adjust/c13473,.htm (May 4).

Golubtchik, B. (2005b). Create a Multisensory Classroom, Available at: teachersnetwork.org/ntol/howto/energize/c13472,.htm (May 4).

Jones, K. C. (2007). Worldwide E-Learning To Draw Nearly $53 Billion By 2010, InformationWeek, Available at: http://www.informationweek.com/news/internet/showArticle.jhtml?articleID=201311139 (February 12).

Kline, D.I.; Strickland, T.J. (2004). Skill Level Assessment and multi-section standardization for the introductory Microcomputer applications Course. Issues in Information Systems, October 2004 (V,2) pp. 572-578.

Lovell-Troy, L. A. (1989). Teaching Techniques for Instructional Goals: A Partial Review of the Literature. Teaching Sociology, 17(1), 28-37.

Smart, K. (2003). Master Syllabus for BIS 104. Computers and Society, BIS Department, Central Michigan University, March 2003.