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Editorial

The Universal Interface

Donald G. Perrin

Mainframe computers revolutionized business by its incredible power to process, store, and retrieve information. Its strength, and its weakness, was its ability to share the power of one computer between hundreds of users. As more and more users were added, service deteriorated.

Then came the Personal Computer. Each user had his or her own processor and storage for programs and data. PCs became fast, powerful and affordable, even for small business and individuals. Windows made software friendly and easy to use.

Next came the Internet. The World Wide Web made the Internet easy to use and accessible to everyone who could use a computer. It opened up vast stores of news and information, powerful search engines, and instant communications. It had global impact. It toppled governments and leveled the playing field for the new global economy.

Transformations continue. The software that resides on your computer is being replaced by internet-based services that work through any browser. Names that ushered in the PC like Microsoft are being challenged by Internet giants like Google. For the user, this may be a perfect storm as the major players compete for our attention and our business.

These same forces are working within education. Distance learning technologies have global reach. As leading players compete, higher benchmarks are achieved for academic quality and learner services. Globalization promises to level the playing field with increasingly higher standards as academic giants emerge and compete. Some have already positioned themselves, like the Open University in Great Britain setting higher levels for quality and services, and the Massachusetts Institute of Technology by sharing its entire curriculum with the world – for free.

In globalization, we need to grapple with old challenges in a new and more urgent way, like interfacing communications, business, and education with countries that have language, social, cultural, and economic differences. Education is already researching these areas as demonstrated by articles in this issue of the Journal.

Editor's Note: This study is significant for its global implications. It demonstrates how technology can better prepare students for the global environment through communication with persons from different cultures.

Using Interactive Videoconferencing Technology for International Education: The Case of ISIS

Mimi Miyoung Lee, Deborah S. Hutton

USA

Abstract

Interactive videoconferencing technology provides a convenient way to connect rural classrooms with speakers from remote locations. In this paper, a case study of such a videoconferencing program offered by a university is discussed. International Studies In Schools (ISIS) was designed to support international education for rural learning environments in Indiana and has been successfully implemented in many classrooms statewide. In the first part of this article, the history and programs of ISIS are presented as well as the guiding theories behind it. Based on results of a case study, the second half of the paper provides suggestions for future implementation of the ISIS program in rural learning environments.

Introduction

There is no mistaking that we live in a global world. Emerging technologies today offer multicultural educational events that can foster shared understanding, dignity, respect, and the exchange of highly current and intriguing information (Rasmussen, Nichols, & Ferguson, 2006). With technologies such as blogging, podcasting, wikis, videoconferencing, and chat, content can be presented that is not typically part of the curriculum or that may take years to find its way into textbooks (Beldarrain, 2006). At the same time, meaningful conversations can transpire among people who will likely never meet physically. It is clear that the opportunities for global sharing, collaboration, apprenticeship, and mentoring are expanding.

Aa this plethora of collaborative technologies have emerged, so too have pleas for global awareness and understanding. Fortunately, technologies such as videoconferencing can bring current topics in the news directly into the classroom for discussion, debate, and reflection. With videoconferencing, students can become aware of worldviews different from those in their communities; including specific struggles, successes, and life experiences of a particular person or group of people. Before and after such videoconferencing events, students might use other educational technologies to gather data and further understand and interact about that culture or topic. Researchers have noted that the benefits of online collaboration with technologies such email, chat, asynchronous conferencing, and videoconferencing include greater perspective taking, critical thinking, task engagement, and overall sensitivity to cultural differences (Bonk, Appelman, & Hay, 1996; Merryfield, 2003). As Merryfield (2007) states, "By introducing students to diverse people within a country, a teacher can help students learn to appreciate complexity within cultures and the dynamics of how cultures change" (p. 270).

For the past twelve years, Indiana University has been a leader in addressing such global awareness issues through a program called "International Studies In Schools" or ISIS. ISIS is a video distance-learning (VDL) program that uses interactive video (IAV) technology to connect K-16 student and community groups in Indiana and other states with international students, scholars, and specialists at Indiana University (IU). ISIS brings IU's international studies specialists out of academe's 'ivory tower' into public and undergraduate classrooms in surrounding rural communities. ISIS also works with another IU project called the Global

Interactive Academic NeTwork (GIANT) to bring speakers from around the world, via IAV, into direct contact with IU undergraduate students.

One reason ISIS came about is that Indiana experienced a sharp increase in numbers of immigrants starting in late 90s, especially in smaller communities that were traditionally considered racially and ethnically homogeneous. In light of such changes in population demographics, educators felt the need to bring international and multicultural issues close to home in their classrooms, especially in rural areas. In this regard, one effective way of bringing the world to students is interactive videoconferencing technology. Videoconferencing technology is relatively simple to use, yet highly effective when appropriately integrated into the curriculum. The interactive and synchronous nature of the technology makes it especially useful in teaching about different cultures as the technology enables real-time interaction. Using this technology, a video image of the speaker is received on the classroom television monitor while the speaker talks about his or her country and culture. Importantly, the students can engage in direct interaction with the speaker during the presentation.

International Studies In Schools (ISIS)

History of ISIS

The International Studies In Schools (ISIS) program originated in 1995 as a joint endeavor of Indiana University's Office of International Programs and the Center for Excellence in Education (CEE[1]), with the support of a two-year Content Providers' start-up grant from the Corporation for Educational Communications (CEC). The continuation and expansion of ISIS through 1997-1999 was made possible with the combined support of an International Awareness Grant from the Indiana Humanities Council and Office of International Programs, world area studies centers at Indiana University (IU)[2], and the IU Center of Research on Learning and Technology. IU continues to support ISIS with funding, presenters, and staff. The world area studies centers provide presenters for requested programs, as well as the materials to support each program. Indiana University contributes its entire IAV technology support personnel and systems, including paying for the line charges when used by *Vision Athena* described below.

How It Works

ISIS was designed for the purpose of providing learners with access to other cultures through live interaction with people from those cultures or experts on topics of global significance. This innovative international outreach program is primarily realized by means of *Vision Athena*.

Vision Athena is an interactive video project of Center for Interactive Learning and Collaboration (CILC); a nonprofit corporation established to enhance education throughout the state through the use of evolving communications technologies. ISIS uses two-way IAV technology through fiber optic lines and Internet Protocol (IP) connections.

The ISIS program assumes that both the presenter and the students benefit from the interactivity of the medium. Topics might be fairly general such as “The Daily Culture of India” or much more specific as in “The Effects of the Rainforest Biome on the Local Culture” (International Studies In Schools, 2007). The presenters are always encouraged to ask and solicit questions. Synchronous interactions with a representative of another culture not only make the sessions

[1] CEC has changed its name to the Center of Research on Learning and Technology (CRLT).

[2] These include the African Studies Program, the Center for Latin America and Caribbean Studies, the Center for the Study of Global Change, the East Asian Studies Center, the Inner Asian and Uralic Resource Center, the Russian and East European Institute, and the West European Studies National Resource Center.

more interesting and exciting, they foster further interest in that culture. In this regard, it is important for the presenter to solicit as much input from students as possible during the course of presentation. By asking questions in real time, students tend to focus on their most pressing knowledge gaps in their attempt to understand other cultures and receive answers from presenters who are usually native to that culture.

Characteristics pertaining to a particular audience, such as education level, are also crucial to consider because the level or type of interactivity must vary accordingly to be effective. ISIS offers different formats and content to various levels of audiences, suited to their needs. As an added enticement to use technology for global education, ISIS programs are provided free-of-charge; even connection fees are covered, if applicable. As explained below, there are currently two kinds of programming offered by ISIS.

Tailored Programs

The specific needs of requesting teachers are addressed through tailored programs such as "*European Security Issues in the 21st Century*," "*The Chinese in Mongolian History*," and "*Daily Life in Kenya*." Tailored programs are initiated by a teacher who contacts ISIS to request development of an IAV program focusing on a particular curriculum topic. Once a request is received, the relevant world area studies center at Indiana University identifies presenters. The next step in the process is for the ISIS Program Coordinator to provide a short training session to the presenter regarding the best use of this medium. The final product is negotiated among the teacher, the presenter, and the ISIS Coordinator. Each "event" is scheduled for a broadcast time that fits everyone's schedule. ISIS topics include a wide range of international cultures, countries, and issues in tailored programs. For example, a session on "*Doing Business in Other Cultures*" was delivered to an introductory business class at the university.

Topical Series

Any audience can choose to link to programs in a preplanned K-16 topical series, such as the two award-winning series "International Education Week 2002: Interactive Series for Indiana" and "Face to Face with the World," an activity of the "Bridges to the World: Youth Trade Fair. The International Education Week" series which included the following sessions:

- What do you want to know about Iraq?
- East European Origins: Focus on Hungary
- Islam in Africa: Niger
- Meet the Mongolian Throat Singers
- Burmese Students: Perspectives of Refugees

Mechanisms for Monitoring and Dealing with Technical Difficulties

Technical difficulties are monitored on three possible levels involved in any program: (1) the IAV studio in use, (2) the IU technical support by VICNOSS (Virtual Indiana Classroom Network Operations Support Specialists), and (3) the help desk at CILC, if the program is using the *Vision Athena* network.

Before any newly proposed IAV connection, the technical support teams are required by IU to run a test (or tests) for the connection. During a program, IAV studio technical support people ensure that the program has begun successfully and are then available throughout the program for instant problem-solving. All IU IAV programs are constantly monitored in a central VICNOSS office, whose personnel are readily available by telephone to help with possible problems. Similarly, all *Vision Athena* programs have a help desk, *Video Images*, which can be called to address technical difficulties.

Implementation of ISIS

The Case Study of ISIS at Jamestown

As a graduate student in 2000, the first author, Lee, participated in an ISIS program as a presenter for the topic "Culture and Life in Korea." This experience, coupled with Lee's expertise in Instructional Systems Technology, led her to the opportunity of serving as an assistant coordinator to the ISIS program, working closely with the ISIS program director in 2001. During the collaboration, it was brought to Lee's attention that, in spite of a sharp increase in requests for ISIS programs as well as positive feedback from teachers and students, no research had been done to substantiate the impact of this program. Previous research on videoconferencing has primarily been limited to design and implementation tactics (Siantz & Pugh, n.d.) or evaluation of student satisfaction at a very general level.

Only recently has effort been made to study the integration of technology into multicultural education (Abbott, Austin, Mulkeen, & Metcalfe, 2004; Adams & Cafagna, 2007; Faulkner & McClelland, 2002; Luck & Laurence, 2005). As costs for videoconferencing plummet, through the use of IP-based videoconferencing as in ISIS, and growing school and teacher familiarity with online video conferencing and low-cost webcamming, the opportunities for interacting with global experts and guest lecturers continue to increase.

Geography and financial constraints are no longer key barriers to global education (Luck & Laurence, 2005). Today, key barriers are more likely to be limited familiarity and comfort with such technology, instructor or school hesitation, shortage of time to brainstorm possible uses of videoconferencing, and lack of persistence once one has a good idea. The work at ISIS during the past twelve years can serve as an example for other centers, institutes, schools, and organizations. In fact, part of the mission of ISIS is to reduce any perceived hesitancy and reluctance by providing a safe, free, and highly supportive program in which to test out global education ideas using videoconferencing.

In the year 2002, Lee launched an ethnographic study of two classrooms in two different rural middle schools where the ISIS program was implemented as part of regular curriculum. For this paper, some findings from one of the schools are discussed[3]. The real names of the school, district, and participants of the study have been replaced with pseudonyms. The study's findings suggest possible implications for educators who want to develop learning environments where students can be empowered with a sense of intercultural competence as members of a multicultural society.

For the study, Mr. Anderson and 34 students in his seventh grade social studies class in Jamestown Middle School were provided with the ISIS program as a part of their regular curriculum. The students of Jamestown Middle School typically come from low socio-economic backgrounds. Forty percent of the student population is at the poverty level, receiving free or reduced meals at school. During the three years previous to the study, the average mobility rate of Jamestown students was 38 percent. Historically, this particular community has been racially

[3] The result reported in this paper is a part of a larger study where data from two rural schools were collected. The data includes interviews of four different parties involved in the program implementation: (1) the teachers, (2) students, (3) international presenters, and (4) ISIS coordinator. Sections of the larger study, focusing on different parties involved, are scheduled to appear in other publications. More detailed analysis of the students' understanding of the program and interpretation of the differences can be found in Lee's article, "Going Global": Conceptualization of the *Other* and Interpretation of Cross-cultural Experience in an All-white, Rural Learning Environment (2006). The teacher's use of the program is recently discussed in Lee (2007).

homogenous. In fact, according to state statistics, the school had a Caucasian student population of 100% in 2001.

In terms of overall technology support, a 2001 report from this school noted that every classroom and office in the Jamestown district had at least one computer with Internet access. Every teacher had communication capabilities via telephone, voicemail, and emails, in his/her classroom. As a recipient of a high tech school grant, there were two mobile carts with thirty-two laptops each. These carts circulated among the junior/senior high school classrooms on a reservation basis. The industrial arts department had some basic broadcasting equipment (sound board, video switcher, and microphones) that could be used to broadcast over the high school's Channel One network. The report also noted that only 11 percent of the 7th grade students responded that they used computers on a weekly basis.

Mr. Anderson, the teacher, knew about ISIS but this was the first time he implemented it in his class. Having experienced a lack of sufficient resources for his 7th grade "World Geography and People" class, he welcomed the opportunity to be involved and participated in design of the implementation. During the year of 2002-2003, Mr. Anderson's class participated in six programs on countries that he chose corresponding to the contents of the textbook he was using. Each program was designed for one class period lasting approximately 50 minutes. The selected countries were (1) Iraq, (2) Kenya, (3) China, (4) South Korea, (5) Australia, and (6) Malaysia. Given the availability of the presenters, the selection and the order of the sessions were designed by Mr. Anderson and were scheduled to match his curriculum and class plans.

For each session, the class and the presenter "met" through a large TV screen in Mr. Anderson's classroom. The speakers presented their videoconferencing program in a studio at Indiana University. The studio was equipped with two-way videoconferencing technologies that included cameras, a videocassette recorder, computers, a document camera, and dial-up connections through local phone lines. The presenters, who were natives of the countries being studied, usually brought photographs or traditional artifacts to their presentations. Students were encouraged to ask questions about the respective country and culture during these interactive sessions. During and after implementation of the program, the teacher and the students were interviewed for their reactions to the program.

Mr. Anderson reaction to the ISIS program was overall extremely positive. In general, he viewed the program as an opportunity to draw students' attention and motivate and engage them in the subject matter. In addition, Mr. Anderson was focused on how the implementation of ISIS provided a better understanding of lives in different countries covered in the curriculum. Such opportunities had not previously been possible in an isolated, rural environment like Jamestown. In effect, ISIS served as an instructional support that propelled students beyond the lectures and textbooks into the real world.

Given the nature of the topics in World Geography and People, the teacher and students had felt a need for resources beyond textbooks and encyclopedias. For this reason, the sessions generated much excitement for students and the teacher. The introduction of the new technology, possibly due to the novelty effect, was also received positively, despite some early anxiety on Mr. Anderson's part. Without any prior experience with videoconferencing equipment or events, Mr. Anderson initially was not very confident about his ability to maneuver the technology. With help from the technology specialist at the school, he soon grew more comfortable and his concerns were resolved. The students regarded the prospect of learning about different cultures through interacting with "real" human beings especially exciting. The interactive videoconferencing technology also seemed to have contributed significantly to the students' excitement.

An overview of the findings from the interviews is listed below:

Positive outcomes:

- The teacher provided positive feedback regarding the implementation of the program in increasing students' motivation.
- Early concerns of the teacher about using technology were resolved when he found the equipment easy to maneuver with timely support from the school's technology specialist and the ISIS coordinator. After these videoconferencing experiences, he expressed confidence in using technology in his instruction.
- Students showed much interest in this technology as a positive addition to their instructional resources.
- Interaction with the international presenters, made possible by the videoconferencing technology, provided motivation for the students to approach the textbook and other resources with greater interest.

Concerns and challenges:

- After the initial novelty effect of technology subsided, students expressed different degrees of comfort related to the technology. For example, the teacher focused the camera on the student asking a question of the presenter, zooming in on the student's face. Some students felt uncomfortable, and, in a few cases, it actually hindered them from more active participation.
- While this first exposure to other cultures stirred up much interest and excitement, the students were not prepared or given sufficient guidance to "interpret" and make sense of the cultural differences they encountered. The case study pointed to the fact that contact with other cultures should be supported and facilitated with a framework for understanding differences.
- The current system using volunteers for ISIS presenters does not allow a sufficient planning period for the sessions.

Guiding Theories behind ISIS and its Implementation

Importance of Interaction as Instructional Strategy[4]

Because presenters and students are physically separated at the time of instruction, the ISIS program is considered a type of distance learning program. Psychological and communications space for potential misunderstanding between the learners and instructors is called the "transactional distance." Three sets of variables define the extent of transactional distance in an educational environment: dialogue, structure, and learner autonomy (Lee & Paulus, 2001).

Dialogue can be translated as interaction which places value on the synergistic nature of the relationship of the involved participants (Moore, 1993). Based on this theory of potential transactional distance, interactions are even more important in distance environments than in face-to-face classrooms.

Interaction can be defined as "sustained, two-way communication among two or more persons for purposes of explaining and challenging perspectives" (Garrison, 1993, p.16) or as "two-way communication among two or more people within a learning context, with the purpose either as the task/instructional completion or social relationship building" (Gilbert & Moore, 1998). Vygotsky's (1978) concept of the Zone of Proximal Development (ZPD) is based on the idea that

[4] Part of this subsection appears in Lee and Paulus (2001) AECT Conference Proceedings..

social interaction is crucial to the development of the new patterns of thought and behavior. It is argued that social interaction and dialogue are central to learning. In the case of the ISIS program, the technology enables an interaction between the students and speakers of different countries that is otherwise impossible.

Contact Theory and ISIS

Allport (1979) points out that in general "contacts that bring knowledge and acquaintance are likely to engender sounder beliefs concerning minority groups and for this reason contribute to the reduction of prejudice (p.268)." Services that ISIS provides are based on this understanding: though made possible by technology through a TV screen, the contact can contribute to a fostering a sense of familiarity, thereby reducing a sense of fear toward the unknown. The teacher, Mr. Anderson, seemed to share this assumption. He stated during his interviews that his interest in the implementation of ISIS into his social studies curriculum was twofold: (1) the ISIS will serve as an instructional support to motivate the students in social studies, and (2) the interaction with people from other cultures will enhance their intercultural understanding.

Integrating Interactive Videoconferencing Technology in Instruction

In many cases, IAV shares the same benefits as telecommunications. Researchers have shown that telecommunications technology help to bring students and educators out of the isolation of their schools into the real world, as shown by examples ranging from music education to health education for rural students in The Division of Continuing Medical Education (CME) in the University of British Columbia. Interactive technology enables learners' instantaneous connection to and with teachers and provide expertise to regions of the state that do not otherwise have access. In this sense, the videoconferencing technology can significantly expand learning opportunities for rural school settings.

Learning about other cultures can be done most effectively with some direct experiences. When such an option is not possible as in many parts of Indiana where white populations exceed 95 percent, one can turn to an appropriate technology that can simulate the face-to-face interaction most closely. IAV can serve as such a technology. *The Guide to Distance Learning* (Yoakam, 1999) points out that the real-time broadcast of video-based instruction is the closest replication of the traditional classroom that distance-learning technology offers. IAV is now the perfect fit for a more global curriculum—it is available at a relatively low cost, closely resembles real human interaction, and increases opportunities for international content and experiences. Opportunities for learners to express their own points of view, to explain issues in their own words, and to formulate opposing or different arguments have shown to result in deeper-levels of cognitive processing, improved learning, and the development of critical thinking.

The impacts of interactive videoconferencing on learning include the following:

1. The technology provides for dynamic learning and understanding through collaborative, substantive discussions;
2. Videoconferencing adds a new dimension to the curriculum allowing for a greater exchange of information than otherwise possible;
3. The technology allows for integration of current, real-time information and ideas that can challenge students to generate new understandings.

(Retrieved July 10, 2007 from www.brownsburg.k12.in.us/curriculum/Secondary/SocialStudies/JHGeneralInfo.pdf

These same three aspects—dynamic learning through collaborative and in-depth discussions, the exchange of information not available elsewhere, and highly current and real-time exchanges of ideas—apply directly to the case of ISIS. Now, with IP-based videoconferencing technology, anyone can tap into sources that are unique and novel as well as intense and engaging interactions

with people around the planet who have valuable life experiences. Decades of research on learner-centered instruction indicates that many of these same features underlie successful learning environments (Alexander & Murphy, 1994; McCombs & Vakili, 2005; So, Bonk, & Wisher, in press). Such environments include opportunities for feedback from multiple audiences, the sharing of perspectives, building on students' prior knowledge, knowledge construction opportunities, and fostering of student reflection, learner choice, collaboration and interaction.

Suggestions for Future Implementation of the Program

Continuous Implementation of the ISIS Program

This was the first research project conducted on curriculum integration for a series of presentations as part of the ISIS program. It was also Mr. Anderson's first use of the ISIS program. The novelty of the program may have contributed to excitement generated by the students. Continuous implementation of the ISIS program will help teachers and researchers move beyond the novelty effect. Further use of the program will also make it possible for students and teachers to understand the multiple and diverse aspects of each culture that is presented.

In future implementations of the ISIS program in similar settings, there are several possible scenarios that can address the issues mentioned above. We propose the following alternative scenarios to the current format of ISIS programs.

Scenario 1. When designing the ISIS sessions, suggest categories that respond to issues of diversity such as class, gender, and sexuality, instead of focusing primarily on ethnicity. This strategy can help the students reflect more clearly the heterogeneity of each culture. For example, one ISIS session might address the issue of gender across different cultures and have panels of presenters from two or more countries share their opinions about gender in their society. In such a format, American students can participate as part of a panel. Another session might cover issues of class hierarchy and how each country deals with its problems in this area. Because everybody has a concept of membership to one's own class, this topic will be as relevant to the students as perhaps talking about "dating" or "career aspirations." The issue of "dating" can even be discussed under the more macro themes of "class" or "gender." How do the dating customs reflect the gender roles, for example, in China? Are there different expectations depending on the social class to which one belongs? Are there as many single-parent households in Korea as in the U.S.? If not, what is an explanation? Does it vary depending on different regions within a country? These issues should be discussed in the context of the social climate of the country, including the people of that country's own effort for social change.

Scenario 2. Similar to the first scenario, the objective of this second scenario is to keep the current format of "one country per session," while incorporating a template that addresses the topics mentioned above. Have each presenter be more aware of the issues him/herself so that s/he can emphasize the diverse aspect of his/her own culture. This can minimize the risk of presenting a culture as a set of fixed attributes. By making a connection between understanding other people's cultures and one's own identity, the teacher can use the ISIS program to start dialogues about tolerance and equality.

Collaboration across the Program Areas in the University

There has been an increasing awareness of and concern about the ethnocentric understanding of other, especially non-Western, cultures. Trubek (2001) points out that:

> [I]ssues arise in the relationship with the humanities as cultural studies and post-colonialism become more important in the humanities and require a redefinition of the relationship between areas studies and humanities department. These newer traditions tend to challenge some of the work that has been done by area scholars in U.S.

> universities. There is a growing critique of "Orientalism" or the tendency to construct knowledge of other societies based on assumptions of Western supremacy. (p.316)

One way of addressing potential underlying tones or feelings of supremacy is for ISIS participants to collaborate with subject matter experts in cultural studies. In addition to its current close partnership with the centers of area studies and the international program, additional collaboration with the School of Education, such as multicultural education or instructional technology would be beneficial. Support from instructional technologists in terms of a needs analysis can also assist in identifying conditions and limitations related to the use of the program.

Instructional Resources in Teaching Tolerance

Intercultural understanding is inseparable from the tenets of multicultural education. The common goals include: (1) to respect and appreciate differences, (2) to understand the issues of equality in society, and (3) to foster a sense of tolerance which will contribute to the development and empowerment of individuals as members of the diverse world of the 21st century. In our opinion, learning *about* other cultures should prepare these students to be able to learn to live *with* people from other cultures. In this sense, the goal of these cross-cultural encounters should be closely tied to that of multicultural education.

An important aspect of multicultural education is the cultivation of an attitude of tolerance. Jamestown Middle School had its own program called "Diversity Project" designed and facilitated by the high school counselor. The program offered one 45-minute session per week for six consecutive weeks, covering issues of diversity and tolerance. It was initiated by the counselor in an effort to embed additional multicultural issues into the curriculum. In addition to ISIS, Mr. Anderson used the program in his classes.

The Diversity Project introduced and addressed issues related to tolerance. As such, it coordinated extremely well with the ISIS program. Topics of the project included: tracing back through family histories (immigration), civil rights (racism), and holiday traditions (customs). The project was designed to point out many similarities and differences among the various traditions simply termed as "American" while touching on the issues of intolerance and social injustice based on external differences. Intolerance based on social hierarchy among peers resonated with most middle school students. Instead of separate implementation of the two projects, as currently done in Jamestown, they can be designed and implemented in collaboration. With closer interaction with and reference to in-house projects like the "Diversity Project," students can better understand "international" issues made evident through ISIS in a more personal and local framework.

Plan for Multiple Speakers

Among the six sessions implemented in Mr. Anderson's class, five sessions were presented by single speakers. In the case of Malaysia, however, the session had a team of two speakers, one Chinese and one Malay. As seen in the case of Malaysian presenters, having a team of speakers better highlighted the diverse makeup of that culture. Sessions that include a panel of speakers from various socio-economic levels, educational backgrounds, or ethnicities within the same country help to minimize oversimplification of a culture. Many Jamestown students were interested in the lives of teenagers in other countries. Having presenters who are similar in age to the audience could also be extremely motivating. Support at the University administration level is necessary in order for ISIS to access a larger pool of potential speakers.

Need for More Tangible Incentives for the ISIS Presenters

In most cases, the ISIS presenters in conjunction with the teacher(s), the ISIS coordinator, and sometimes the relevant area studies outreach coordinator make decisions about what to present

and how to present it. For this reason, there can be extensive variation in terms of what is emphasized about the various cultures. While the 60-90 minute training prepares the presenters for uses of technology, it typically does not provide sufficient time for specific content planning with the ISIS program coordinator because the presenters are volunteers. One suggestion is to provide more tangible benefits for the presenters such as course credits. That way the ISIS Outreach coordinator can rightfully ask for more time with the presenters, making it possible for them to design and develop the sessions with consultation from those in multicultural education, cultural studies, and area studies.

Conclusion

As an international studies program delivered via interactive two-way videoconferencing technology, International Studies In Schools (ISIS) offers a vital service to rural classrooms, especially in geographically and culturally isolated communities. The use of the ISIS program is a start of collaboration between the rural schools and universities. After a year-long implementation of the program in the World History curriculum, the case study in Mr. Anderson's classroom provided us with suggestions for future implementations of the program. The findings of the study also point to the fact that while the videoconferencing technology provides exciting new ways to communicate with people from other cultures, fostering intercultural awareness requires combined efforts of educators, administrators, and program coordinators as well as continuous implementation, extension, and modification of programs such as ISIS.

Today more than ever in the history of this planet, global awareness is critically needed. Fortunately, videoconferencing and other emerging technologies make it possible. It is up to all of us to begin exploiting it for educational and cultural gains. As Merry Merryfield argues,

> "The flattening of the world through new technologies and globalization challenges all of us. By introducing students to diverse people within a country, a teacher can help students learn to appreciate the complexity within cultures and the dynamics of how cultures change" (p. 270).

ISIS has provided a model program of how this can happen for more than a dozen years now. It is time to start thinking about and planning for the types of global collaboration programs that may benefit the human race a dozen years from now.

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About the Authors

Mimi Miyoung Lee is an Assistant Professor at the University of Houston. She received her Ph.D. in Instructional Systems Technology from Indiana University. Her email address is:mlee7@uh.edu

Deborah S. Hutton is a professor at Indiana University at Bloomington.

Editor's Note: Distance learning assigns to the student responsibility for time scheduling and management. Student self-regulation is key to successful adoption of distance learning technologies.

Relationships between Course Management System (CMS) Use and Teacher Technology Adoption

Robert Hancock, Gerald Knezek

USA

Abstract

This study examined the difference in student self-regulation as defined by technology adoption for participants in the free Hotchalk course management system (CMS) which is referred to as the Hotchalk Learning Environment (HLE). 1078 respondents completed a battery of instruments to determine if there was a relationship between self-regulation and CMS use. Previously, the authors had successfully cross-validated these instruments against each other in a study that won the best research paper at the 2007 National Education Computing Conference. Results of this study indicate there is a strong positive relationship between self-regulation as defined by level of technology adoption and use of the Hotchalk learning environment that is significant at the .01 level across all three instruments of assessment.

Introduction

A course management system is hardly a new concept in the field of education and online instruction is now an integral part of higher education across institutions (Terry, 2007). The question has long shifted from online versus traditional instruction, and for most professors is a matter of hybrid or online-only forms of delivery (Willett, 2002). Course management systems have made dramatic inroads to K-12 school systems with many school districts using one of the many paid or free systems currently in the market to facilitate online instruction and parent communication. (Barge & Loges, 2003). Indeed, it is this parent expressed desire (2003) for a different kind of communication pattern with teachers that has driven implementation in many school districts. Parents are no longer satisfied with the traditional patterns of infrequent teacher–parent conferences and notes home. For example, a parent commented on the benefits of more frequent contact; "When I saw the good information about my child instead of only bad things, it made me feel good. More positive, less negative. [sic] We do need to hear the good and not just the bad" (Barge & Loges, 2003, p. 146). There is strong evidence that course management systems are effective in accomplishing this goal as well their more traditional roles of organizing the class environment (Munoz & Duzer, 2005). There is also strong evidence (2005) that free systems such as Hotchalk, Moodle, and Sakai do as good a job or better at managing course information and facilitating communication as the pay systems such as Blackboard. There remains however the question of the relationship between the user and the management system.

The concept of academic self-regulation and its role in the learning environment has been around for some time (Ruban, McCoach, McGuire, & Reis, 2003). According to Zimmerman, (1989) self-regulation refers to "the degree that individuals are metacognitively, motivationally, and behaviorally active participants in their own learning process" (p. 329). Zimmerman (1989) identifies the hallmarks of academic self-regulation to include academic time management, practice, mastery of learning methods, goal-directedness, and a sense of self-efficacy.

Recently, researchers have begun to look at issues of self-regulation and its relationship with success in online learning environments (Zerr, 2007; Whipp & Chiarelli, 2004). Yet studies in this area remain few and far between (Whipp & Chiarelli 2004), and a call for more research has been issued (Hodges, 2005). It is in response to that call that this study was undertaken.

Although primarily conceived of as measures of technology adoption, the Concerns-Based Adoption Model-Levels of Use (CBAM-LoU) (Hall. Loucks, Rutherford, & Newlove, 1975), the Apple Classrooms of Tomorrow Teacher Stages (ACOT) (Dwyer, 1994), and the Stages of Adoption of Technology (Christensen, 1997; Knezek & Christensen, 1999) roughly conform to Zimmerman's hallmarks of practice, mastery of learning methods, goal directedness, and self-efficacy and provide a good starting point for measuring self efficacy for teachers in the use of course management systems. Time management, while not a component measured by these instruments, is measured separately in the study in terms of frequency of use of the Hotchalk CMS. It is felt by the authors that these instruments, combined with frequency of use (time) measurements, provide a vital first step in assessing the relationship between self-regulation and online learning and design of a practical instrument for assessment of self-regulation in the online learning environment.

Conceptual Rationale

It is the author's belief that the Concerns-Based Adoption Model-Levels of Use (CBAM-LoU), the Apple Classrooms of Tomorrow Teacher Stages (ACOT), and the Stages of Adoption of Technology (Stages) can serve as a starting point for assessing what Hodges (2005) referred to as the behavioral, personal, and environmental components of self regulation by establishing a self-judgment regarding the individual's will and skill with technology (in this case the Hotchalk course management system) tool.

According to Zimmerman this self-judgment is essential. He states (1989) that "self-judgment refers to students' responses that involve systematically comparing their performance with a standard or goal" (p. 333). The format of the instruments provides this framework of self-judgment to the user.

By administering this battery of instruments to active educators who are either users or non-users of course management systems, it is possible to determine if there exists a relationship between self-regulation in terms of technology adoption and course management system use. Further, by comparing the scores of active users with their frequency of use, it becomes possible to examine more closely the role of time management (in terms of usage) in the adoption relationship.

Together these measurements give us the starting point for measuring self-regulation in terms of technology adoption for users of course management systems.

Review of Literature

The use of online course management systems is now commonplace (Caruso, 2004). In a national study with a sample of 18,400 students with a response rate of 4,374 students across thirteen separate universities, Caruso (2004) found that 96.4 % of students used the internet for classroom activities. Students also responded that they used technology primarily for classroom activities with an average of four hours of study per week using electronic means and an average of 2.48 hours per week interacting with a course management system (Caruso, 2004). These numbers were in excess of the amount of time spent playing computer games and shopping online.

Communication and convenience stand out as major benefits offered by the CMS to both students and instructors (Caruso, 2004; Morgan, 2003).

Caruso (2004) indicates that the number one impact of CMS technology in the classroom as stated by students was, “helped me to better communicate with the instructor” (Caruso, 2004, p. 5). The second was, “resulted in prompt feedback from the instructor” (Caruso, 2004, p. 5). The third was, “helped me communicate and collaborate with my classmates” (Caruso, 2004, p.5). Close behind these results were easy access to materials online. In a nutshell, the findings indicated that for these students the main benefits of the CMS were communication and convenience.

Morgan (2003), in a study of 740 faculty members, indicates that 80% are using the CMS in a hybrid manner with some face-to-face and some online instruction. Morgan asserts that 59% of professors surveyed indicated an increase in communication with students as a result of using the CMS. Perhaps best of all, Morgan reports that “in the process of using these tools, many faculty members begin to rethink and restructure their courses and ultimately their teaching…resulting in an accidental pedagogy … faculty teaching is improved as a result” (Morgan, 2003, p. 4)

These findings were largely replicated in the pilot study for this research conducted by Devaney and Hancock in 2006. In this study of 655 respondent students from a sample of 1900, it was found that the majority (76.7%) of students had access to high speed internet services, 87.2 % were enrolled in an online course, 94.6% were accessing course material primarily from home, and were utilizing online services with low anxiety as indicated on the anxiety subscale of the Teacher’s Attitude Toward computers questionnaire with an overall mean attitude equal to 1.58 ($M = 1.568$, $SD = .631$).

Morgan (2003) indicates that the high cost of CMS systems will force high usage rates among faculty and students. While usage is definitely high, there has been a response that was partially unforeseen by Morgan; the rise of the free CMS system. As costs for systems such as Blackboard continue to spiral upward, many universities and public school systems have turned to free systems such as Hotchalk, Moodle, and Sakai as a free alternative for CMS services.

In 2005, Munoz and Duzer conducted a comparison study of Blackboard and Moodle CMS implementations. Blackboard is a commercially available product partially owned by Microsoft whereas Moodle is a freely available open source alternative. The results were intriguing, 0% of Blackboard users strongly agreed that Blackboard enhanced instruction while 7.1% of Moodle users strongly agreed that Moodle enhanced instruction (Munoz & Duzer, 2005). The somewhat agrees were roughly equal (2005) with 23.1% of Blackboard users agreeing that Blackboard enhanced instruction and 21.4% of Moodle users saying the same for Moodle. The number of Moodle users who did not believe that Moodle enhanced instruction was also less than the number of Blackboard users with 53.9% of Blackboard users thinking Blackboard was not useful in enhancing instruction and 42.9% of Moodle users thinking that Moodle was not useful in enhancing instruction (Munoz & Duzer, 2005).

Similar results were found when considering communication with the instructor. 46.2% of Blackboard users agreed/strongly agreed that Blackboard enhanced communication with the instructor while 61.4% of Moodle users agreed/strongly agreed that Moodle enhanced communication (Munoz & Duzer, 2005). The number of Moodle users who believe that Moodle impeded instruction was also less than the number of Blackboard users with 38.5% of Blackboard users thinking Blackboard somewhat/significantly impeded instruction and 7.1% of Moodle users thinking that Moodle somewhat/significantly impeded instruction (Munoz & Duzer, 2005).

Moodle also did better than Blackboard in enhancing student communications. Over 71.4 % of students felt Moodle enhanced student to student communication as compared to 53.9% of students who utilized Blackboard (Munoz & Duzer, 2005).

This study by Munoz and Duzer was consistent with other literature that indicates that communication is the key benefit of the CMS; it also indicates that free CMS has equivalent or even superior potential to be beneficial to both student and instructor. This leaving us with the question of how to measure that benefit.

The question of achievement is part of this study; however, it is more concerned about "accidental pedagogy" associated with self-regulation that is referred to by Morgan (2003). The focus is the relationship of self-regulation and use. Self-regulation is measured as technology adoption on the part of participants.

The Concerns-based Adoption Model-Levels of Use (CBAM-LoU) questionnaire is targeted to describe behaviors of innovation users through various stages - from orienting, to managing, and finally to integrating use of the technology. It is designed to be more quickly administered than SoCQ, and CBAM-LoU does not focus on attitudinal, motivational, or other affective aspects of the user. The instrument is based on eight levels of use defined in the Levels of Use Chart (Loucks, Newlove, & Hall, 1975). The levels of use are: (0) Non-Use, (I) Orientation, (II) Preparation, (III) Mechanical Use, (IVA) Routine, (IVB) Refinement, (V) Integration, and (VI) Renewal. The levels-of-use concept also applies to groups and entire institutions. Because the Concerns-Based Adoption Model - Levels of Use is a single item survey, reliability measures of internal consistency cannot be calculated for data it gathers. However, test-retest reliability estimates generally fall in the range of .84 to .87 for elementary and secondary school teachers (Christensen, Parker, & Knezek, 2005, p. 189).

The Stages of Adoption of Technology instrument is a single-item survey used in both pre-service and in-service education to measure the impact of information technology training as well as trends over time. It was derived from work of Russell (1995) in research assessing adults learning to use electronic mail. Russell's stages included: (1) awareness, (2) learning the process, (3) understanding the application of the process, (4) familiarity and confidence, (5) adaptation to other contexts, and (6) creative applications to new contexts. In the Stages of Adoption of Technology instrument (Christensen, 1997; Christensen & Knezek, 1999) the stage descriptions are generalized to make them appropriate for any information technology.

As with the CBAM-LoU, the Stages of Adoption of Technology instrument is a single item survey, internal consistency reliability measures cannot be calculated for data gathered through it. However, high test-retest reliability estimates (.91 - .96) have been obtained from validation studies on Stages of Adoption (Christensen, Parker, & Knezek, 2005, p. 189).

By the time ACOT research ended in 1998, Apple Classrooms of Tomorrow, had been working with the National Science Foundation for more than eight years on professional development for teachers in different environments. In its entirety, the ACOT project was one of the largest and longest continuing educational studies of its kind.

Drs. Eva Baker, Joan Herman-Cooper, and Maryl Gearhart of the Center for the Study of Evaluation at UCLA designed and implemented a three-year, cross-site study of ACOT. Student demographic and psychometric data were collected annually from participating districts, using subsets of the Iowa Tests of Basic Skills and other measures.

The project analysis (Baker, Herman, & Gearhart, 1988) indicated a progression of attitudinal change that the authors believed could be viewed as an evolutionary process similar to other models of educational change (Berman & McLaughlin, 1976; Giacquinta, 1973; Gross & Herriott, 1979) such as CBAM. This served as the basis for what would become labeled stages of instructional evolution in the ACOT classrooms: Entry, Adoption, Adaptation, Appropriation, and Invention. In this model, text based curriculum delivered in a lecture-recitation-seatwork

mode is first strengthened through the use of technology, and then gradually replaced by far more dynamic learning experiences for the students (Dwyer, Ringstaff, & Sandholtz, 1991).

These instruments have been cross-validated against each other and found (when used in combination) to form a reliable, valid, measure of the construct technology integration that is stable across geographic location and time (Hancock, Knezek, and Christensen, 2007). Stages of Adoption of Technology, CBAM Level of Use, and ACOT stages of instructional evolution form a consistent self-report measure that has stable construct validity and aligns well with anticipated changes in educator attitudes as technology integration progresses.

It is the author's belief that these measures, when combined with frequency of use information, will provide an accurate picture of self-regulation in terms of technology adoption useful for analyzing participants in course management systems.

Methods

This study examined the difference in self-regulation as defined by technology adoption. The study consisted of a sample of 20,000 teachers drawn from across the United States with 1078 respondents. Of these 1078 respondents, 307 were active participants in the free Hotchalk course management system which is referred to as the Hotchalk Learning Environment (HLE). This response comprised 5.6% of the accessible population. Respondents represented 47 of the 50 US states, plus the District of Columbia.

The HLE is free community software for teachers, students, and parents. It includes curriculum management, lesson plan development, automated assignment distribution, collection, and grading in a web-based environment. Teachers find, create and share standards aligned resources and best practices through the HLE interface. The HLE is accessed through an Internet browser and is available anywhere there is an internet connection worldwide. The HLE is funded through advertising with individual schools able to control the type of advertisement displayed as well as the time of display. Currently 100,000 schools are in the HLE database.

Participants were given a questionnaire consisting of the three instruments and several demographic questions including frequency of use of the Hotchalk CMS.

Analysis

Analysis consisted of the examination of levels of adoption for users versus non-users, adoption versus frequency of use, and function analysis of these factors in combination.

Technology Adoption and Use/Non-Use

The first step was to determine if there was a difference in technology adoption among users or non-users of the Hotchalk Learning Environment (HLE). Analysis shows that Stages, CBAM, and ACOT are all significantly different at the $p < .01$ level for users versus non-users. Factor scores on technology adoption were produced for each teacher. These factor scores were then included in the ANOVA (Table1). The results is mean = -.08 for the do not use Hotchalk group vs. mean = .22 for the group that reported using Hotchalk. The magnitude of the difference between the two means is .22 – (-.08) = .30 / 1.00 STD. The ES of .30 would be considered educationally meaningful in most circles. (Bialo, 1996)

Table 1

Analysis of Variance in Technology Adoption among Users and Non-Users of HLE

		Sum of Squares	df	Mean Square	F	Signif
STAGES	Between Groups	8.375	1	8.375	6.366	**0.012**
	Within Groups	1086.693	826	1.316		
	Total	1095.068	827			
CBAM	Between Groups	27.412	1	27.412	17.392	**0.000**
	Within Groups	1303.458	827	1.576		
	Total	1330.870	828			
ACOT	Between Groups	11.276	1	11.276	9.542	**0.002**
	Within Groups	977.276	827	1.182		
	Total	988.552	828			
REGR factor score 1 for analysis 1	Between Groups	13.716	1	13.716	13.916	**0.000**
	Within Groups	814.145	816	0.986		
	Total	827.861	817			

Technology Adoption and Frequency of Use

The second step was to determine if there was an association between technology adoption scores and frequency of use of the Hotchalk Learning Environment (HLE) (among those who reported using the HLE). Among the 358 teachers who reported using the HLE, there was a significant positive correlation ($p < .01$) found between extent of Hotchalk use and ratings on CBAM Level of Use, ACOT teacher stages, and the composite factors scores of technology adoption (Table 2). There was not a significant association between Stages of Adoption and HLE use, although the association in the case of Stages vs. Hotchalk level of technology integration implementation was also positive ($r = .o47$, $p = .34$).

Table 2

Correlations between Technology Adoption Measures and Frequency of Use

		FREQHOTU	STAGES	CBAM	ACOT	REGR factor score 1 for analysis 1
FREQHOT U	Pearson Correlation	1	0.059	0.160	0.163	0.157
	Sig. (2 tailed)	-	0.280	0.003	0.003	0.004
	N	358	340	340	339	339
STAGES	Pearson Correlation	0.059	1	0.700	0.578	0.876
	Sig.(2 tailed)	0.280	-	0.000	0.000	0.000
	N	340	340	340	339	339
CBAM	Pearson Correlation	0.160	0.700	1	0.605	0.889
	Sig.(2 tailed)	0.003	0.000	-	0.000	0.000
	N	340	340	340	339	339
ACOT	Pearson Correlation	0.163	0.578	0.605	1	0.836
	Sig.(2 tailed)	0.003	0.000	0.000	-	0.000
	N	339	339	339	339	339
REGR factor score 1 for analysis 1	Pearson Correlation	0.157	0.876	0.889	0.836	1
	Sig.(2 tailed)	0.004	0.000	0.000	0.000	0.000
	N	339	339	339	339	339

** Correlation is significant at the 0.01 level (2-tailed)

Strength of Predictors

If Technology Integration Implementation is analyzed as a function of a) whether or not one reports using the HLE, and b) how much the HLE is used, if it is used, then most of the variance is attributable to whether or not use takes place, (beta = .145, See table 3) while the remaining portion due to frequency of use is not a strong predictor. (beta = .067).

Table 3

Strength of Predictors

Model	R	R Square	Adjusted R Square	Std. Error of Estimate		
1	0.189	0.036	0.031	1.00681524		
a Predictors: (constant), FREQHOTU, USEHOT2						
Coefficients						
		UnStandardized Coefficients	Std. Error	Standardized Coefficients	t	Significance
1	(Constant)	-0.573	0.168		-3.404	**.001**
	USEHOT2	0.297	0.117	0.145	2.545	**0.011**
	FREQHOTU	6.750E-02	0.058	0.067	1.168	0.243
a Dependent Variable: REGR factor score 1 for 1 analysis						

Conclusions

Results of this study indicate a strong positive relationship between level of technology adoption and use of the Hotchalk Learning Environment. This is significant at the .01 level across all three instruments of assessment. There is also a strong positive relationship between frequency of use of the Hotchalk Learning Environment and level of technology adoption for two of the instruments (CBAM-LoU and ACOT) significant at the .01 level. When modeled together, reported use of the Hotchalk Learning Environment accounted for roughly 15% of the variance in total technology adoption scores, significant at the .01 level.

These results indicate a strong relationship between use of the Hotchalk Learning Environment and level of technology adoption. This leads to the question whether or not the impact of the learning environment is the basis of the relationship, if stronger adopters are more likely to embrace the use of a system like the HLE, or perhaps both.

While it is tempting to leap toward the second question, there is intriguing evidence for the last. Figure 1 compares teacher responses toward CMS impact upon instruction in this study with responses the Munoz and Duzer study of 2005 (2005) and shows a dramatic difference in teacher attitudes toward a particular CMS and its ability to impact instruction.

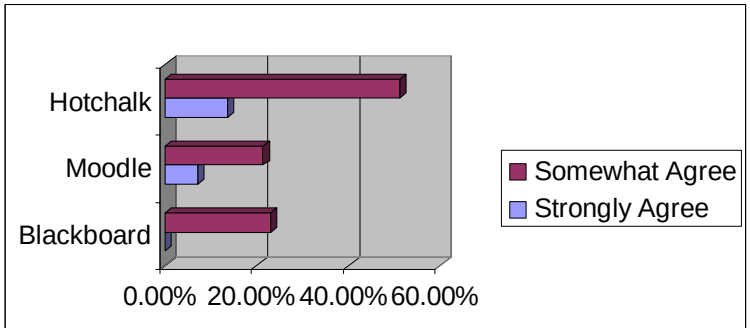

Figure 1. Teacher response to the question, "Did the learning environment enhance instruction?" taken from this study and the Munoz and Duzer study of 2005.

The authors are aware of dangers inherent in conclusions from comparing results of different studies, and such conclusions are beyond the scope of this document.

The current study establishes a strong relationship between use of the Hotchalk Learning Environment and high levels of teacher technology adoption. It indicates that function analysis is a stronger than frequency of use in predicting a CMS user's ability to self-regulate instruction.

Further research is needed to validate these findings with other populations and CMS environments and to determine which factors lead to significant differences in CMS results and under what conditions. The implications of this data to guide design and implementation of CMS based systems of learning would be far-reaching.

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About the Authors

Dr. Robert Jason Hancock is editor of Connexions for Educational Technology Leadership, the online technology in administration journal of the National Council of Professors of Educational Administration. Dr. Hancock is the first author of *Cross-Validating Measures of Technology Integration: A First Step Toward Examining Potential Relationships Between Technology Integration and Student Achievement*, which the award for best research paper at the 2007 National Education Computing Convention sponsored by the International Society of Technology in Education. Dr. Hancock is a regular author and presenter at research conferences worldwide and is a reviewer for ITDL.

Robert Hancock, Ph.D.
Department of Educational Leadership and Technology
Southeastern Louisiana University
robert.hancock@selu.edu

Dr. Gerald Knezek is President-Elect of the Society for Information Technology and Teacher Education (SITE). He is the founder of the American Education Association Special Interest Group TACTL. He has won four separate research paper awards from AERA and is second author on the above mentioned work of Dr. Hancock. He is active in multiple world-wide initiatives and is currently working with UNESCO on ubiquitous computing. He currently is President of the Institute for the Integration of Technology into Teaching and Learning, which is an international organization aimed at improving the integration of technology in teaching and learning worldwide. gknezek@gmail.com

Gerald Knezek, Ph.D.
President-Elect: Society for Information Technology and Teacher Education
Department of Computer Education and Cognitive Systems
University of North Texas
gknezek@gmail.com

Editor's Note: Distance learning technologies make learning accessible to larger numbers of students, especially those who are time bound (cannot fit class schedules) and space bound (distant from campus). Materials produced for distance learners often enhance learning for on-campus students and raise the overall quality of teaching and learning. This is an example from an Open University in India.

Virtual Classroom Modules for Basic Electronics Course at YCMOU: An Overview

Chetana H Kamlaskar

India

Abstract

Since 1996, Yashwantrao Chavan Maharashtra Open University, Nashik, has offered a technical academic programme 'Electronics Engineering Diploma Programmes (EEDP)'. Heterogeneity of learners and non-uniform delivery of course content at each study centre creates a series of problems in delivering technical education. The University has attempted to keep up with curfrent distance learning technologies for imparting quality learning anywhere, anytime.

To retain the student interest in the learning process and make learning more enjoyable and exciting, highly interactive Virtual Classroom Modules (multimedia learning materials) have been created that incorporate text, video, audio and graphics with simple interactive animation. VCMs combine distance education instructional pedagogy with the latest interactive multimedia technology.

The work described in this paper represents an innovative approach to the design; creation, use and total quality assurance of VCMs for the 'Basic Electronics-2' theory course. It describes how VCMs enhance traditional teaching methods and help the learner to conceptualize principles of electronics and understand dynamic behavior of the electronics circuits.

Introduction

In 1996, the Yashwantrao Chavan Maharashtra Open University (YCMOU) introduced a technical programme, *Electronic Engineering Diploma Programme* (EEDP), for the first time in India. This program provides an opportunity for disadvantaged sections of society to pursue higher education in electronic engineering. These persons could not attend traditional on-campus programs for various reasons. All EEDP courses were designed specifically to enhance and refine the skills needed in today's rapidly changing competitive world of technology.

Across the state of Maharashtra, approximately 200 counselors enroll 5000 learners (students) at 40 different study centres annually. These students are from diverse academic backgrounds, interests, and motivation.

To a large extent, the success of any programme, depends upon the quality of its learning materials, delivery systems and evaluation mechanisms. Open and distance education is now established strongly in India. Until now there has been a heavy emphasis on print media for learning materials and little use of audio, video, TV, CD, etc.

In distance education, it is assumed that learners are self motivated and capable of learning on their own. Not all the learners have reached this level of maturity when they enroll in distance education programme for the first time. Thus, various media must be incorporated to enhance their learning process.

The university supports print materials with Virtual Classroom Modules (VCMs) to improve both effectiveness and efficiency of the self-learning process for the EEDP students. The development objective is to *create interactive materials that combine graphics, animations, audio/video and text in an exciting environment that provide in depth exploration of the electronics concepts and allows the learners to understand the dynamic behavior of electronics circuits and how these circuits can be utilized in real life situations.*

What is Virtual Classroom Module?

Virtual Classroom Modules are 'well prepared high quality multimedia lectures from the master trainer, which are followed by discussion and/or tutorial during face to face counseling sessions at each study centre'. One of the most important purposes of development of a Virtual Classroom Module (VCM) is to increase student understanding. Other important purpose is to increase student, interest, motivation, and retention and to provide uniformity in counseling.

Interactive multimedia delivery systems greatly enhance the teaching-learning process in a higher education setting. It is well known from educational studies that we remember about 20% of what we hear, 40% of what we see and hear, and about 75% of what we see, hear and do. In addition, CBI programs provide a 10 to 20% of learning improvement as compared to conventional classroom teaching (Molnar, 1990, cited in Oblinger, 1992, p. 6).

Numerous educational studies show that the majority of students are visual learner. The information conveyed to students through interactive multimedia learning materials helps to enhance their performance by stimulating multiple senses. Further, the students of today require a more stimulating approach to learning. A step-by-step animation of a circuit ,with explanations, will make a lasting impression on students and make it easier to recall. VCM uses the multiple-sense approach to learning to increase retention in order to foster interest in the material necessary for retention. (Karuppan, 1999).

Heterogeneity of learners as well as non-uniform delivery of course content at each study centre creates a very serious problem in imparting technical education. During each counseling session, student learning depends on the presentation method/style of the instructor. While some instructors may express themselves fluently, others are less articulate even though they know their subject well. Further, to make the learning process more enjoyable and exciting, highly interactive VCMs have been created that incorporate text, video, audio, graphics, simple and interactive animation. "The best use of technology occurs when the academic complements a deep understanding of the subject with imagination and a vision of how the subject could be taught differently with new technologies" (Bates, 2000, p.75). Thus the use of standardized counseling aids like VCMs makes the presentations more uniform.

Multimedia applications spark interest and enthusiasm for learning. A VCM may be used before starting a new topic to give an overview, stimulate a student's attention, and prepare the student before starting actual discussion. This approach to present fundamental concepts for critical discussion and understanding is the most effective because each presentation module is followed by discussion and/or tutorial for about 15 ± 5 minutes with a counselor. It ensures effective learning and active participation of students and fully engages the student in the learning process. Furthermore, it encourages higher level of thinking and allows students to develop skills in dealing with the technology in a professional environment**.**

Mixing both face-to-face counseling and VCMs provide an engaging environment for an optimum learning experience. VCMs are more effective than self-instructional textbooks because of their audio-visual media and interactive components. The University plans to develop VCMs which combines distance education instructional pedagogy with latest interactive multimedia technology for imparting quality learning anywhere, anytime.

New Perspective of Teaching

One of the most essential factors in a student's academic success is his/her desire to learn. This desire can be enhanced by presenting course material in an attractive manner that motivates students to learn. For example, combining text, audio, graphics, and motion to animate technical concepts/circuit diagram helps students to understand the main concepts and enable "learning by doing". VCMs have proven to be effective in technical education because they hold students' attention and encourage their involvement.

To create a learning environment in web compatible electronic form, the course contents of BET042: Basic electronics-2, Theory were divided into small topics known as modules. Duration of a typical VCM is limited to 20 ± 5 minutes to ensure student's concentration. For each credit point, the University plans to develop 5 VCMs. Hence, for this 6 credit course point, a total 30 VCMs were developed. This covers most of the difficult topics like operational amplifier, oscillators and power supplies and their applications. To understand and explore each electronic circuit and its analysis in depth, appropriate media is to used. For example, to illustrate operation and analysis of various Op Amp circuits, 20 modules are available on Op Amp. During the VCM presentation, various effects such as 'Entrance, Emphasis, Exit and Motion' are used to highlight important concepts, key points and steps in circuit operation Synchronized audio improves learning effectiveness and retains student interest during presentation. At the end of each module, there are summary, solved examples, data sheets, study tips, and on-line self-tests.

VCMs can be used in two modes - standard mode and slide show mode. Standard mode is recommended to reinforce self-study. It provides better flexibility and controls for the individual learner. In this mode learner needs to interact with VCM to continue its play, which ensures more learner involvement in the learning process. Use of slide show mode is recommended at the study centre to provide better visibility and unattended play of sound and animation for all VCM slides.

Development Process of VCM

> 'In open and distance education, the expected outcomes of learning depend heavily on efficient and effective design of instructional materials to fit peculiar characteristics and needs of the adult learner (Jegede, 1992, 1998). The teaching of course content must also be done using appropriately selected media or technology to complement or supplement the print based materials. All these complex and inter-woven activities in the delivery of instruction at a distance aggregate to form enormous tasks which require extensive research effort to generate information which support and guide the accomplishment of the tasks'.
>
> **Olugbemiro Jegede**
> **Centre for Research in Distance & Adult Learning**
> **Open University of Hong Kong**

Dr. A P J Kalam, President of India expressed this need clearly while addressing the inauguration of the conference on EDUSAT, Bangalore (23-07-2004: Bangalore):

> 'There are three components for education: lectures, laboratory and library. The content includes all the above three. The content should have supportive animations, which may even bring virtual laboratories and virtual immersion effects to the remote students. When the content is generated, it should be a sharable learning object across the nation and across all platforms. The content may be generated making use of the student's creative and innovative thoughts under the guidance of the expert teachers as a group activity based on a pre-determined standard.'

Thus, the development process is based on research and best practices. This paper sets out the processes and procedures dev eloped by the School of Science and Technology, YCMOU to successfully implement design and creation of highly engaging and accessible learning materials. VCM development is teamwork involving many steps and processes. A brief summary of the VCM development process (Killedar, 2002) is as follows:

1. Prepare a list of probable VCM Titles for difficult topics from the course
2. Identify experts for the development team and allot work to them
3. Prepare the first draft of VCM: Storyboard for each slide and transcript of associated text or lecture (prepared by Academic Resource Person)
4. Edit Content and Technical Skills (Academic and Technical Editor)
5. Edit Language (Language Editor)
6. Modify first draft of VCM: incorporate suggestions of editors for each slide and transcript of its associated lecture/presentation (Academic Resource Person)
7. Prepare Second draft of VCM in an electronic form (Technical Resource Person)
8. Obtain collective approval from (1) Academic Resource Person (2) Academic and Technical Editor and (3) Language Editor
9. Prepare and submit Third draft of VCM in electronic form, containing prerecorded lecture for each slide and basic animation by Technical Resource Person
10. Assess 'Total Quality' for final approval or rejection by 'School Preview'
11. Update final draft to final VCM for Committee approval
12. Pay Honorarium to all members of development team (by University).

VCM Templates

Based on distance educational pedagogy and interactive multimedia technology, a VCM template was developed to guide new developers. Templates have a number of advantages that include:

- Ease of use
- Uniformity
- Cost-effectiveness
- A number of evaluative strategies to ensure quality
- Clear delivery methods (e.g. DVD, CD-ROM/ WWW)

Table 1 shows the details of VCM templates

Table 1

VCM Template

Sr. No.	Name of Slides
1	**VCM-CCCXXX-XXX** : Module Title
2	**Credits**
3	**Learning Objectives** Each module has well defined learning objectives.
4	**Prerequisites** Each module has clearly stated pre-requisites for the fruition
4	**Introduction**, where the main goal of the module is stated and curiosity is aroused to learn the module content.
5	**Key Terms**: This consists of a list of important terms which student should know and are frequently coming across the modules.
6	**Section Title of Your Module-1**: which is the real body of the module content, containing the explanation of all the concepts, circuit operations, procedures etc;
7	**Section Title of Your Module-2**: which is the real body of the module content, containing the explanation of all the concepts, circuit operations, procedures etc;
8	**Section Title of Your Module-3** : which is the real body of the module content, containing the explanation of all the concepts, circuit operations, procedures etc;
9	**Section Title of Your Module-4**: which is the real body of the module content, containing the explanation of all the concepts, circuit operations, procedures etc;
10	**Section Title of Your Module-5**: which is the real body of the module content, containing the explanation of all the concepts, circuit operations, procedures etc;
11	**Section Title of Your Module-6**: which is the real body of the module content, containing the explanation of all the concepts, circuit operations, procedures etc;
12	**Summary**, which consists of a list of the fundamental concepts the student should have acquired after studying the main content;
13	**Study Tips** (Includes book references, links to datasheets, website address related to content covered, Online Self Test) A link to online self-test provides self-evaluation in the form of a test with automatic feed-back; it consists in a set of questions with predefined answers, and the result obtained may be used to determine whether or not the student has acquired the required exit level of knowledge for the module.
14	**End of the Module**
15	**Solved Examples** (To refer required formulae, hyperlinks are provided to particular content) which contains a collection of exercises with their solutions so that the student can check the knowledge of the concepts presented;
16	**Derivation** (To refer how formulae/equations are derived, hyperlinks are provided to particular content) which contains a collection of steps so that the student can check how the particular formula is derived based on knowledge of the concepts presented.

Coherence and Integration of Media and Technology in VCM

Standardized software and hardware are used to create each stand-alone, self learning (user friendly) module.

- Web compatible technologies
- State of art of compression techniques to keep small file size
- Simple animation to explain difficult concept and circuit operation
- Synchronization of animation with timeline of audio lecture

VCMs are designed using only web compatible technologies to facilitate distribution on the web and/or CD. Small file size and rich multimedia quality is ensured by using state of art software and compression techniques. Without video, a typical VCM size is approximately 3 MB. Hence, about 200 VCMs can be easily accommodated on a single CD. To distribute 30 VCMs of BET042 course one CD is sufficient. The cost of CD is negligible compared to printed textbooks, so students can get a multimedia learning experience at low cost.

VCMs are the best viewed with Microsoft's 'Internet Explorer 6', 'Office Animation Runtime', 'Windows Media Player 9' and 'Adobe Acrobat Reader 6' at a minimum 800 x 600 resolution and true color setting on any multimedia PC. This free software can be downloaded from web.

Using this standardization, students are able to interact with real teachers through discussion forum on web for online counseling. Online self-tests on the University website enables the students to receive formative feedback about the content covered in the module.

Quality Assurance

Total quality testing is an integral part of the development process in development of high quality VCM learning materials. Rigorous testing is undertaken by the School preview committee. The developed VCM material is subjected to rigorous quality controls to ensure the materials are of high quality, meet all guidelines, and are fit for purpose. Figure 1 shows various qualities Controls.

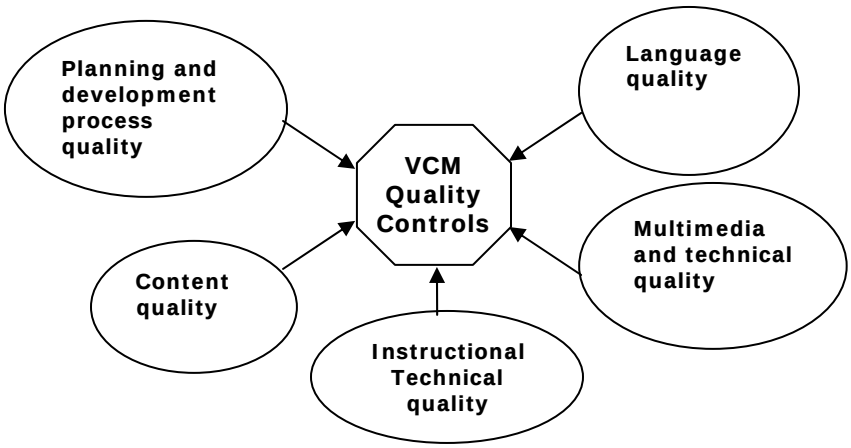


Figure 1. The University constituted a School Preview Committee to evaluate the total quality of each VCM as a learning tool.

A quality parameter checklist based on developed based on the above quality parameters, cover:

- Content
- Functionality
- Cross-compatibility
- Compliance to YCMOU guidelines
- Web compliance for people with disabilities

The School Preview Committee evaluates Total Quality of the VCM. Each quality parameter is assessed on a 5 point scale by consensus among the members. A minimum 300 quality points is essential for acceptance; otherwise VCM is rejected. Suggestions for quality improvement from the "School Preview Committee" are incorporated in the final version of VCM.

Evaluation

To determine the impact of VCMs on the students learning and to improve teaching of the course, students were interviewed and quality of the prepared modules was evaluated by evaluating following quality parameters:

- Planning and Development Quality
- Content Quality
- Instructional Technology Quality
- Language Quality
- Multimedia Quality

A 'Total Quality' Assessment Format was used to take students opinion about total quality consisting of content quality, language quality, and instructional technology quality of all these modules. Students were also interviewed related to accessibility, effectiveness of modules, its help in clarifying difficult concepts, and organization of modules. Since, the modules were available on the web; comments were received from students and faculty from other universities. Students were excited and satisfied by this new learning tool compared to traditional style of teaching. They also stated that the VCMs aided in conceptualization of Electronics principles and circuit operations that could be effectively applied in practice. The initial experience of students as well as faculty has been very positive.

Evidence of Impacts

Technology in and of itself does nothing to improve education. The use of technology as a tool, the use of technology to supplement learning, and the use of technology to draw the students in and create the stimulating environment that fosters learning is what is needed.

Almost all students preferred modules that incorporated animation and interactivity to traditional static images and diagrams. They welcomed the technology with enthusiasm and overwhelmingly considered that these VCMs to be helpful in understanding difficult concepts. Hence, students will learn more and retain more as VCMs are developed with 'Self-Instructional' features of distance education pedagogy.

In addition, they are able to gain access at their own time and pace outside the classroom and laboratory as VCMs are available for use on Web and/or CD. With VCMs the student's ability to analyze, think and apply various electronics concepts are enhanced. Students are encouraged to engage in creativity, design processes, and troubleshooting electromechanical systems that they use at home and work place.

Examples of VCMs Topics

Basic Theory of Differential amplifier: Two modules are available on differential amplifier which allows students to study different configuration of differential amplifier, its basic principle of operation, why differential amplifier is used as a building block of IC Op Amp. For better understanding of analysis of differential amplifier, circuit animation in streamline with audio is done. Thus, the students understanding of the underlying concepts have been enhanced by providing a rich suite of circuit's animation.

Op Amp Theory: Modules available on this topic, gives the students the ability to immediately familiarize with the various terminologies used in Op amp, its ideal and practical characteristics, circuit symbol and its pin diagram. In addition student can investigate the basics associated with the characteristics, DC biasing, open loop and closed loop configuration of Op Amp with the help of various Op Amp circuit via a combination of simple animation and audio.

Inverting Op Amp Amplifier: Closed loop configuration of Op Amp in inverting mode has been used as the foundation for this module. This module gives the student the ability to immediately study the effect of negative feedback on the amplifier gain, input impedance, output impedance, offset voltage and frequency response. With the aid of a highly animated circuit diagram, the virtual ground concept and analysis of Inverting amplifier using virtual ground concept has been illustrated.

Noninverting amplifier using Op Amp: This module provides the student with an understanding of how noninverting amplifier can be designed and analyzed using Op Amp which will meet most of the ideal characteristics of voltage amplifier. More emphasis is given on the concept or fundamental understanding with the aid of animated circuit diagram and synchronized audio. This will allow the student to explore their understanding of material in analytical or problem solving approach.

Linear Application of Op amp: Over five modules are available to student on the various linear applications of Op Amp such as AC amplifier, Summing amplifier, differential amplifier, instrumentation amplifier and single supply AC amplifier. A rich suite of animated circuit diagram with synchronized audio are presented to enhance the student learning process. It allows the student to design and analyze various Op Amp circuits. In addition, the essential data sheets in PDF format is provided for immediate reference. Hyperlinks are also provided for online guidance of the specified content.

Nonlinear Application of Op Amp: To explore the various nonlinear application of Op Amp with well illustrated examples, animated circuit diagram and streamline audio, total six modules are available. These modules covers the most frequently required applications such as active diode circuits, Comparator, Schmitt Trigger, Integrator, Differentiator, Waveform generator. Thus, by presenting each module in VCM format, helps the students to visualize the dynamic behavior of the Op Amp circuit and becomes very easy for them to visualize how the electronic circuits behave.

Sinusoidal Oscillators: These modules are presented to allow the student to understand and analyze how sinusoidal oscillations are generated, what is essential condition to develop sustained oscillation? A highly animated circuit diagram, synchronized audio and well illustrated examples helps the student to immediately understand the circuit diagram, working principle, applications of RC phase shift, Wien Bridge, and crystal oscillator.

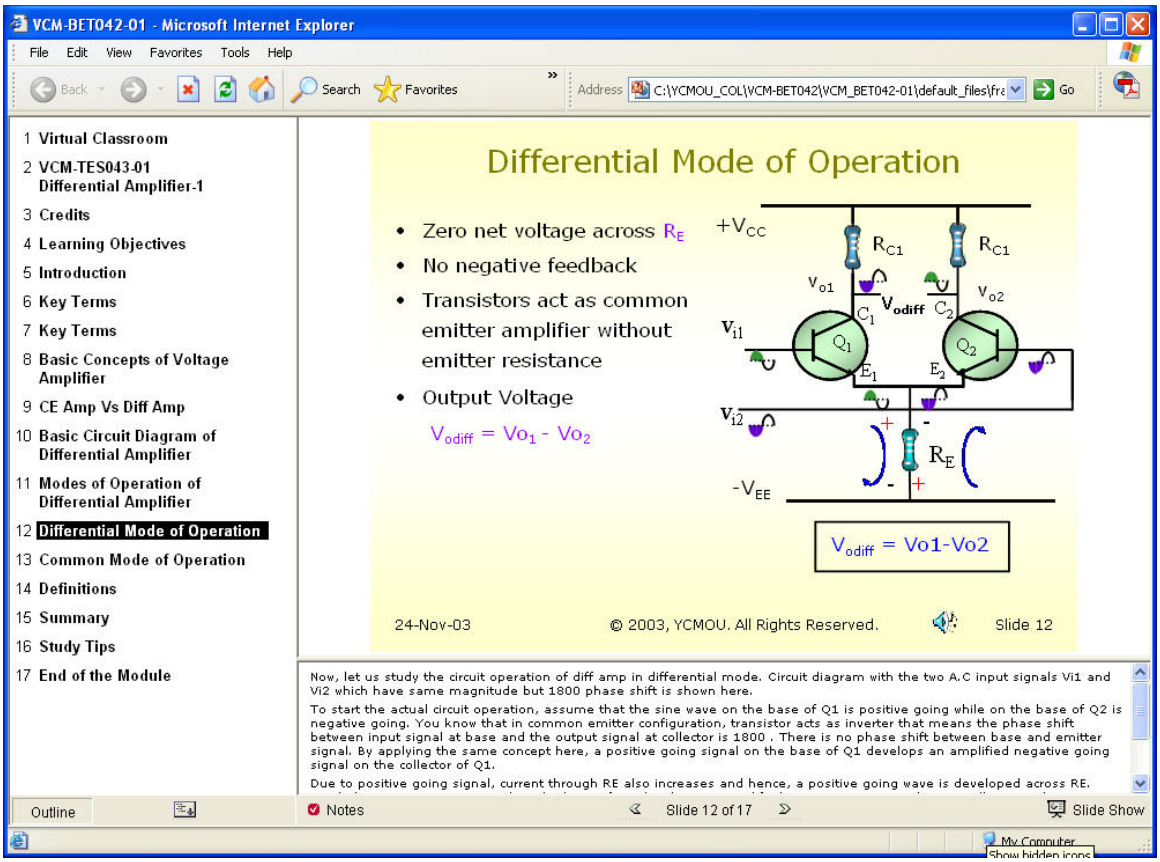
IC 555: To present the operation and applications of the popular and versatile '555' timer integrated circuit, three modules are prepared. The basic block diagram of IC 555, astable and monostable configurations of the circuits are available to exhibit the timing circuits associated

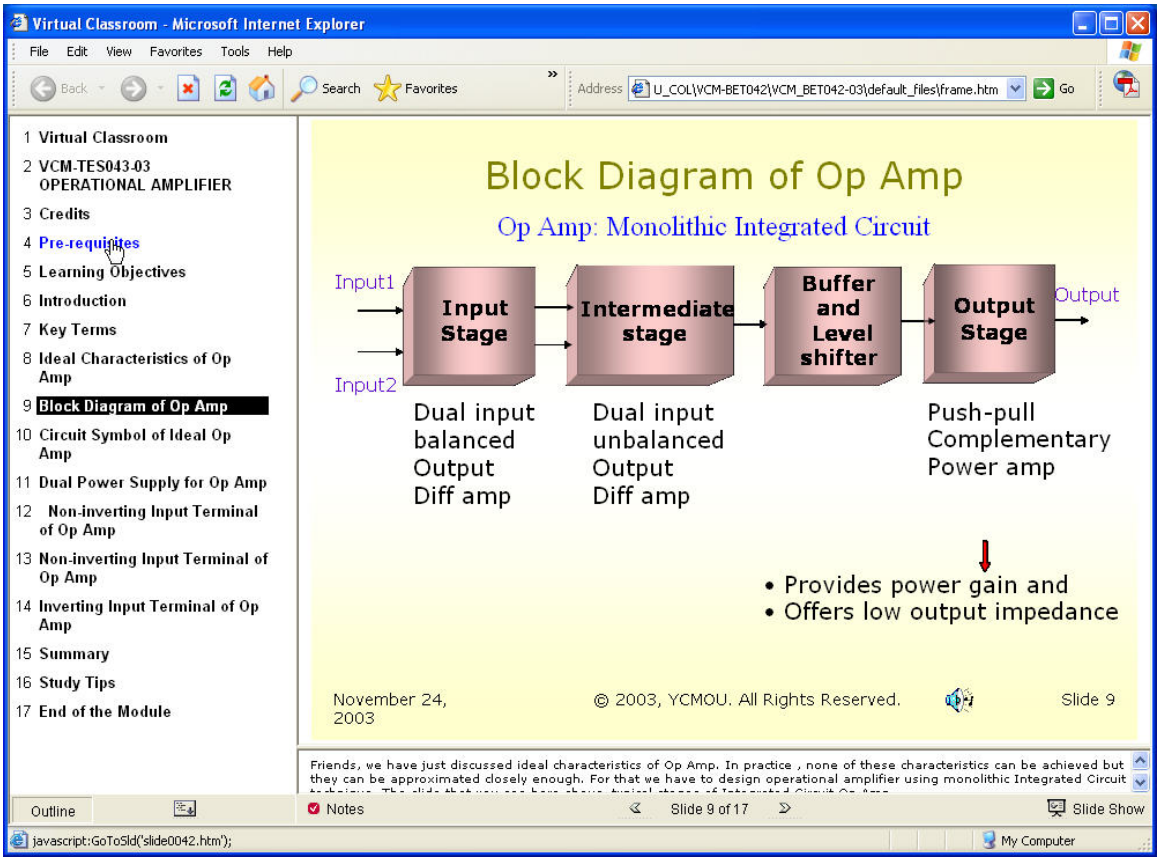
with oscillators and single pulse generation. A rich suit of animated circuit diagram provides a very basic understanding of how the circuit's output signal evolves over time.

Voltage Regulator: In order to enhance the student's critical mind and to understand the most commonly used voltage regulated power supply in detail; four modules are available. These modules covers in detail the ideal characteristics of voltage regulator, transistorized series voltage regulator with current limiting technique, Zener voltage regulator, three terminal regulator and switched mode power supply (SMPS).

For each module, in addition to rich suite of animated circuit diagram with synchronized audio, the essential data sheets in PDF format are provided for immediate reference. Hyperlinks are also provided for online guidance of the specified content. Further, to enhance the understanding of underlying concept of each module, hyperlinks are provided for derivation and Solved problems.

10 Sample Screens:

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1 Virtual Classroom
2 VCM-TES043-03 OPERATIONAL AMPLIFIER
3 Credits
4 Pre-requisites
5 Learning Objectives
6 Introduction
7 Key Terms
8 Ideal Characteristics of Op Amp
9 Block Diagram of Op Amp
10 Circuit Symbol of Ideal Op Amp
11 Dual Power Supply for Op Amp
12 Non-inverting Input Terminal of Op Amp
13 Non-inverting Input Terminal of Op Amp
14 Inverting Input Terminal of Op Amp
15 Summary
16 Study Tips
17 End of the Module
Block Diagram of Op Amp
Op Amp: Monolithic Integrated Circuit
Input1
Input2
Input Stage
Intermediate stage
Buffer and Level shifter
Output Stage
Output
Dual input balanced Output Diff amp
Dual input unbalanced Output Diff amp
Push-pull Complementary Power amp
• Provides power gain and
• Offers low output impedance
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Slide 9
Friends, we have just discussed ideal characteristics of Op Amp. In practice , none of these characteristics can be achieved but they can be approximated closely enough. For that we have to design operational amplifier using monolithic Integrated Circuit
Outline
Notes
Slide 9 of 17
Slide Show
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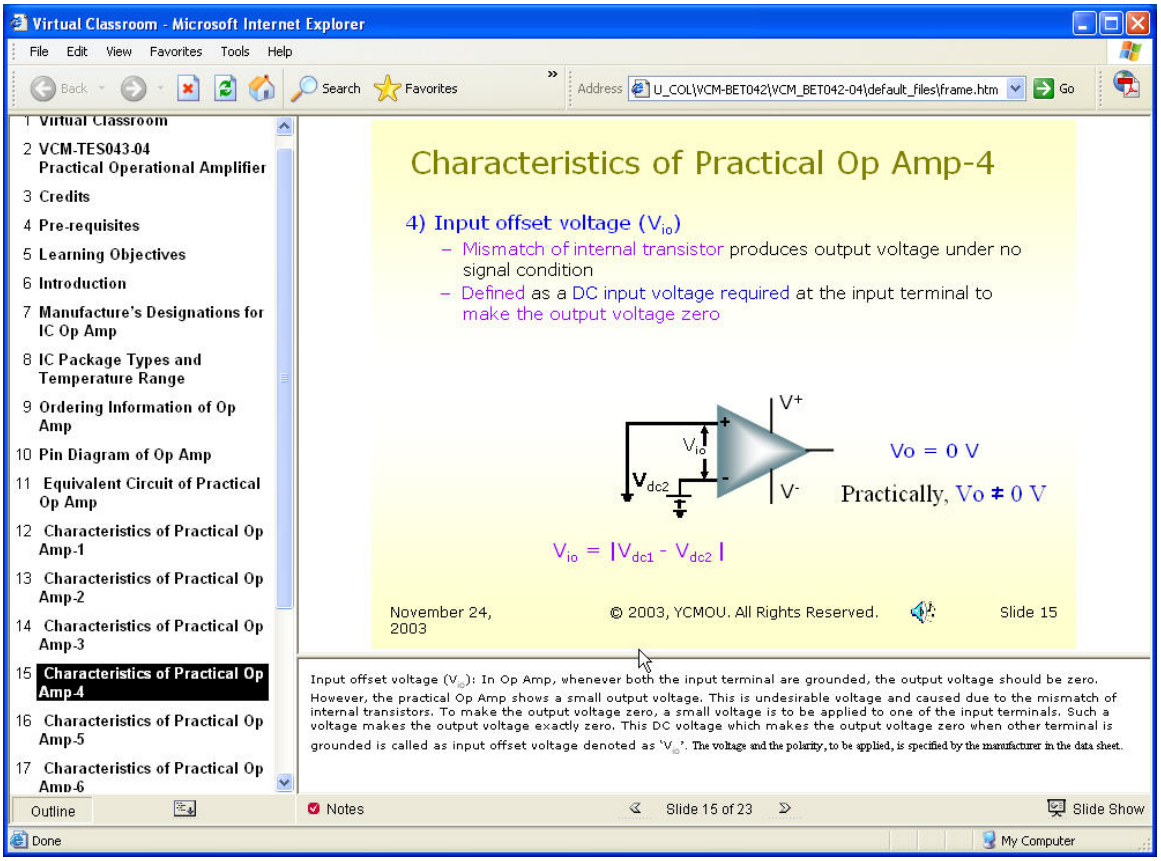
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2 VCM-TES043-04 Practical Operational Amplifier
3 Credits
4 Pre-requisites
5 Learning Objectives
6 Introduction
7 Manufacture's Designations for IC Op Amp
8 IC Package Types and Temperature Range
9 Ordering Information of Op Amp
10 Pin Diagram of Op Amp
11 Equivalent Circuit of Practical Op Amp
12 Characteristics of Practical Op Amp-1
13 Characteristics of Practical Op Amp-2
14 Characteristics of Practical Op Amp-3
15 Characteristics of Practical Op Amp-4
16 Characteristics of Practical Op Amp-5
17 Characteristics of Practical Op Amp-6
Characteristics of Practical Op Amp-4
4) Input offset voltage (V_{io})
– Mismatch of internal transistor produces output voltage under no signal condition
– Defined as a DC input voltage required at the input terminal to make the output voltage zero
V+
V-
V_{io}
V_{dc2}
Vo = 0 V
Practically, Vo ≠ 0 V
$V_{io} = |V_{dc1} - V_{dc2}|$
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Slide 15
Input offset voltage (V_{io}): In Op Amp, whenever both the input terminal are grounded, the output voltage should be zero. However, the practical Op Amp shows a small output voltage. This is undesirable voltage and caused due to the mismatch of internal transistors. To make the output voltage zero, a small voltage is to be applied to one of the input terminals. Such a voltage makes the output voltage exactly zero. This DC voltage which makes the output voltage zero when other terminal is grounded is called as input offset voltage denoted as 'V_{io}'. The voltage and the polarity, to be applied, is specified by the manufacturer in the data sheet.
Outline
Notes
Slide 15 of 23
Slide Show
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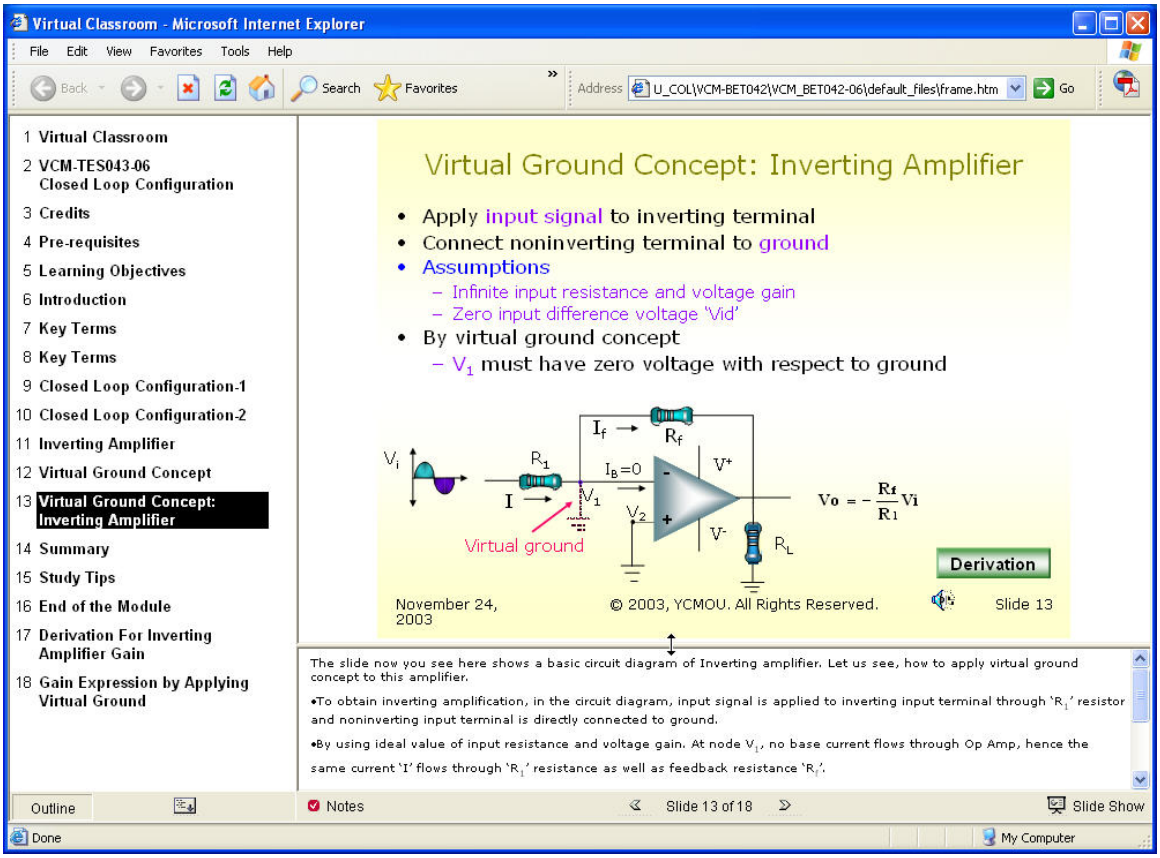
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1 Virtual Classroom
2 VCM-TES043-06 Closed Loop Configuration
3 Credits
4 Pre-requisites
5 Learning Objectives
6 Introduction
7 Key Terms
8 Key Terms
9 Closed Loop Configuration-1
10 Closed Loop Configuration-2
11 Inverting Amplifier
12 Virtual Ground Concept
13 Virtual Ground Concept: Inverting Amplifier
14 Summary
15 Study Tips
16 End of the Module
17 Derivation For Inverting Amplifier Gain
18 Gain Expression by Applying Virtual Ground
Virtual Ground Concept: Inverting Amplifier
Apply input signal to inverting terminal
Connect noninverting terminal to ground
Assumptions
Infinite input resistance and voltage gain
Zero input difference voltage 'Vid'
By virtual ground concept
V1 must have zero voltage with respect to ground
Vi
R1
I
If
Rf
IB=0
V1
V2
V+
V-
RL
Virtual ground
Vo = - Rf/R1 Vi
Derivation
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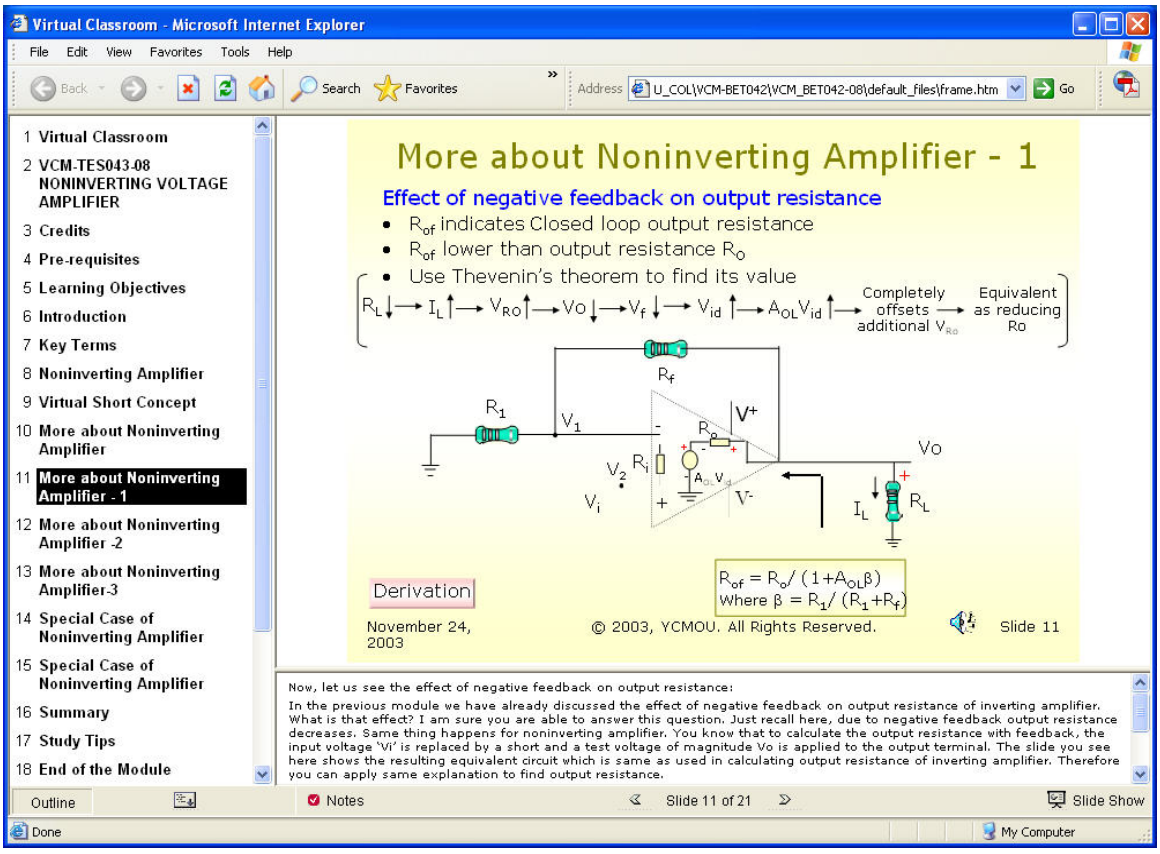
Slide 13
The slide now you see here shows a basic circuit diagram of Inverting amplifier. Let us see, how to apply virtual ground concept to this amplifier.
•To obtain inverting amplification, in the circuit diagram, input signal is applied to inverting input terminal through 'R1' resistor and noninverting input terminal is directly connected to ground.
•By using ideal value of input resistance and voltage gain. At node V1, no base current flows through Op Amp, hence the same current 'I' flows through 'R1' resistance as well as feedback resistance 'Rf'.
Outline
Notes
Slide 13 of 18
Slide Show
Done
My Computer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1 Virtual Classroom
2 VCM-TES043-08 NONINVERTING VOLTAGE AMPLIFIER
3 Credits
4 Pre-requisites
5 Learning Objectives
6 Introduction
7 Key Terms
8 Noninverting Amplifier
9 Virtual Short Concept
10 More about Noninverting Amplifier
11 More about Noninverting Amplifier - 1
12 More about Noninverting Amplifier -2
13 More about Noninverting Amplifier-3
14 Special Case of Noninverting Amplifier
15 Special Case of Noninverting Amplifier
16 Summary
17 Study Tips
18 End of the Module
More about Noninverting Amplifier - 1
Effect of negative feedback on output resistance
Rof indicates Closed loop output resistance
Rof lower than output resistance Ro
Use Thevenin's theorem to find its value
RL ↓ → IL ↑ → VRO ↑ → Vo ↓ → Vf ↓ → Vid ↑ → AOL Vid ↑ → Completely offsets additional VRo → Equivalent as reducing Ro
Rf
R1
V1
V+
V-
V2
Ri
Vi
Vo
IL
RL
Derivation
Rof = Ro/ (1+AOLβ)
Where β = R1/ (R1+Rf)
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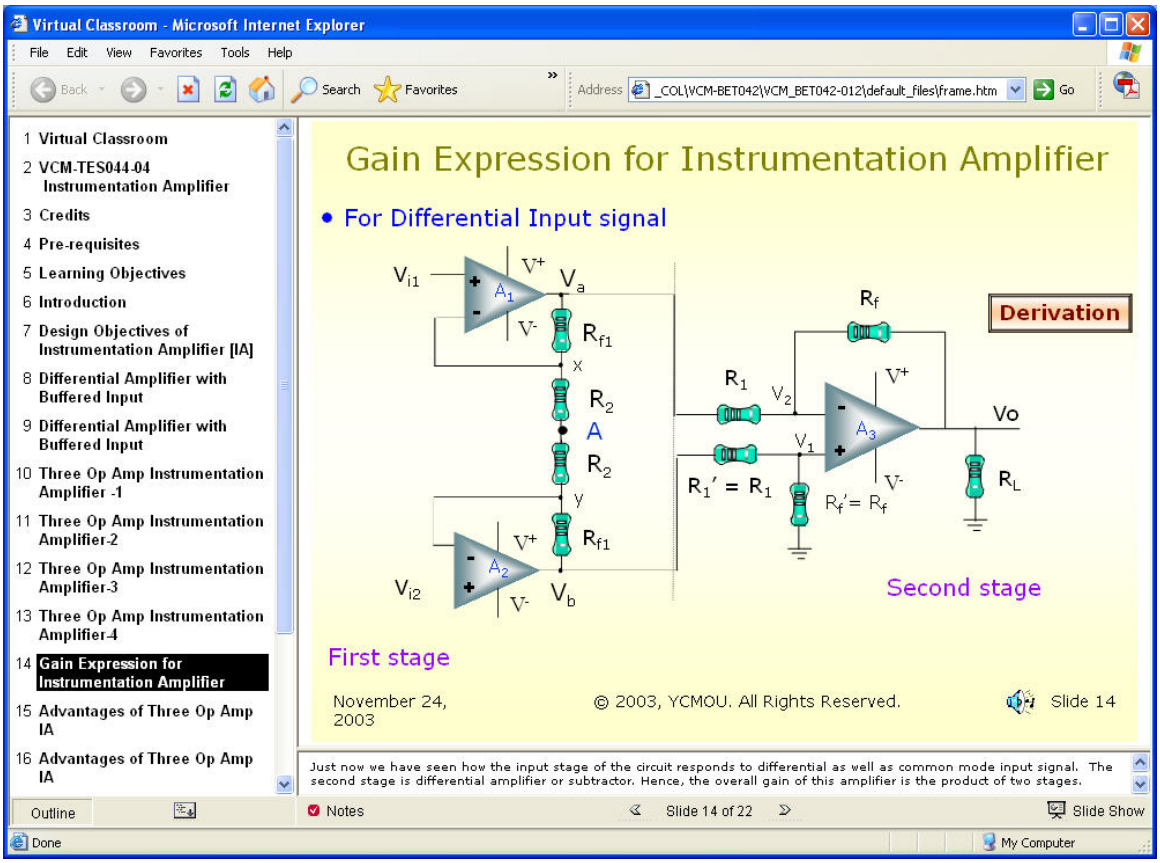
Slide 11
Now, let us see the effect of negative feedback on output resistance:
In the previous module we have already discussed the effect of negative feedback on output resistance of inverting amplifier. What is that effect? I am sure you are able to answer this question. Just recall here, due to negative feedback output resistance decreases. Same thing happens for noninverting amplifier. You know that to calculate the output resistance with feedback, the input voltage 'Vi' is replaced by a short and a test voltage of magnitude Vo is applied to the output terminal. The slide you see here shows the resulting equivalent circuit which is same as used in calculating output resistance of inverting amplifier. Therefore you can apply same explanation to find output resistance.
Outline
Notes
Slide 11 of 21
Slide Show
Done
My Computer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1 Virtual Classroom
2 VCM-TES044-04 Instrumentation Amplifier
3 Credits
4 Pre-requisites
5 Learning Objectives
6 Introduction
7 Design Objectives of Instrumentation Amplifier [IA]
8 Differential Amplifier with Buffered Input
9 Differential Amplifier with Buffered Input
10 Three Op Amp Instrumentation Amplifier -1
11 Three Op Amp Instrumentation Amplifier-2
12 Three Op Amp Instrumentation Amplifier-3
13 Three Op Amp Instrumentation Amplifier-4
14 Gain Expression for Instrumentation Amplifier
15 Advantages of Three Op Amp IA
16 Advantages of Three Op Amp IA
Gain Expression for Instrumentation Amplifier
For Differential Input signal
Derivation
First stage
Second stage
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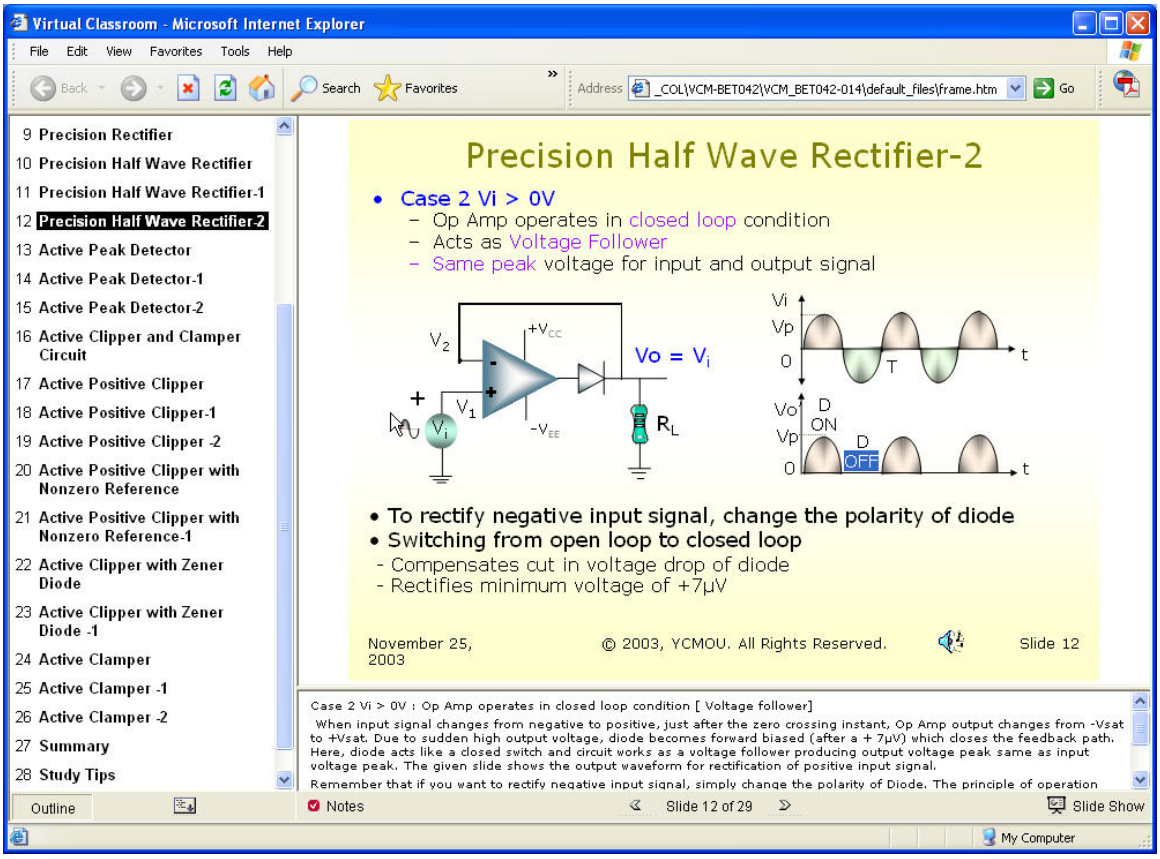
Slide 14
Just now we have seen how the input stage of the circuit responds to differential as well as common mode input signal. The second stage is differential amplifier or subtractor. Hence, the overall gain of this amplifier is the product of two stages.
Outline
Notes
Slide 14 of 22
Slide Show
Done
My Computer


Virtual Classroom - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
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Go
9 Precision Rectifier
10 Precision Half Wave Rectifier
11 Precision Half Wave Rectifier-1
12 Precision Half Wave Rectifier-2
13 Active Peak Detector
14 Active Peak Detector-1
15 Active Peak Detector-2
16 Active Clipper and Clamper Circuit
17 Active Positive Clipper
18 Active Positive Clipper-1
19 Active Positive Clipper -2
20 Active Positive Clipper with Nonzero Reference
21 Active Positive Clipper with Nonzero Reference-1
22 Active Clipper with Zener Diode
23 Active Clipper with Zener Diode -1
24 Active Clamper
25 Active Clamper -1
26 Active Clamper -2
27 Summary
28 Study Tips
Precision Half Wave Rectifier-2
Case 2 Vi > 0V
Op Amp operates in closed loop condition
Acts as Voltage Follower
Same peak voltage for input and output signal
Vo = Vi
To rectify negative input signal, change the polarity of diode
Switching from open loop to closed loop
Compensates cut in voltage drop of diode
Rectifies minimum voltage of +7μV
November 25, 2003
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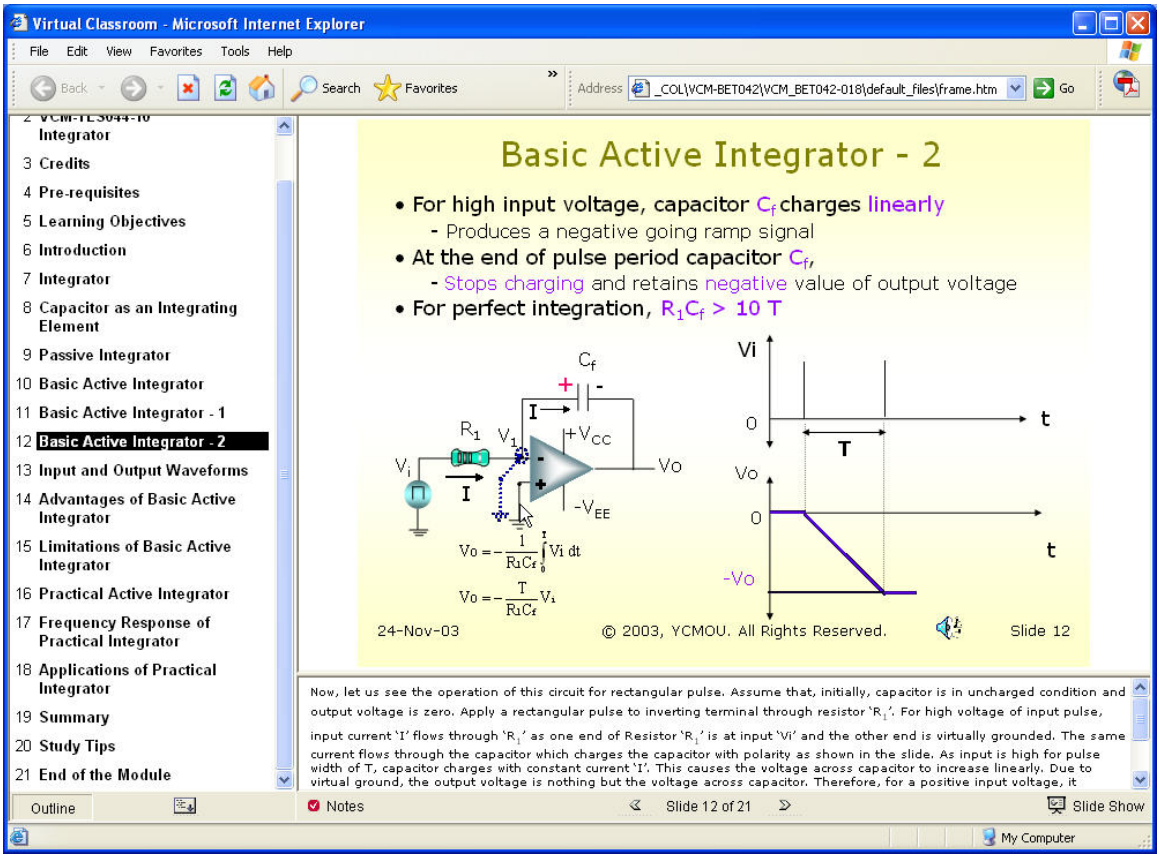
Slide 12
Case 2 Vi > 0V : Op Amp operates in closed loop condition [Voltage follower]
When input signal changes from negative to positive, just after the zero crossing instant, Op Amp output changes from -Vsat to +Vsat. Due to sudden high output voltage, diode becomes forward biased (after a + 7μV) which closes the feedback path. Here, diode acts like a closed switch and circuit works as a voltage follower producing output voltage peak same as input voltage peak. The given slide shows the output waveform for rectification of positive input signal.
Remember that if you want to rectify negative input signal, simply change the polarity of Diode. The principle of operation
Outline
Notes
Slide 12 of 29
Slide Show
My Computer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Go
Integrator
3 Credits
4 Pre-requisites
5 Learning Objectives
6 Introduction
7 Integrator
8 Capacitor as an Integrating Element
9 Passive Integrator
10 Basic Active Integrator
11 Basic Active Integrator - 1
12 Basic Active Integrator - 2
13 Input and Output Waveforms
14 Advantages of Basic Active Integrator
15 Limitations of Basic Active Integrator
16 Practical Active Integrator
17 Frequency Response of Practical Integrator
18 Applications of Practical Integrator
19 Summary
20 Study Tips
21 End of the Module
Outline
Basic Active Integrator - 2
• For high input voltage, capacitor Cf charges linearly
- Produces a negative going ramp signal
• At the end of pulse period capacitor Cf,
- Stops charging and retains negative value of output voltage
• For perfect integration, R1Cf > 10 T
Cf
R1
V1
Vi
I
+Vcc
-VEE
Vo
Vo = -1/(R1Cf) ∫ Vi dt
Vo = -T/(R1Cf) Vi
Vi
0
t
T
Vo
0
t
-Vo
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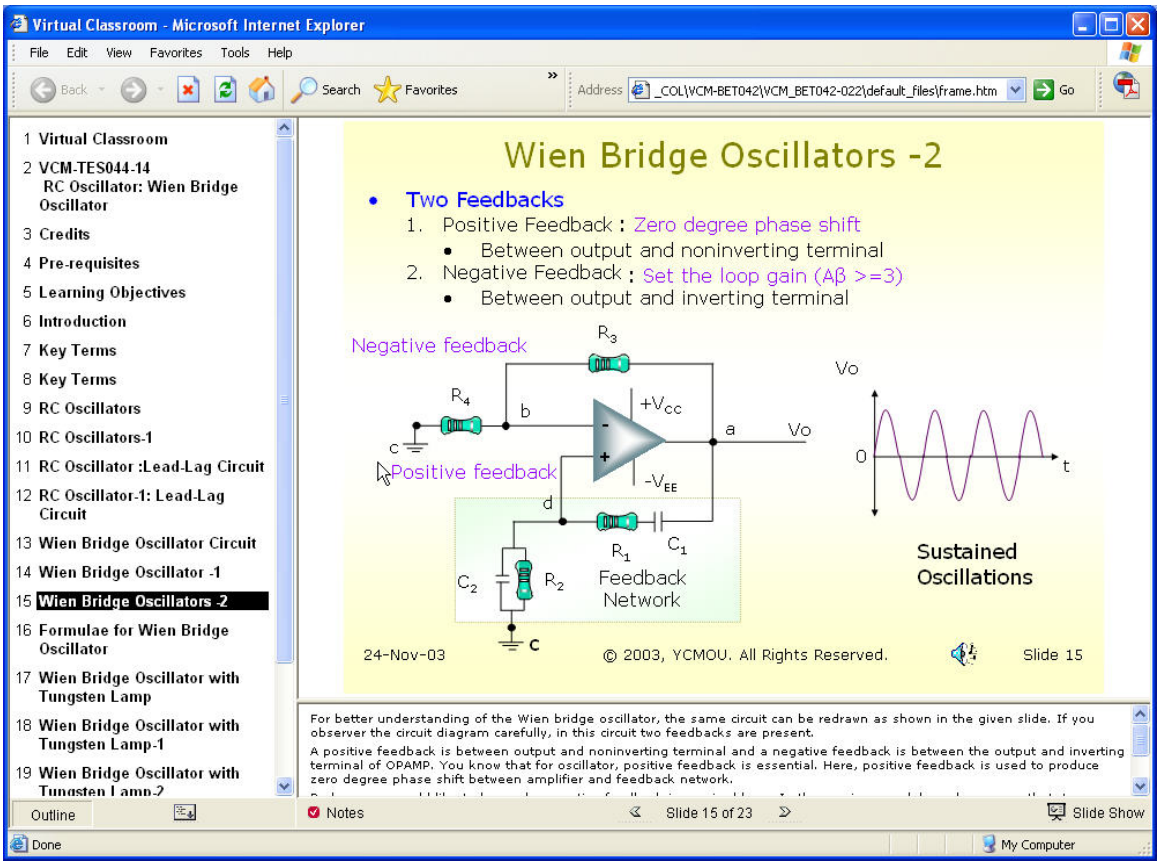
Slide 12
Now, let us see the operation of this circuit for rectangular pulse. Assume that, initially, capacitor is in uncharged condition and output voltage is zero. Apply a rectangular pulse to inverting terminal through resistor 'R1'. For high voltage of input pulse, input current 'I' flows through 'R1' as one end of Resistor 'R1' is at input 'Vi' and the other end is virtually grounded. The same current flows through the capacitor which charges the capacitor with polarity as shown in the slide. As input is high for pulse width of T, capacitor charges with constant current 'I'. This causes the voltage across capacitor to increase linearly. Due to virtual ground, the output voltage is nothing but the voltage across capacitor. Therefore, for a positive input voltage, it
Notes
Slide 12 of 21
Slide Show
My Computer


Virtual Classroom - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address _COL\VCM-BET042\VCM_BET042-022\default_files\frame.htm
Go
1 Virtual Classroom
2 VCM-TES044-14 RC Oscillator: Wien Bridge Oscillator
3 Credits
4 Pre-requisites
5 Learning Objectives
6 Introduction
7 Key Terms
8 Key Terms
9 RC Oscillators
10 RC Oscillators-1
11 RC Oscillator :Lead-Lag Circuit
12 RC Oscillator-1: Lead-Lag Circuit
13 Wien Bridge Oscillator Circuit
14 Wien Bridge Oscillator -1
15 Wien Bridge Oscillators -2
16 Formulae for Wien Bridge Oscillator
17 Wien Bridge Oscillator with Tungsten Lamp
18 Wien Bridge Oscillator with Tungsten Lamp-1
19 Wien Bridge Oscillator with Tungsten Lamp-2
Outline
Wien Bridge Oscillators -2
• Two Feedbacks
1. Positive Feedback : Zero degree phase shift
• Between output and noninverting terminal
2. Negative Feedback : Set the loop gain (Aβ >=3)
• Between output and inverting terminal
Negative feedback
R3
R4
b
+Vcc
-VEE
a
Vo
c
Positive feedback
d
R1
C1
C2
R2
Feedback Network
c
Vo
0
t
Sustained Oscillations
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Slide 15
For better understanding of the Wien bridge oscillator, the same circuit can be redrawn as shown in the given slide. If you observer the circuit diagram carefully, in this circuit two feedbacks are present.
A positive feedback is between output and noninverting terminal and a negative feedback is between the output and inverting terminal of OPAMP. You know that for oscillator, positive feedback is essential. Here, positive feedback is used to produce zero degree phase shift between amplifier and feedback network.
Notes
Slide 15 of 23
Slide Show
Done
My Computer

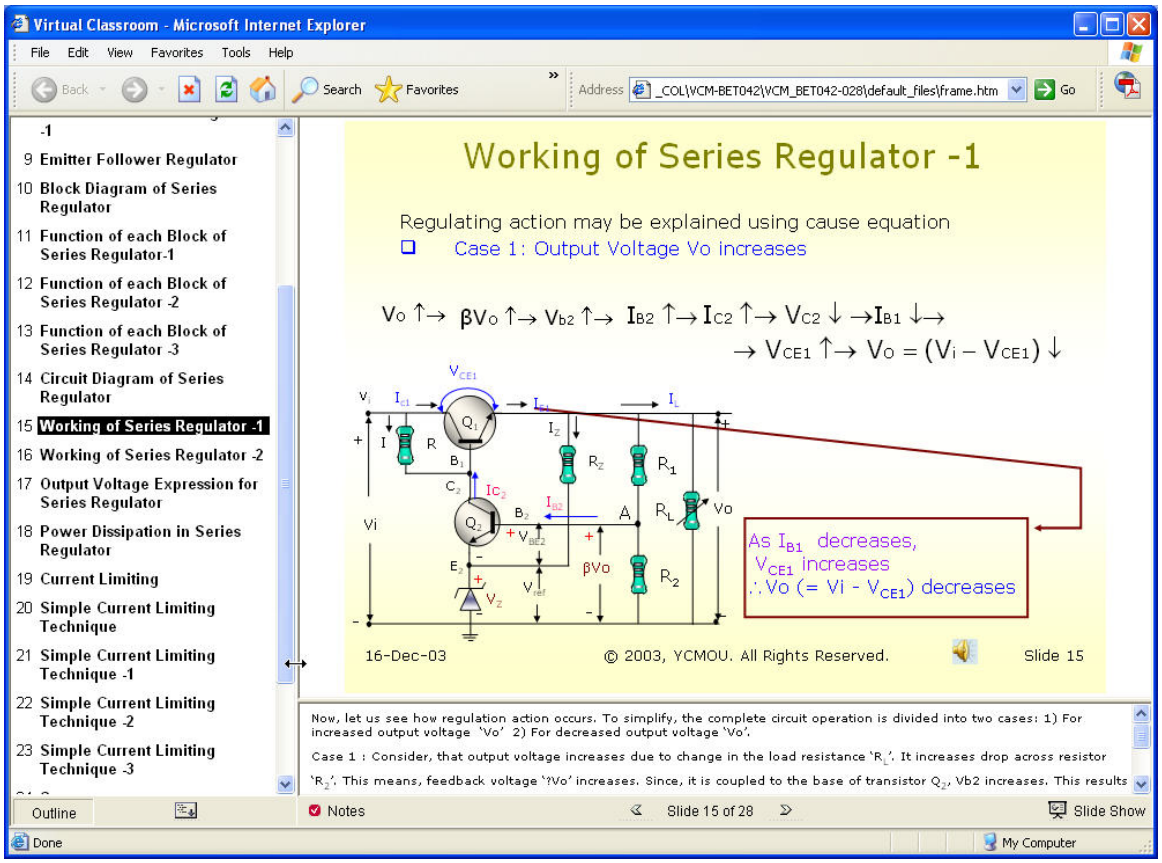

Figure 2 – 10-Sample Screens

Summary

Here, the aim was to develop and implement interactive multimedia tools for BET042 course which resembles the interaction between an excellent tutor and a student. The developed modules should serve as good learning tool to complement classroom and laboratory instruction which should enhance learning opportunities for students within the total context of their studies. All students should master the material they study. Everyone should learn to the highest level, even though the times of learning may differ from student to student

Student's feedback shows a significant positive impact on their studies, understanding the dynamic behavior of the electronics circuits. Use of VCMs has brought paradigm shift in the student community from teacher centric to learner centric. Moreover, VCMs enable anywhere anytime self-learning. At present, however, the efficacy of VCMs has been quite clearly demonstrated and surely deserves further, in depth, investigation.

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Web Sites on Internet:

http://www.ysmou.com/: YCM Open University, India

http://www.microsoft.com/: Microsoft Corporation, USA

http://www.ouhk.edu.hk/: The Open University, Hong Kong

http://www.athena.edu/: Virtual Online University

About the Author

Chetana H Kamlaskar is a Lecturer at the School of Science and Technology, Yashwantrao Chavan Maharashtra Open University at Dyangangotri, Near Gangapur Dam, Gangapur, Nashik 422 222, MS, India.

E-mail: Chetana_k@rediffmail.com

Web: http://www.ycmou-st.com/

Editor's Note: As commerce and communication move from face-to-face to web transactions, so is teaching and learning. And just as PCs replaced mainframe computers, the Web is displacing personal computing with locally stored programs and data to web based equivalents. It is no longer necessary to go to home, school, or to office to use your computer; all of these resources are available on the Web wherever you have access to a computer. This study applies such technology to courses in computer programming in Korea.

Student-Centered Online Support for Learning Computer Programming:
Student Perceptions and Preliminary Study

Joong-Kak Kook

Korea

Abstract

The purpose of this study is to examine college students' perceptions of online learning environments toward learning object-oriented programming, based on student-centered learning, as a supplement to the traditional classroom on campus. Questionnaires were given to students majoring in computer science. Results of the study indicate students generally perceive online learning as positive in helping them reach their learning objectives and students see high value in specific aspects of online learning: self-directed, supports different needs, builds individual interest, delivers programming-related materials, provides access to learning content, offers alternative modes of learning, interaction and collaboration, and so on. In contrast, they do not see the online courses as having better educational value: feeling comfortable when taking online courses or online multimedia, learning more through online materials, favor online courses to traditional courses, or immediate feedback through chats. This case study was performed as a preliminary examination of online learning environments.

Keywords: online learning, object-oriented programming, student-centered learning, students' perceptions

Introduction

The computer science and engineering program, SahmYook University (SYU) has a short history, and is only 11 years old. It is a small, liberal arts, and church college, devoted to excellence in teaching. The computer science and engineering division (CSED) program is relatively new, and the accommodates about 350 students, many students are employed by industry upon graduation. To prepare students better for jobs in industry, the University is attempting to enhance students' learning activities and incorporate recent technology trends into computer science curricula.

It is generally acknowledged by IT educators that learning computer programming is difficult. Traditionally, first year computer science (CS1) courses teach the principles of computing using the basic features of chosen programming languages such as C, Java, C++ and so on. We teach structured programming - C in the first year of the computer science major, and object-oriented programming - Java in the second year (CS2).

From past research and studies, it is well known that Java is a good language to study, but learning programming is not an easy task (Cheung, 2006). We are reviewing how easy the language is to learn, and whether or not an online learning environment can support novice students to aid in their learning process. In practice, students need to spend considerable time doing practical activities outside the classroom,in order to comprehend the techniques for computer programming. To enable students to carry out programming activities off-campus, an online learning system as a supplement to traditional classroom learning, and a programming development environment accessible from anywhere, were determined to be necessary.

Today, the Internet is one of most transformative technologies in the emergence of new learning technologies. It is being introduced in many colleges to enhance teaching and learning, and prepare students for the information-age world in which we live (Monte, et al., 2003). In the search of better ways to deliver instruction or learning, faculties at the SahmYook University (SYU) also are encouraged to become involved in web-based learning and Internet technology. The university has expanded the number of courses with blended learning (a "blend" of online and traditional learning approaches). Some faculty members have already integrated these technologies into their everyday teaching activities.

Currently, a few online courses in Microsoft Word, Excel, PowerPoint, Access, Outlook, etc. are offered by SYU. These are elective courses for all freshman students with majors in Business, Science, Art, and Education that are offered every semester (Spring and Fall) at the University. They are offered as cultural studies that taught in an online format to understand "Introduction to computer practice". Most students take the online course to gain a certificate. These courses are administered by the Information and Education Center, which is attached to the University.

In SYU, no online courses are offered by the computer science and engineering division (CSED). A few faculty in the division offer limited services through an individual FTP Server or via the CSED home page (http://cs36.com). These services are insufficient for students. Currently, the only online courses in computer programming are from an off-campus vendor.

Several research papers on online programming suggest that online education and blended instruction can be as effective as traditional classroom approaches. However, few studies have focused on learner-centered satisfaction with online learning environments, particularly in the transition from traditional learning (face-to-face) to online learning approaches (Smart and James, 2006).

In this study, knowing exactly how students in the CSED perceive online learning is an important first step. The way in which online courses in computer programming are offered via the web can influence students' comprehension of computer programming and related courses, as well as the way in which faculty members use electronic teaching materials. Students may feel that online learning will better meet their needs and desires in terms of offering flexible educational opportunities anytime and anywhere, but the fact remains that little is known about how students learn or how they feel about learning online.

The objective of this study is to examine how the students feel and learn during online courses in computer programming and how they perceive the overall learning experience. The following are the main *research questions*:

- What are the students perceptions of the overall course quality of online learning if they already had programming related online learning experience?
- What are the learners' perceptions of the benefits of programming related online learning?
- What are the learner's perceptions of learner support in programming related online learning?

For a preliminary study of programming-related online learning, this study examines students' perceptions from students majoring in computer science and engineering that have experienced previous online programming courses.

Definitions

Several terms are used in this paper (often interchangeably) with the following meanings.

Student-centered learning

"student-centered learning" implies a "need for students to assume a high level of responsibility in the learning situation and be actively choosing their goals and managing their learning. They can no longer rely on the lecturer to tell them what, how, where and when to think."(Ellis, 2001, p.169). In this student-centered learning, students are required to be active participants in their learning; they learn at their own pace and use their own strategies; learning is more individualized than standardized.

Online learning

Online learning" is defined as the following: "As a technical term, online learning encompasses a range of technologies such as the world-wide-web, email, chat, newsgroups, and text, audio and video conferencing delivered over computer networks (local area networks, intranets or the public Internet) to deliver education and training, both remotely and in the classroom." (Backroad, 2003).

Web-based learning

The term web-based learning is defined as the following: "Web-based learning is often called online learning or e-learning because it includes online course content. Discussion forums via email, videoconferencing, and live lectures (videostreaming) are all possible through the web. Web based courses may also provide static pages such as printed course materials. One of the advantages of using the web to access course materials is that web pages may contain hyperlinks to other parts of the web, thus enabling access to a vast amount of web based information." (McKimm, et al., 2003, p.3).

Blended learning

Spenser defines blended learning by "e-Learning can augment traditional classroom offerings, thereby freeing up valuable resources and expanding the offering to greater numbers of campus-based students" (Spenser, 2001).

Purpose

It is anticipated that the result of this case study can contribute to the preliminary investigation of providing online learning for supporting learning of computer programming at the SYU University. The necessary elements in a learner–centered environment would greatly improve opinions, managements, and policies for students and online programming learning. By identifying both the positive attitudes and the obstacles held by students, the results of this study can also form the basis for a department-wide online learning implementation plan. The results can also be used to build future efforts aimed at implementing online learning not only in the CSED department, but in other departments or colleges throughout the SYU.

Data Collection

The questionnaire was designed to be applicable to the study's population in terms of actual working conditions. Several items, used in this questionnaire from other studies (Uskov 2003; Uskov, 2002), were rephrased for this study or developed partially by the author.

The survey volume held 3 pages, containing their experiences of online courses that supported the student-centered principles of education. The author focused on SYU students of the Computer Science and Engineering Department(CSED) major.

The students represent the population of the research target of this case study. As mentioned earlier, no computer programming-related online courses were offered by the CSED department or any other departments in SYU. Therefore, the survey asked them their online experiences toward computer programming-related online courses taken from commercial web-sites off-campus.

Before performing the survey, the first draft of the questionnaire was tested in a pilot study of 5 students (3 senior, 2 sophomore) after which revisions were made to clarify several questions. The revised questionnaires were distributed to about 350 students enrolled in the CSED. The survey asked participants to provide honest feedback about their experiences. The survey was collected over two weeks from the end of the 2nd semester of 2006.

217 out of a total of 350 students completed and returned the survey to the author.
After collecting data of 217 students, students were controlled and classified into two groups: one group of participants had taken at least one computer programming-related online course and the other group of participants had not taken any online course. The former group had 82 respondents, and the latter group had 135 respondents. The latter group of students who had not experienced such online course(s) had to be eliminated from data analysis. The author has adopted the former group only to obtain more effective and accurate information. The results of the study, therefore, are based on 82 respondents, who had taken at least one computer programming-related online course.

The questionnaire was composed of 38 items. Of them, 12 items were demographic information (Q1-Q12), such as gender, student grade, SYU online course, SYU online course, computer programming experience, computer programming-related online courses, type of available Internet mode, weekly Internet hours used on campus or off-campus. The remaining 26 items (Q13-Q38) were related to the topic of this paper.

Data analyses were carried out with SPSS v.12 (Statistical Package for Social Science), using frequencies, percentage, cross-tabulations and chi-square tests, t-test, correlations, and scale reliability.

Results and Analysis

The following is the basic information related to the respondent's characteristics or descriptive statistics.

> Of the 82 respondents who completed all aspects of computer programming-related online courses, the gender was identified as 30.5% female (N=25) and 69.5% male (N=57), as shown in Figure 1. They consisted of 54.9% (N=45) freshman, 30.5%(N=25) sophomore, 14.6%(N=12) junior, and 0% (N=0) senior. See Figure 2.
>
> The majority of respondents (97.6%, N=80) have the Internet available at home, and of them, 75.6% use a commercial cable line, and the remaining use other communication media, including DSL, MODEM, etc., while almost all of the students (98.7%, N=81) use the Internet at least three hours weekly off-campus.
>
> Students were asked the question: "What are the three main reasons to connect to the Internet?" 67.5% (N=55) of them answered for entertainment or games, and 64.6% answered for getting general 1nformation, and 57.2% (N=47) answered for earning learning activities, and the reaming answered for other uses: email (20.7%, N=17), chatting (45.1%,N=37), and others (23.2%, N=19).

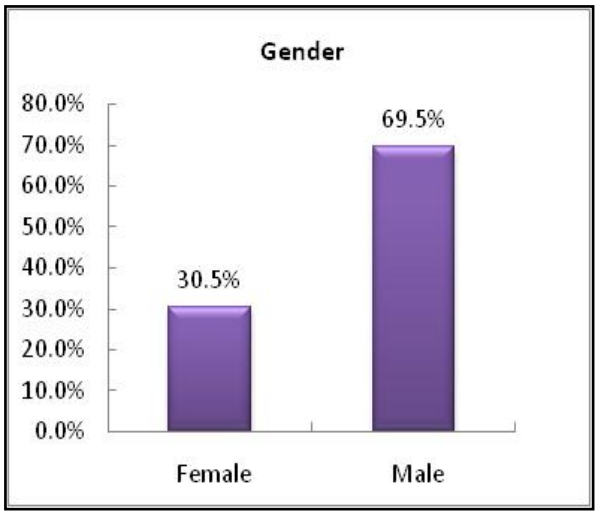

Figure 1. Gender

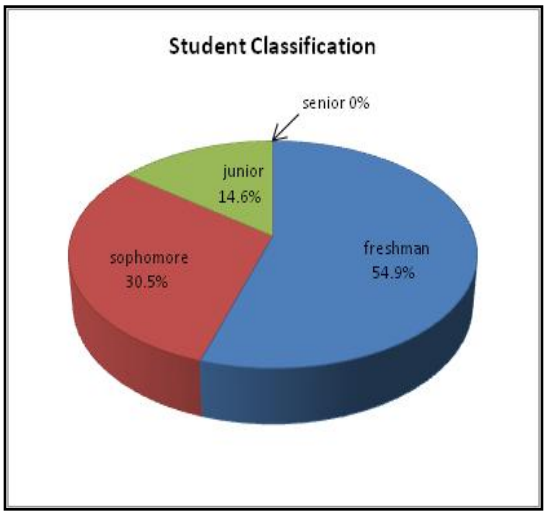

Figure 2. Student classification

The majority of the students (92.7%, N=76) had computer programming experience, at least, with a semester course, and 7.3 % (N=6) had no experience. Most of them (86.6%, N=11) had some online experience from SYU campus, and 13.4% (N= 11) had no experience. Of them, most of the students, 72.0% (N=59) had some experiences, with at least 1 computer programming-related online course, 21.9% (N=18) with 2 courses, and the remaining 6.1% (N=5) had no experience.

The following data analysis attempted to see if any differences existed for demographic variables, illustrated earlier, among students, and were run to determine the differences in perceptions. The result indicates that Table 1 shows no significant differences in students' perceptions toward online learning, in these demographic variables at the p=0.05 level. To put it shortly, the analysis showed no significant differences in gender, SYU online course, experience of other web sites (off-campus), computer programming experience, number of computer programming-rated online courses, type of internet mode, weekly internet hours used on campus (except class), and weekly Internet hours used at home.

The following data analysis is related to the topic of this study, containing 26 items (Q13-Q38) in the questionnaire, each item used a 5-scale Likert type. For each subject's responses, **5** means strongly agree and **1** means strongly disagree.

Table 1

Student Perceptions and Demographic Variables

Variables	Mean	S.D.	p
Q1. Gender:			0.56
1) female	3.57	0.37	
2) male	3.64	0.50	
Q5. SYU online course:			0.09
1) yes	3.64	0.47	
2) no	3.39	0.38	
Q6. Experience at the other web sites (off-campus):			0.25
1) yes	3.65	0.48	
2) no	3.5	0.39	
Q7. Computer programming experience:			0.62
1) yes	3.60	0.47	
2) no	3.71	0.39	
Q8-1. Number of computer programming-related online courses:			0.35
1) 1 online course	3.58	0.47	
2) 2 online courses or more	3.71	0.45	
Q10. Type of Internet mode:			0.19
1) cable (dedicated line)	3.60	0.41	
2) others	3.28	0.15	
Q11-1. Weekly Internet hours used on campus (except class):			0.25
1) 1 hour	3.55	0.4	
2) 2 hours or more	3.72	0.51	
Q11-2. Weekly Internet hours used off-campus (at home):			0.77
1) 1 hour	3.52	0.24	
2) 2 hours or more	3.62	0.46	

For data analysis, these 26 items were sub-grouped into five broad categories:

I. Convenience (Q18-Q21, Q25, Q28, Q38),
II. Flexibility (Q17, Q26, Q27, Q33),
III.Collaboration (Q16, Q29, Q36, Q37),
IV. Retention (Q13-Q15, Q22-Q24, Q30-Q32), and
V. Globalization (Q34, Q350).

Summary data is presented in Table 2.

A statistical technique was used for testing internal consistencies. Reliability statistics between these five subgroups showed Cronbach's alpha values of 0.736, 0.615, 0.601, 0.719, and 0.778 for each group, respectively. These values were higher than at the 0.6 level which implies that these subgroups were moderate for internal consistencies.

Table 2

Statistics of the Whole Sub-Group

N=82 Sum-Scale	Number of Items	Average Mean	S.D.	Reliability Statistics Cronbach's Alpha
I. Convenience	7	3.88	0.60	0.736*
II. Flexibility	4	3.76	0.59	0.615*
III. collaboration	4	3.68	0.59	0.601*
IV. Retention	9	3.21	0.59	0.719*
V. Globalization	2	3.95	0.79	0.778*
Overall	26	3.41	0.46	
Cronbach's $\alpha > 0.6$ *				

For the first sub-scale, the mean score of 7 items is 3.88, for the second, the mean of 4 items is 3.76, for the third the mean of 4 items is 3.68, for the fourth the mean of 9 items is 3.21, and for the last the mean of 2 items is 3.95. The overall mean of 26 item questionnaires is 3.41. In sum, it indicates that the students slightly agreed with the statements.

Next, the mean value shown in Table 3 indicates that many items have positive opinions toward online learning held by the students. Only a small portion (M=2.63, 3.01, 3.11, and 3.12 in the Q15, Q14, Q13, and Q30 of subgroup IV, in order) tended to hold negative opinions toward online learning. The S.D. (standard deviation) also reveals the spread of the score distribution toward the statements about online learning. The data collected also indicated the extent to which survey respondents provided similar responses in answering the questions. The S.D. value was small in the survey responses. In sum, the data analysis revealed that the students generally held positive opinions toward online learning.

Table 3

Students' Response for Each Item

Q#	Statement	Students' Response			Sub-Group
		N	Mean	S.D.	
Q18	unbound by place	82	4.07	0.90	I
Q28	less online learning cost (tuition fee, .)	80	3.99	1.01	
Q38	all course-related materials, handouts, etc.	82	3.93	0.83	
Q20	do not require student's physical attendance	80	3.85	1.01	
Q19	self-paced (any time, any place, any pace)	82	3.84	1.00	
Q25	various learning styles(lecturing; hands-on	82	3.80	0.89	
Q21	on-demand access to learning content	82	3.72	1.06	
Q27	self-directed, different needs, interest	80	4.15	0.70	II
Q26	various available modes of learning	80	3.94	0.85	
Q17	look up the information I need	80	3.59	0.82	
Q33	learn in greater depth.	82	3.50	0.86	
Q29	interaction and collaboration.	80	3.90	0.77	III
Q16	working with my teammates	82	3.67	0.89	
Q37	necessary to communicate to and interact	80	3.49	1.03	
Q36	a member of a team in virtual collaborative .	80	3.45	0.95	
Q32	attractive audio- and video lectures	80	3.61	0.86	IV
Q31	hyperlinks, graphics, animations, etc. and/	80	3.55	0.99	
Q24	a class learning style	80	3.49	0.97	
Q22	prefer online courses to traditional course	81	3.46	1.15	
Q23	40% online course + 60% with lecture	82	3.39	1.11	
Q30	active online multimedia course	82	3.12	0.96	
Q13	feel comfortable taking course online.	82	3.11	1.01	
Q14	learn more through on-line material	82	3.01	1.01	
Q15	immediate feedback through chats	82	2.63	1.07	
Q34	global resources of knowledge	78	3.99	0.85	V
Q35	no geographic isolation	80	3.93	0.87	

Q#: Question# N: number of respondents

S.D.: Standard Deviation Ave. Mean: Average Mean

Discussions and Summary

The results of this investigation revealed commonly held opinions among students on online learning and indicate that students tend to view online learning positively. Students were of the opinion that online learning benefits students and assists learning in general. Results of this study echo earlier studies by Yang (2006), Smart (2006), Maltby (2000), and O'Malley (1999).

Results of this study also revealed other widespread opinions on advantages and benefits displayed in online learning, as follows:

- Online can encourage more independent and active learning for students to do programming activities.
- Online saves students and faculties time and effort.
- Information or class materials for programming learning can vary in quality and level. So accurate guidance and preparation is needed.
- Resources can be accessed from any location and at any time.
- Online learning is able to link resources to many different formats.
- Online learning can be an efficient way of delivering programming course materials.
- Online learning can make teaching more efficient.
- Online learning provides students greater access to educational opportunities.
- Online learning can provide useful supplementary materials to conventional classes in computer programming.

In addition, whether based on the commonly held opinion resulting in each subgroup and reality of programming class in traditional classroom, the following draws the major components of online environments that can enhance and improve the learning of programming in online learning, and that can make the learning environment as smooth as possible.

Advanced online system with multimedia system and visual tools

Many students are interested in an online environment that uses visualization to display class structure. They spend lots of time discussing class structure in object-oriented programming. In fact, visuals have been an important pedagogical tool for a long time in computer programming. The online system can provide opportunities to expand availability of visualization-based programming learning tools. Some tools such as *BlueJ* and *Jeliot* are recommended for activating learning tools (Maria and Luis, 2005), (Buabeng, et al. 2002).

BlueJ is a visual programming environment designed to teach object-oriented programming using *Java*. It is an integrated teaching environment and language, developed at Sydney University and Monash University in Australia. This program helps students to develop an understanding of object-oriented concepts such as objects and classes, message passing, method invocation and parameter passing. *Jeliot* emphasizes program animation to demonstrate the execution of input-output, assignment, selection and loop statements (Haataja, et al., 2000).

In addition to these tools, *Rational Rose* and *Together* are powerful visual modeling tools for object-oriented system development using UML (Unified Modeling Language). They support full round trip engineering, allowing reverse engineering and the generation of UML diagrams from source programs. These are not suitable for use as a tool for beginners to learn object-oriented programming (Cheung, 2006). Some functions can compare with other OOP visual packages: **BlueJ**, **Sun ONE Studio**, **Rational Rose**, etc. (Cheung, 2006).

Collaborative and interactive system

The online system can provide an integrated collaborative and interactive environment for students to do programming activities at anytime and anywhere, including the following activities:

1. Building effective interactions among students is important in the learning process. When students are geographically remote from each other, the system is capable of accessing a database server that stores students' work and logs their behavior while doing programming activities online.
2. Another important function in learning programming online is to give instant help for those students who need it. Students can use e-mail or bulletin board messages to contact their peers or instructors. In the online system, the main idea is to answer the questions as quickly as possible so that the upcoming problems do not hinder the learning process (Haataja, et al., 2000).
3. Students do not learn in isolation. Learning is no longer bounded by the closed wall of the classroom but transcends the limits of time and location. They are often involved in learning activities that require them to work with their peers in small groups and teams, both inside and outside the classroom (Cheung, 2006).
4. The students can be engaged in different kinds of out-of-class activities, and can work in groups that need to communicate, debate, and give opinions to other group members, encouraging the kind of reflection that leads to learning, through various technology-enhanced forums and interactions.
5. The system also allows instructors to effectively monitor the learning progress of students and provide timely feedback to them (Sheung-On, et al., 2004; Ellis, 2001; Esteves, et. al., 2006).

Online system offering rich materials for programming activities

In a face-to-face programming course, learning materials and exercises are the same for most students. It is difficult to come up with learning materials and exercises that are suitable for all levels of students performing programming activities. Certain homework may be too difficult for some students, others find them too easy, many are frustrated (Uskov, 2002). Also, the structure of the networked environment can be improved (Haataja, et al., 2000).

The ideal system would offer rich adaptive materials learning materials to cater for students at different levels.

Effective learning management system for novice programmers

An effective learning management system eliminates some of the programming environment difficulties that students usually encounter. For example, students can work anywhere, anytime, at their own pace. Students can conduct programming activities in a convenient way, without worrying about media storage or the locations of their coursework. Students don't need to install Java JDK, set up suitable environment variables for program compilation, and provide additional IDE tools. The online system is fully equipped and includes automatic compiling, checking, testing, and plagiarism detection of submitted programming assignments (Truong, et al., 2005). For example, programs created by students can be sent to the server for compilation or execution of classes can be activated by clicking on the corresponding class icons. With such an effective system, students can get hints and extra help easily. They can use this online system to develop their programming activities and can receive support from the effective learning management system anytime and anywhere.

In summary, so far we have observed opinions among students on online learning, and we have also seen with some desirable or necessary components, displayed among students surveyed, as follows: An advanced online system with multimedia system and visual tools, a collaborative and interactive system, an online system offering rich materials for programming activities, and an effective learning management system for novice programmers.

From a student's perspective, it is desirable to have an advanced system that provides an integrated programming environment for students to do programming activities and services anytime and anywhere. This also enables smooth integration of programming with lecture notes and other web based content. Faculties will also favor the use of such an automatic learning management system that is able to monitor and collect information about students' performance.

Conclusions

As mentioned earlier, this paper describes student-centered online support for learning computer programming. Overall, the results indicate that students tend to view online learning positively. These results are preliminary, but they are helping to identify some issues to be focused upon in future studies.

Sstudents see high value in some items: self-directed, different needs, individual interest, programming-related materials, access to learning content, various available modes of learning, interaction and collaboration, and so on. In contrast, the students do not see the online learning courses as having better educational value or satisfied state in some items: feeling comfortable when taking online courses, online multimedia courses, learning more through online materials, favor of online courses to traditional courses, or immediate feedback through chats.

This study only considers students' opinions, not professors' opinions. A follow-up study must be conducted to assesses faculties' opinions. Some important outcomes of this study point to the need for further investigation. How do the faculties integrate the traditional programming class into online learning? What is the best method to monitor student progress? And when is standard content better than customized content? To put it clearly, research about online learning is broad and complex. Research in the near future may take on a collaborative form, with the SYU University in partnership with other universities throughout the world.

Finally, the hope of the author is that this case study will contribute to a better understanding of students' opinion toward online programming learning at the Sahm Yook University' computer science and engineering department (CSED), and that this preliminary information will assist in designing better online learning environments and more challenging questions for research**.**

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About the Author

Kook, Joong-Kak, Ph.D. is a professor of Division of Computer Science and Engineering, Sahm Yook Universitty at Seoul, Republic of Korea.

Email: cookyok@gmail.com