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Research and innovation in teaching and learning are prime topics for the *Journal of Instructional Technology and Distance Learning* (ISSN 1550-6908). The Journal was initiated in January 2004 to facilitate communication and collaboration among researchers, innovators, practitioners, and administrators of education and training involving innovative technologies and/or distance learning.

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Editorial

Good Times and Bad

Donald G. Perrin

A few nights ago I watched a feature-length documentary entitled “Who Killed the Electric Car”. It described a lengthy romance with electric vehicles that was swept aside by the gasoline powered automobile and fossil fuel industries. Today, with oil prices at record highs, there is renewed interest in the electric car and increasing public pressure to stimulate development of alternative energy sources.

There is a continuing drive in business and industry to reduce cost, increase revenue, and maximize profits. Education is subjected to similar pressures to do more with less. Downturn in the world economy has wreaked havoc with educational budgets that were already lacking and education as we knew it is facing a perfect storm. Industry is solving similar problems with automation, technology, and scientific management. As a “folk” industry, education is resisting such changes for fear of “dehumanizing” the teaching-learning environment.

In the early 1960’s, James D. Finn did an extensive series of nationwide studies on the adoption of technology for the National Education Association and the U.S. Department of Education. He predicted a “Technological Revolution”. It never occurred in the way he imagined. It was already occurring slowly by assimilation. Rather than replacing people with machines, it made people and processes more efficient. Examples include inexpensive high-speed copy machines, interactive multimedia, and computer management. Major innovations come from peripheral operations such as continuing education, where distance learning with audio, video, and computers found a natural home. A half century later, traditional education programs are enriched by these tools and luddites, where they exist, have diminished input to educational policy, management, and design.

Alternative paradigms of teaching and learning have been researched, tested, and implemented. With current pressures for change, a revolution in education is imminent; not be the technological revolution visualized by Finn, but restructuring and adoption of modern communication tools and management procedures.

Learning Management Systems (LMS) are one aspect of scientific management for education. The LMS integrates assessment (diagnostic-prescriptive tools), performance objectives, learning modules (interactive multimedia), delivery systems (Internet) and evaluation. The LMS also gathers data for continuous quality improvement. They are proven to be effective in meeting the needs of the majority of students for most of the time. The LMS releases instructors for individual counseling, problem solving, tutoring, lesson revision, and development of new lesson materials. Well designed learning programs find widespread use, recover their cost, and teach more for less. The human power within the system can now be refocused for human needs because information technology and learning management systems will play an increasing role in delivery, discussion, learning activities, and evaluation of knowledge, skills and aptitudes.

The projected demand for computer based learning experiences requires efficient and low cost production. Funding may come from business, industry and government to supplement existing education budgets. Lower cost design and production services may be achieved through competitive bid. This month’s lead article that shows how outsourcing and off-shoring support lesson development for a University in Malaysia. Outsourcing can be combined with other innovative models such as: interactive television for Graduate Engineers at Stanford University, hybrid and online programs for the *Open University* in the United Kingdom, nationwide programs such as Beijing Radio and Television University, and campus without walls such as *Rio Salado College Online* in Arizona, USA. It is imperative to redesign education for the new millennium.

Editor's Note: Global competition requires higher quality at lower cost. Many industries have benefited by outsourcing and off-shoring various aspects of design and production. The publishing industry and education are no exception. Outsourcing requires close management to ensure high quality, contain costs, and keep projects on schedule. The editors are grateful to Dr. Wendy Bong for sharing her experience in this arena.

Monitoring Off-shore Outsourcing Projects for Learning Resource Development

Bong Chin Wei
Malaysia

Abstract

In the world of “borderless education”, off-shore outsourcing of learning resources becomes the norm practised by universities worldwide, especially for a new start-up institution such as the Wawasan Open University (WOU). For the past 3 years of experience in learning resources development, the WOU has encountered various issues such as managing of writers in distant locations, meeting deadlines, training of writers in distant locations, keeping the cost down, copyright issues, quality control, and cultural differences/localisation of context. In overcoming some of these issues, the WOU has adopted an effective monitoring mechanism to enable success of this key activity in the university. Since its inception in 2006 until early 2008, the institution has successfully outsourced about fifty course materials off-shore and locally. This paper first introduces the outsourcing process in WOU followed by some of the issues faced by the university while working with the offshore writers and the adaptation of course materials. Subsequently, details of the monitoring mechanism used in the outsourcing process are explained. Lastly, this paper presents WOU's future direction in this perspective.

Introduction

The Wawasan Open University (WOU) is Malaysia's first charity-backed, private, not-for-profit Open University. It started to recruit students in 2007 with teaching and learning methodology that combines limited face-to-face instruction and computer-assisted instruction to maximise the student learning process. A self-contained learning resource in printed format is distributed to every student who enrolls in a course at the beginning of the semester. WOU currently has more than 2,000 active students.

In order to cope with the needs of business efficiency within a university for global competition, the WOU narrowed their field of business to so-called ‘core-business’. This is done by turning over activities performed internally in the university to an external party. The external party is paid to provide its services within a specific period of time. The term used to describe this service is *outsourcing*. At the WOU, there are two ways of off-shore outsourcing projects for learning resources development: 1) work with academic members from foreign institutions to develop new courses and 2) purchase rights to adapt existing course materials from other institutions. Two major reasons to promote off-shore outsourcing are 1) to gain access to world-class capabilities and 2) to access resources that are not easily found internally. The decision for outsourcing was planned carefully by the respective schools in the WOU.

The WOU requires developers for various study materials used by distance learners. With a limited number of faculty members and constraints of time, one of the ways to develop the study materials is by outsourcing off-shore and locally. Since its inception in 2006 until early 2008, the institution has successfully developed 48 course materials; twenty-one outsourced off-shore and twenty-seven outsourced locally.

This paper first introduces the outsourcing process in WOU. It explains the monitoring mechanism used for project development and some difficulties and issues faced by the university while working with off-shore developers and adaptation of study materials. Finally, this paper projects the future direction of the WOU in this perspective.

The Off-Shore Outsourcing Process

Currently, the university has three schools that are responsible for the design and development of individual programmes. In the WOU, a programme is a group to obtain a particular qualification. A course refers to a defined area of study for learners in a programme. For instance, the School of Science and Technology has designed a Bachelor of Technology in E-Commerce (BTEC) programme. As illustrated in the detailed design of the BTEC programme in Figure 1, a list of courses was designed and developed based on their specific content or syllabus. Students are required to learn those specific areas of knowledge in the syllabus based on the definition of their respective learning outcomes. Learning outcomes are the specific intentions of a programme or course, written in specific terms. They describe what a learner should know, understand or be able to do at the end of that programme or course.

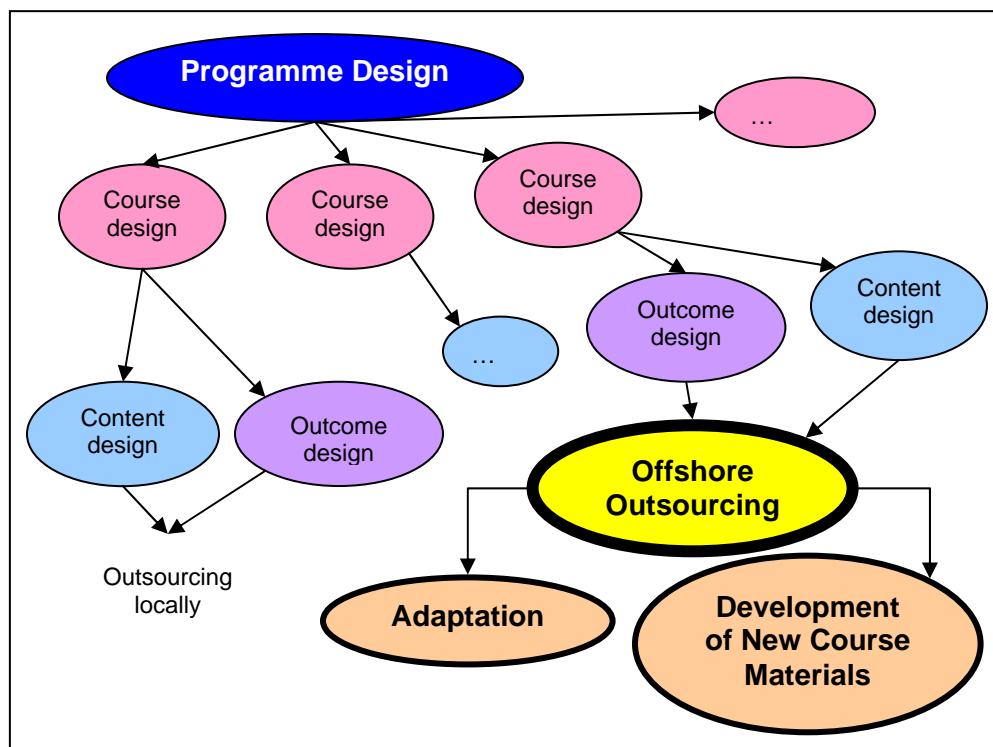


Figure 1. General planning of outsourcing.

In each course, self-contained study material, sometimes referred as course material, comprises units to be covered in a course. Thus, a unit is a portion of the study material and they are broken into sub-topics or sections. In each course, a credit value will be assigned with a numerical symbol representing the number of hours a learner spends on a course during a semester. In the WOU, one course credit is equivalent to 40 hours of learning. The WOU's course material comprises a course guide and printed material (divided into 5 units and sections) with self-tests (delivered via learning management system and limited face-to-face tutorial sessions).

After the content and learning outcomes have been designed by the schools, the consideration to outsource will take place. Referring to the bold circle in Figure 1, the two ways of off-shore outsourcing include working with academic members from foreign institutions to develop new

courses (development of a new course) and the purchase of adaptation rights for existing course materials from other institutions (adaptation).

After the WOU has signed an agreement with the off-shore partner, a standard workflow is constructed as shown in Figure 2. One developer or a team of course developers is appointed to develop a particular course. A common pattern of cooperation is to go through a middle man or organisation that is responsible to find a team of experts to produce the course material. Another possible mode of cooperation is to interact directly with the course developer.

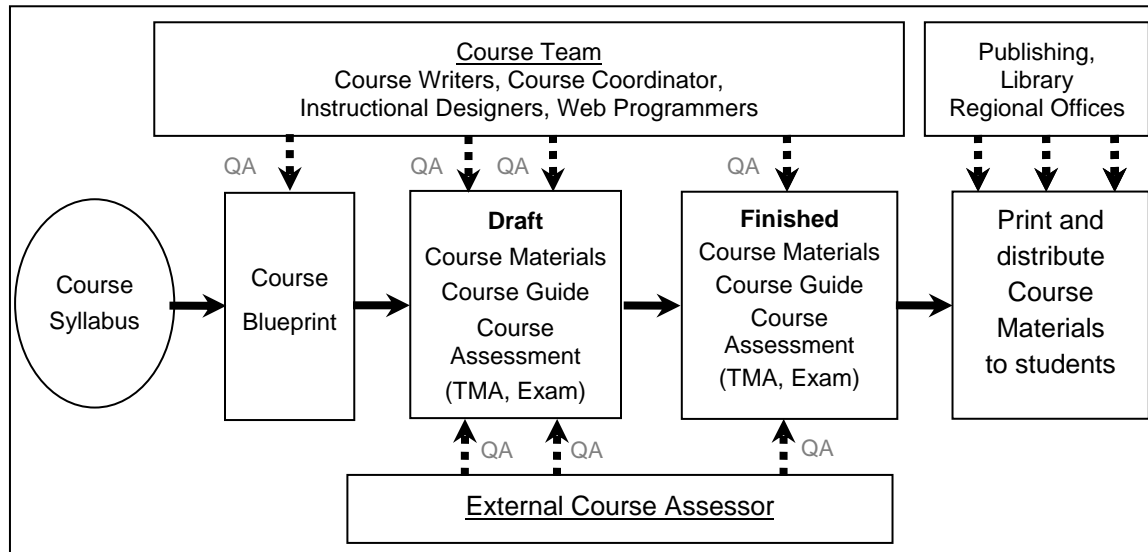


Figure 2. Workflow of the development of a new course.

In the process of developing a new course, course developers are required to produce a course blueprint based on the syllabus provided by WOU. In the course blueprint, the course design or structure is fixed with preliminary template or guidelines. A textbook and other reference sources are identified. In revision of the course blueprint, the WOU course team, led by a course team leader who is sometimes called the Course Coordinator (CC), contribute their expert knowledge wherever necessary. After the course blueprint has been finalised, the course developers start to write the units.

Units of study material will be revised several times based on the exchange of content knowledge between the content experts from the WOU's internal course team and course developers. Instructional designers from WOU will ensure that the developed course material is consistent with WOU's house style. In addition, an external input through a named external course assessor (ECA) is incorporated into the mechanism to ensure quality control in the overall development of the course.

In the case of a course adaptation, before the outsourcing process commences, WOU and the offshore partner have to negotiate and sign a license agreement where all terms and conditions including the royalty payment are agreed upon. With this agreement, the CC is given access to request and review course materials before the purchase of adaptation rights. The CC plays an important role in reviewing and assessing the suitability of the course material identified for adaptation. If a course material is appropriate and adheres to WOU syllabus, the Publishing Unit will purchase the rights from the offshore partner.

Following the purchase, the CC will source for a writer to adapt and localised the course material contents to learners' requirements. The whole process of adaptation might take up to 6 months. The writer's job scope includes providing new case studies, local examples, assignments,

examination questions, and a course guide. The subsequent process of course development is similar to the work-flow depicted in Figure 2 except that the ECA report is provided by the outsourced institution.

For both purchasing of adaptation rights and development of new courses by foreign academic members, a license agreement needs to be drawn and agreed upon by the two working parties.

1. Agreement between WOU and the offshore partner for adaptation

As mentioned above, before the purchase of adaptation rights, WOU and the outsourced institution have to sign an agreement which describes the grant of reproduction and modification rights, royalty payment (amount and frequency), termination clause and intellectual property rights of the owner.

Adherence to the agreement is an important aspect of success of the collaboration. Mutual trust and frequent communication is important for the two parties to work successfully with each other.

2. Agreement between WOU and local writer or foreign institution for development of new course

Agreement between a local writer and a foreign institution includes similar terms and conditions. The essential elements that determine accomplishment of the project are the timeline for course development, job specifications and resolution of copyright issues.

The writer is provided with a schedule or timeline to assist him/her to meet the deadline. An example of a course development timeline is presented in Table 1. The schedule assists the Course Coordinator in monitoring progress and enables the Course Coordinator to mediate and assist the writer if he/she has difficulty in fulfilling his/her commitment.

Table 1
Sample Course development timeline

Category of Work	Estimated Pages	Commencement Date	First Draft Submission*	Final Draft Submission*
Convert Course to Blueprint Develop Unit One (3-5 lessons)	Approx. 5-10 p. Approx. 60-80 p.	July 1, 2006 July 15, 2006	July 10, 2006 Aug. 15, 2006	July 15, 2006 Oct. 1, 2006
Develop Unit Two (3-5 lessons) Develop Unit Three (3-5 lessons)	Approx. 60-80 p. Approx. 60-80 p.	Aug. 15, 2006 Sep. 15, 2006	Sep. 15, 2006 Oct. 14, 2006	Nov. 1, 2006 Dec. 1, 2006
Develop Unit Four (3-5 lessons) Develop Unit Five (3-5 lessons)	Approx. 60-80 p. Approx. 60-80 p.	Oct. 14, 2006 Nov. 15, 2006	Nov. 15, 2006 Dec. 15, 2006	Dec. 31, 2006 Feb. 1, 2007
Course Guide, Specimen Examination Paper, Answer Key and Marking Schemes, Assignment Files, PowerPoint Slides for each unit etc.	Approx. 50-100 p.	Dec. 15, 2006	Jan. 15, 2007	Mar. 1, 2007

Categories of works are listed clearly in the Annexure of the contract, which specifies the work relevant to the development of the course.

WOU respects and observes the Intellectual Property Rights of all individuals. As such, copyright is strictly observed in the University. The course developer is responsible and liable to identify and obtain all items that require copyright clearance. If the course developer is unable to obtain the copyright clearance, the university shall endeavour to seek clearances for such items identified. If copyright is unobtainable, these materials have to be omitted and replaced with others by the course developer.

Monitoring Mechanism

The monitoring mechanism used in the learning resources development is a crucial component in the success of the outsourcing project. From the start of the project, the WOU ensures that the developers have been trained in WOU house style (definition) as a one of the crucial preparatory activities. Besides that, an ECA will be identified so that he/she as an expert will grant the initial design of the course. The initial design of the course will be stated in the course blueprint.

In the course blueprint, the course team leader and the course developer collaborate to setup deadlines. Every unit will go through several revision processes involving WOU course team members. Submission of each unit is tracked by individual course as depicted in the progress report in Figure 3.

Progress Report		Date: 05-Sep-07						
Course code and Title:								
Course Coordinator/Course Team Leader:								
Academic member and Instruction Designers:								
Preparatory activities								
<input checked="" type="checkbox"/>	Identify writers	Course writers: _____						
<input checked="" type="checkbox"/>	Writer Training	_____						
<input type="checkbox"/>	Appoint ECA	Name of ECA: _____						
Development process		Blueprint Deadline	Writing				CTR	ECA
			1st draft	2nd draft	3rd draft	> 3 drafts		
<input checked="" type="checkbox"/>	Blueprint	02.03.07						
<input type="checkbox"/>	Unit 1	17.04.07						
<input type="checkbox"/>	Unit 2	17.05.07						
<input type="checkbox"/>	Unit 3	15.06.07						
<input type="checkbox"/>	Unit 4	18.07.07						
<input type="checkbox"/>	Unit 5	17.08.07						
<input type="checkbox"/>	Course Guide/Tutor Guide							
Submission due date to Publishing:		_____						
<input type="checkbox"/>	Final ECA report							
<input type="checkbox"/>	Course Development Report							

Figure 3: Sample progress report for individual course development.

Usually, a developer requires about one month to develop a unit. Revision takes longer as the course team needs to discuss issues such as the accuracy of content, design of instruction, presentation of the academic content, and compliance with the WOU's house style. The course team will hold rigorous meetings in order to ensure the units have gone through a maximum internal quality assurance process. Information related to improvement of the unit is recorded in specific report, the Course Team Report (CTR).

Every single unit must be assessed by the ECA in terms of its organisation, flow and accuracy of the content. Checklists will be provided to the ECA in addition to interim reports on compatibility of course materials, relevance to course objectives, suitability for target student populations, and suggested changes in activities and assessment questions. The ECA will identify major strengths and weaknesses in the course materials and ensure whether the course materials are relevant in content, style and presentation, and functionality of case studies, activities, and references. More importantly, the ECA must evaluate and compare course materials with similar courses taught in ODL and/or traditional modes. In some cases, the ECA will recommend changes and revisions.


After the units have been completed, the course developers produce a course guide for students and tutor guide for tutors who facilitate the course in face-to-face tutorial sessions. These


documents are reviewed by the ECA for quality assurance. A final report from the ECA indicates completion of the development process. The completed materials re sent to the in-house publishing department for editing and layout design. Before the learning materials are published, the course team leader must proof read the documents to ensure accuracy and consistency.


As the WOU is a new university, the development process is very active and the school needs to monitor the many stages of development of all courses. As a result, the course development and presentation summary is the key reference to ensure that the development is going smoothly and the material for subsequent presentation is ready on-time. As shown in Figure 4, the status column serves as an alert key for problematic courses that require special attention and may require remedial action. An example of problematic course development includes developers involved in plagiarism or who are not able to meet the deadlines. The alert system is also important to show the number of courses and when they are ready to be offered.


Course Development and Presentation Summary																				
Year	Courses		Course development and presentation schedule										STATUS							
			2007		2008		2009		2010		2011		CBP	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	CG	TG
TITLE	CODE	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2									
2009																				
S1	BASIC	<u>Computer Organisation</u>	TCC 201																	
	CORE	<u>Electronic Materials and Devices 1</u>	TEL348																	
	BASIC	<u>Solid State Physics</u>	TEE 232																	
	BASIC	<u>Computer Network</u>	TCC 351																	
	BASIC	<u>Database1</u>	TCC 231																	
	ELEC	<u>Engineering Mathematics</u>	TMA 227																	
S2	BASIC	<u>Analog Circuit 1</u>	TEE 241																	
	BASIC	<u>Digital Design</u>	TEE 246																	
	BASIC	<u>Electronics Principles</u>	TEE 245																	
	BASIC	<u>Operating Systems</u>	TCC 202																	
	BASIC	<u>Database2</u>	TCC 232																	
	BASIC	<u>Network programming</u>	TSN 212																	
	CORE	<u>Information Systems & Electronic Commerce Strategy 2</u>	TEC 202																	
	CORE	<u>Human Computer Interaction</u>	TAI 331																	

Legend

 Under development

 Yet to develop

 Fast-track presenta

 Original scheduled

Abbreviation

S1 Semester 1

S2 Semester 2

CBP Course Blueprint

CG Course Guide

TC Tutor Guide

ECA External Course Assessment

Status explanation

1 Yet to begin

2 Writing in progress

3 Draft sent to ECA

4 Final approval by course team

5 Submitted to Publishing

6 Sent for printing

Figure 4. Sample monitoring chart for a list of courses in year 2009 under the School of Science and Technology.

A number of issues have been identified upon monitoring the learning resource development. Some of these issues were resolved; others were not.

Issues Related To Off-Shore Outsourcing

Similar to the definition used by Backman, Holmberg and Tonnby (2007), the success of the off-shore outsourcing project is defined by the benefits from outsourcing gained by the WOU as a result of deploying the outsourcing strategy. This can be measured by reduction in cost, satisfaction of learners, and perceived level of quality. Some issues that emerge in the process of off-shoring and outsourcing are highlighted as follows:

1. Copyright

One major problem encountered with foreign writers is infringement of Intellectual Property Rights (IPR), either intentionally or unintentionally. Surprisingly, some writers assume that information from websites is copyright free and can be used liberally.

There have been incidents where writers copied from textbooks or journals without citing references and giving credits where it is due. It is the WOU's policy to acknowledge and respect IPR. Plagiarism is not allowed and must be avoided at all costs.

Under the Publishing Unit of WOU, there is a copyright page that serves as the gatekeeper to ensure that all course materials published by the university is free from copyright infringement. It is the university practice to write to all copyright owners to request permission and make payment to use the material when necessary. The materials will not be used if we failed to obtain consent from the owners.

2. *Managing course developers in distant locations*

Training of course developers is required, especially at the beginning of the outsourcing project. Understanding of WOU learners is important as it relates to the satisfaction of the target user of the course material. WOU imposes a set of house styles on the course materials and must ensure this style is fully understood by course developers and adaptors. Characteristics of a good course have to be defined at the very beginning and must be stated clearly ensure that developers meet WOU's expectations. Sharing of methods used to design an effective course and its preferred language or assessment types are also important to course developers and adaptors.

Offshoring of university study material should be regarded as a dynamic process that evolves over time (Jesen and Pedersen, 2007). Therefore, bridging the gap between the two parties is extremely important. Universities that embark on an outsourcing strategy would do well to first establish a structured approach to close the gap that often exists between two parties. In the case of WOU, maintaining the relationship between WOU and course developers/adaptors ensures success in collaboration. Nevertheless, the support team must be responsive in providing feedback that the other parties require. Communication between the two parties need to be predictable, interactive and proactive (Fuchs, 2007). WOU needs to appoint one or several members of a team for in-house and offshore locations to be responsible for communication exchange and to monitor the development of course materials. There must also be a person who is responsible for supporting and monitoring knowledge delivery process during the training process. This person will also be the main contact person for the off-shore team members and general queries will be dealt by this person.

3. *Meeting deadlines*

The average time for course development in WOU is between eight to twelve months. Any delay in submission of manuscript will affect the course presentation scheduled. Meeting the deadline of submission is crucial to the CC as there are still many level of preparations required before the course can be presented to the students. This includes several revisions from the in-house course team members and the ECA before the work is considered ready for publishing process.

As most of the course developers have other work, social and family commitments, they might not be able to meet the manuscript submission deadlines. Among the consequences are delay of course presentation, termination of writers and re-looking into the reserve pool for other writers. As a result, the university is burdened with additional cost and loss of time.

The importance of deadline is highlighted during the training and it is also explained in detail in the agreement. The role of the Course Coordinator as mediator is significant in monitoring the progress of the course developer. Ample reminder should be given if there is any delay from the very beginning.

4. *Cultural differences/localisation of context*

Due to the course developers' backgrounds and cultural differences, the course materials developed require editing and amendments to suit Malaysian needs. The case studies used, examples given, and the language style, need to be changed and localised.

This is more apparent in developing business and management courses when foreign course developers do not understand our business and economic environment and hence, are not able to provide examples that students can comprehend.

The course team leader and team must put in extra effort to substitute facts and do their own research to complete course materials submitted by foreign course developers.

Future Direction

The WOU has a good track record in off-shore outsourcing with a moderate success rate. Off-shore outsourcing assists in fast-tracking the University's course development and presentation and fills the gap when local expertise is not available. It also makes it possible for the schools to manage the development of a number of courses concurrently. Sharing of information and exchanging of ideas between academics from different background and experience is also a healthy trend in promoting intellectual knowledge.

We believe all the issues mentioned above could be resolved if more training is provided to the appointed course developers and ongoing communication channels are maintained between them and the appointed Course Coordinator. Mutual trust and respect of working procedures and ethics between faculty and developers facilitates discussion. Both parties need to make an effort to be tolerant in their requests and demands from each other. Off-shore outsourcing is not just a business transaction in a globalised world; it involves inculcating effective working relationships between two institutions.

The WOU as a new ODL institution will continue to outsource either locally or off-shore in meeting the demand of the fast changing intellectual environment. We will source for collaboration opportunities with different partners in fulfilling our future academic needs.

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About the Author

Dr. Bong Chin Wei is Senior Lecturer in the School of Science and Technology at Wawasan Open University, Jalan Sultan Ahmad Shah, 10050 Penang, Malaysia Malaysia. She possesses a Masters and PhD in Information Technology (IT) from the Universiti Malaysia Sarawak (UNIMAS) with the Award of Postgraduate and Post-doctoral Fellowship from the Ministry of Science, Technology and Environment, Malaysia. In 10 years of academic experience, she has delivered computing and IT courses to graduates and undergraduates in private and public universities and colleges. She is actively involved in research and development in Artificial Intelligence, particularly in decision-making theory and fuzzy logic for different applications of optimisation. She has published a number of national and international conference and journal papers. She is IT consultant to a Computer Aided Design (CAD) solution firm, an external examiner for Penang Skill Development Centre (PSDC), and reviewer for several international journals and conferences.

Email: wendybong@wou.edu.my, bongwendy@gmail.com

Editor's Note: When Lincoln Steffans went to Stanford University in the late 19th century he was offended by the predominance of lecture and lack of discussion. He believed that as graduates and as adults, there should be much more exploration and sharing of knowledge between learners as well as between students and professor. Online discussions provide the opportunity for considered and detailed responses that is not constrained by time and where all class members can communicate. Research on specific learner characteristics, such as age and race, contribute to design and moderation of effective online discussions.

Exploring the Role of Age and Race in Online Discussions

Katrina A. Meyer
USA

Abstract

Discussions on various controversial topics (e.g., diversity, affirmative action) in U.S. higher education among ten graduate students were held online during Fall 2005. An earlier study (Meyer, 2006) had found differences in responses to post-discussion surveys based on the age or race of the student; this study analyzed transcripts of the online discussions using qualitative methods to identify possible reasons for those differences. First, younger students posted fewer times to the online discussions but there were no differences between African-American and Caucasian students in their frequency of posts. Content analysis of the online discussions identified four themes. *Theme One* noted greater tentativeness in the written expressions of the younger students. *Theme Two* found older students provided more postings that were also more complex. *Theme Three* found inconsistent approaches to such topics as slavery, racism, and reparations based on the race of the student; on the other hand, the students treated such topics as affirmative action, poverty, and K-12 education in a consistent manner. *Theme Four* noted two differences in the level of thinking in the postings: institutional versus individual responsibility and practical versus transformative change. Only older students mentioned the importance of individual responsibility and transformative change. Theories on psychological and moral development are discussed in an attempt to explain these findings. The relevance of these results for online education is also discussed.

Introduction

Discussions held online by means of a course management system (CMS) such as WebCT, Blackboard, etc. have been the focus of numerous studies. Why this may be so is probably the result of several factors, some practical and others theoretical. On the practical side, CMS products capture the discussion in a printout that can be analyzed for a variety of characteristics and long after the class has completed. This printout is not a transcript, but the actual keystrokes and expressions of students produced by them and it does not require the extra time or cost of a transcription service. On the theoretical side, these discussions allow faculty to assess student participation, growth, grasp of course content, or other outcome of interest, analyze why discussions went well or poorly, find ways of improving future discussions, or understand how students think about class content or life or themselves.

In an earlier study by the Author (2006), graduate students participated in face-to-face and online discussions on controversial topics and were asked to compare their responses in the two discussion settings (face-to-face versus online). The goal was to determine whether discussions about controversial topics were perceived to be different in the two settings, in terms of their sense of discomfort, honesty, worry about hurting others, feeling the same as others, or willingness to disagree. Faculty with experience working on controversial topics had advised the author that such discussions had to occur online or had to occur face-to-face; each point-of-view was stated firmly and confidently. Gladwell (2002) in *The Tipping Point* referred to a study that

stated that individuals who disagreed face-to-face were more credible because it was harder to do. As often happens, the students indicated they felt there was “no difference” between settings, although a majority indicated a preference for discussing matters face-to-face while a minority preferred online discussions.

However, the mean responses for many items were different based on the age and race of the student (Table 1). For example, after the face-to-face discussion, older students felt more uncomfortable but became more comfortable after the online discussions. However, both races had the same discomfort levels after the face-to-face discussion, but the Caucasian students were a little more uncomfortable after the online discussions. Since with such modest numbers it is impossible to conduct statistical tests, it is appropriate to conclude that the responses on how honest students felt they were was similar across age and race. Younger or Caucasian students are more worried about hurting others’ feelings. Older and Caucasian students think they feel the same as others, but these differences lessen somewhat after the online discussion. Older and African-American students feel more willing to disagree, and this is true to the same degree in both face-to-face and online discussions. There are differences between younger and older students and African-American and Caucasian students in their preference for having discussions online, but the differences lessen after the online discussion. These differences capture a particular set of students who are relatively comfortable talking about race and other controversial matters, partly due to many of the students being mature African-American professionals. In any case, they appear to have become more accepting of the online discussion setting over time.

Table 1
Age and Race, Over Topics

Item	F2F				Online			
	Age		Race		Age		Race	
	Y	M	AA	C	Y	M	AA	C
Uncomfortable?	3.3	2.4	3.6	3.6	3.2	4.4	4.1	3.7
Honest?	1.5	1.2	1.3	1.2	1.7	1.3	1.3	1.5
Hurt others’ feelings?	3.3	3.8	4.6	3.2	3.1	4.4	4.0	3.5
Feel same as others?	2.9	2.5	2.4	2.8	2.6	2.4	2.3	2.5
Willing to disagree?	2.7	1.8	1.3	2.7	2.8	1.7	1.7	2.5
Prefer online?	4.1	2.5	3.6	3.9	4.1	3.5	3.9	3.9

NOTES: Very = 1, Moderately = 2, Somewhat = 3, A little = 4, Not at all = 5

Y=Young (20s); M=Mature (30s and above) AA=African American; C=Caucasian

SOURCE: Author (2006)

It is impossible to explain in a definitive fashion why these differences occurred as they did. The online discussions do not directly explain these differences, because the discussion topics were about diversity, affirmative action, gender, etc., in higher education, and not why they felt uncomfortable or did not worry about hurting others’ feelings. However, these different responses certainly triggered an interest on the part of the researcher in exploring other differences and reasons for those differences. Therefore, this research identifies differences in responses by age and/or race using qualitative analysis of the online discussions. Certainly, a

variety of methods and/or theories have been used to evaluate online discussions and there is a large literature based on this approach, including use of the Community of Inquiry framework (Garrison, Anderson & Archer, 2001), the social construction of knowledge (Gunawardena, Lowe & Anderson, 1997), the use of content analysis (Newman, Webb & Cochrane, 1995), or Fahy's (2003) Transcript Analysis Tool. Meyer (2006) has reviewed the numerous methods and theories used to analyze online discussions. In this case, however, rather than use a prechosen theory or conceptual framework to evaluate these online discussions, the analysis used qualitative methods to uncover themes and then theories were sought to explain the findings.

It is important to note that while the earlier study (Author, 2006) compared face-to-face to online discussions, the current research focuses solely on analyzing the online discussions to explore age and race differences. Several definitions also guide this research. First, labeling an issue as controversial was based on the researcher's experienced teaching this subject matter for several years. These are topics that students may disagree on or they touch on one's self-identify and may be difficult for the person to discuss. In this case, they are also topics that are essential to understanding higher education. Second, the students self-identified with a particular race; while they may have actually been mixed race, the simplest way to settle this matter was to allow them to indicate their race.

Several questions guide this research. First, does the age or race of students explain differences in responses posted to online discussions? Second, what cognitive or developmental theories might explain differences or consistencies? And finally, is this approach to analyzing online discussions useful?

Method

In Fall 2005 during a graduate-level class on Historical and Policy Perspectives of Higher Education, ten students were asked to prepare for and participate in a series of discussions on controversial subjects in higher education. The controversial subjects were 1) Diversity, 2) Academic Freedom, 3) Political Tolerance, 4) Affirmative Action, and 5) Gender. These subjects were chosen because they are important policies to higher education and because students invariably have different views about them. The instructor regularly modeled an open approach to discussions of controversial matter in the early weeks of the course, wherein the class would track the definition of "diversity" in different historical eras in American higher education or analyze data on the changing composition of higher education as regards class, race, and gender.

The instructor introduced the first controversial discussion in week six of a 15-week semester, after having given the students several weeks to become familiar with the instructor and their fellow students. Students prepared for the discussions by reading four to five websites with research articles or data on the topic prior to coming to class for the face-to-face discussion. Diversity focused on data on minorities in higher education as students, graduates, faculty, and institutional leaders. Academic Freedom focused on the 1940 American Association of University Professors (AAUP) Statement on Academic Freedom, the Ward Churchill controversy, and articles on academic freedom after September 11th. Political Tolerance focused on readings about movements in the United States to impose a conservative Student Bill of Rights and other liberal versus conservative differences on U.S. higher education. Affirmative Action required a reading of the two U.S. Supreme Court decisions on the University of Michigan admissions decisions and analyses of different approaches to college admissions not based on race. Lastly, the Gender readings focused on various issues of female students and faculty, including sexual harassment and family-friendly work policies.

Based on their readings, students developed questions they felt would be worthwhile discussing with their peers and wrote them on 4 x 6 note cards. This was done to maximize student interest

in the discussion. The instructor then categorized the questions into Bloom's taxonomy, recently updated by Anderson and Krathwohl (2001): Know, Understand, Apply, Analyze, Evaluate, and Create. This was done to make the two discussions as similar as possible in the level of questions asked. One group of questions was posed in class; the other group was posted online after the class was dismissed and continued until the next weekly class meeting. In the online setting, questions prepared by students were posted by the instructor on the class WebCT Discussion Board and students were asked to post responses two to three times during the remainder of the week.

The analysis follows standard procedures for a qualitative study. The printout of the online discussions produced by WebCT form the data for the current analyses. Each posting was identified by the student's name, so answers could be easily separated by student age (young students were in their 20s and mature students were 30 and above) and race (African-American or Caucasian).

The goal of the analysis was to review the postings across multiple readings and identify possible differences by age or race of the student. As stated previously, no particular theory or set of theories guided the analysis, nor was the analysis intended to evaluate the content of the discussion to determine whether the students answered questions correctly, completely, or reflected the extant research literature. The analytical process was based on the guidance given by Maxwell (1996) for qualitative researchers.

To begin the analysis, each posting was analyzed for how ideas were expressed. The discussions were then reviewed carefully for themes in each posting and then consistency or differences in themes between students and groups of students. Themes could occur in a variety of ways, through written expression, the discussion of certain topics, or level of thinking implied by the words or ideas used. Once a possible theme arose, other postings would be reviewed to see if it were consistent across a group of students (for example, all young students or all African-American students). If a theme appeared to identify a difference between groups, all postings were reviewed to confirm or disconfirm the difference. Only those themes that were confirmed over several postings would be included in the final analysis.

To augment this process, the instructor/researcher had prepared notes on the weekly discussions and insights into what was happening. These notes provided additional insight into the themes and modify or expand upon the findings.

In the final stage, explanations for the themes were sought in various cognitive or developmental theories in the existing theoretical and research literature. These theories were developed and tested in the pre-Internet world, so they may be applicable to individuals participating in online discussions or not. However, to the extent that such earlier theories seem to explain what happens during an online discussion, we may find support for their continued usefulness in assessing, evaluating, and understanding what happens in online learning.

Results

Description of Sample and Postings

The discussions resulted in 246 total postings by the ten graduate students in five discussions held over five weeks. To explore whether there were any differences based on age or race in the *number of postings*, both the total and average number of postings were calculated (Table 2). The older students outposted the younger ones (5.5 average posts to 3.5 average posts, respectively), but there was no difference in the average number of posts for African Americans and Caucasians (4.8 versus 4.9, respectively). Of the five discussion topics, Affirmative Action had the highest average number of posts (6.4), Academic Freedom the next highest (5.2), then Diversity (4.7), Political Tolerance (4.5), and Gender (3.8). It also appears that students exceeded the guideline

of the instructor to post “two to three” times to the discussion (the lower number of posts for the last discussion is due as much to having final papers due the same week as any other cause). Because this research includes only ten students, the results are tentative until further replications of the study can be made.

Table 2
Mean Number of Postings to Discussions by Age and Race

Discussion Topics:	Diversity	Affirmative Action	Academic Freedom	Political Tolerance	Gender	Total Mean
Profile by Age (Young vs. Mature)						
Young (n=3)	4.3	3.6	3.6	3.3	2.6	3.5
Mature (n=7)	4.9	7.6	5.9	5.0	4.3	5.5
Profile by Race (African-American vs. Caucasian)						
African-American (n=7)	4.4	6.9	5.1	4.7	3.6	4.8
Caucasian (n=3)	5.0	5.3	5.3	4.0	4.3	4.9
Total Mean Postings by Discussion Topic						
All	4.7	6.4	5.2	4.5	3.8	4.9

NOTE: Young (20s); Mature (30s and above)

Themes

Based on the analysis of the online discussions, four themes arose. They can be classified into themes related to written expression (tentativeness), nature of thinking (complexity), controversial topics that are treated inconsistently (slavery and reparations) and consistently (affirmative action, poverty, K-12 education) by different groups, and level of thinking (individual versus institutional; practical versus transformative). In the discussion that follows, each theme is discussed, examples provided, and consistencies or inconsistencies in the themes described.

Theme One: Tentativeness of Written Expression

The postings made by younger students were frequently expressed *in a more tentative manner*. In response to the question, “Why is African American college enrollment increasing at a lower rate than other groups?” one of the younger students wrote (the italics have been added), “*It would seem* to me that African-American students are not matriculating as much as other groups first because some African-American students *may not be* encouraged as much as other students to attend college.”

While it is not unusual for graduate students to learn that academic writing stresses a more cautious style, a sentence with two or more instances of this type of cautious expression is notable. This may capture the younger students’ lack of self-confidence which in turn contributes to the discomfort with disagreements that may occur in class. This situation may actually be

exacerbated in a graduate-level class, where younger students are outnumbered by older ones or may be at an earlier stage of their graduate study. Certainly, some of the older students' postings contained instances of caution, but not in the number or multiple occurrences in a single posting as these examples contain.

Another example of tentativeness as applied to reasoning is this posting, also by a younger student:

Great article. In a way it makes me think about my own ideas about freedom of speech and thought. I believe that everyone has the right to believe what they believe as long as it causes no harm to another. But where does the line get drawn? I think [the author] is prejudiced, but as a person who agrees with freedom of thought, I must respect his right to his opinion. But . . . he can easily persuade young minds to his thinking . . . what right do I have to stop this man? It's a dilemma I have struggled with long and hard and have not yet come to a conclusion.

One can be sympathetic to this student's plight of resolving conflicting values: stopping harm to young students versus protecting freedom of speech. This quandary is a good example of a reasoning that is tentative, moving back and forth between opposing values, and ending with an unresolved quandary.

Theme Two: Complexity

An example of a posting that was different due to its acknowledgement of *complexity* is the one below:

A good foundation has to be established with solid reading, writing, and arithmetic skills from K-6 . . . part of this foundation is caring parents, teachers, mentors, and a solid curriculum . . . When we get better schools in our neighborhoods and better teachers, our drop-out rates will go down . . . active parental involvement is part of the solution. The importance of an education is going to have to be emphasized [with parents] . . . when your poverty level is higher than everyone else's and you live payday to payday, it's hard to imagine trying to afford sending your child to college . . . [education] is a luxury that you cannot afford . . . Some parents if educated on 529's [the U.S. tax code designation for a college savings plan] probably would make the sacrifice . . . parents need to see education as a necessity and not a luxury.

This posting was long (33 lines), and the student does not settle for one explanation but identifies several causes or reasons (schools, parents, poverty) for why African Americans are not increasing their college-going rate. This student was older and perhaps had a fuller, more complex grasp of the many causes for various social conditions.

Another example of this same complexity is this partial posting: "African-American college enrollment is increasing at a lower rate than other minority groups because of socio-economic factors, such as poverty, lack of family support, and indifference towards African-American students in K-12." The entire posting was also long (34 lines) and focused on more fully justifying this introductory sentence with data; in its entirety, the posting is a good example of this older students' grasp of the several and complex factors influencing minority enrollment in U.S. higher education.

Theme Three: Differences in Topic (Slavery and Reparations)

An interesting difference in the treatments of *topics* of the postings occurred along racial lines. In the postings to the discussions on diversity and affirmative action, the African American students mentioned slavery or racial prejudice four times and the issue of reparations for slavery twice. One student wrote, "Nothing is as significant as the baggage that African Americans still carry from slavery. . . . We have made some great strides, but we have failed to truly overcome some

of the socio-economic issues that still plague our race.” On the topic of reparations, an African-American student wrote, “I do not think that anything besides reparations would truly remedy past discrimination.” Another African-American student disagreed: “I also don’t believe reparations are the answer . . . I just don’t believe you can place a figure on hundreds of years of ‘constitutional human suffering’.”

Caucasian students did not address these topics. Such issues might be a source of discomfort to the Caucasian students and may explain why they avoided these topics. The Caucasian students were probably not insensitive to issues of slavery or prejudice, but more likely were uncomfortable discussing such sensitive issues with their classmates. On the other hand, in response to one African-American student’s posting about the long-term effects of slavery, one Caucasian student wrote the following post about oppression, and its effect on oppressed and oppressor alike:

Oppression for certain minorities has been brutally severe . . . Once the physical overt oppression is stopped, covert psychological oppression lingers for generations. . . . It takes a tremendous amount of courage and effort to change the mentality of the oppressors and the oppressed.

This posting certainly recognizes the effects of slavery, but also notes the impact on “the oppressors.” What is interesting is that no African-American student responded to this idea of the mutual, deleterious effects of slavery. Slavery and the effects of slavery were clearly sensitive topics to these students raised in the southern United States.

Theme Three: Consistency in Topics (*Affirmative Action, Poverty, K-12 Education*)

In contrast to the differences in attention paid to slavery and reparations, an entire week’s discussion was devoted to *affirmative action*, with largely consistent results. “I don’t think affirmative action will remedy past discrimination. Although it’s a scary thought if we totally abolish it at this point. I don’t think our country is ready to view minorities as being on an equal playing field,” wrote an African-American student. A Caucasian student wrote, “I do not think affirmative action will solve the problem with past or current discrimination . . . a law or a policy does not change a person’s beliefs . . . I do think things have improved, but they are anything but perfect. We need to continue making progress.” These postings capture two consistent qualities to the discussion: affirmative action is not, in itself, perfectly effective at remedying past discriminations, but something still needs to be done to achieve equal opportunity for all.

There were also some consistent treatments of the role of *poverty*. Twelve postings (eight African American; four Caucasian) indicated that poverty caused a number of problems for improving minority recruitment and achievement in college, which is remarkable for its consistency across postings and groups of students. In four cases (three African American; one Caucasian), the poster went on to conclude that problems facing African Americans were similar to other groups, including other minority groups but also individuals in lower socio-economic classes. This was meant not to ignore or belittle the experiences of African Americans but to broaden the discussion to include more individuals from additional minority groups who are experiencing similar problems. This may be an instance of trying to find “common cause” with other minority groups or classes rather than claiming that only African Americans had this problem.

Another topic that appeared to receive consistent treatment across groups was the need to focus time and resources on improving *K-12 education*. Fourteen postings include a reference to improving K-12 schools, including ten postings by African-Americans and four postings by Caucasians. An example of such a posting that is similar to many others is this one: “I think the reason for [African-American] college enrollment increasing at a slower rate depends upon how prepared they are [by] high school” and “I think the only way to remedy past discrimination is to improve our public school system.” Both of these comments are from the younger students. The

younger students were more likely to suggest improving K-12 education as their only or main thoughts for improving the issue under discussion (be it gender, diversity, or political tolerance). While the older students were just as likely to mention improving K-12 education as the younger ones, they also had many more suggestions for places or tactics to begin improving matters. For example, as one older African-American student wrote, “I think everyone has a role to play, from families, media, local and national government, schools, and others.”

Theme Four: Level of Thinking (Institutional versus Individual Responsibility)

Two different themes as they relate to *level of thinking* became evident after repeated readings of the discussions. The first theme of this kind was a difference based on age relating to *institutional versus individual responsibility*. In the discussions on diversity, gender, academic freedom, and political tolerance, many students suggested ways that higher education could contribute to solving various problems (such as, improving minority representation among students, faculty, and administration; improving conditions for female faculty; modeling tolerance and understanding in the classroom or campus interactions). As the question was phrased (“What should higher education do to solve this problem?”), it is not surprising that many students responded with suggestions for ameliorative actions to be implemented by higher education institutions. One younger student suggested offering programming that would draw students from all races together to improve understanding of other groups. An older student suggested, “Some of the literature I have been reading indicate that using GPAs, class rank, a lottery system (all qualified individuals go in a pool and names are drawn), and socioeconomic status” may improve the likelihood that higher education would enroll a diverse student population. Another older student wrote “Higher education’s role . . . should be to create more programs that bring people together.” Similar to the earlier theme of complexity, younger students were more likely to offer one or two suggestions while older students had a longer list of ideas for institutional action. In any case, emphasis in these discussions was on what higher education institutions should do.

But what was most intriguing was the progression of the discussion into issues of individual or personal responsibility by the older students. As one older African-American student wrote, “We must each be a point of light to make a change. It may seem too big of a task, but no one said we had to do it by ourselves. Just one small voice makes a difference. You have to Mean It and Want It for it to happen.” Another older student wrote the following in a different discussion, “My parents taught that it takes one small voice to get others to join and we can make a change in our office, department, family, home, church, and schools.” This same student would add later in her posting a comment relating her spiritual beliefs to taking personal responsibility: “To coin a line from a familiar gospel song, ‘If I can help somebody, as I travel along the way, then my living shall not be in vain’.” This emphasis on individual responsibility was exclusively the province of the older students in the class. Of the older students who mentioned taking personal responsibility for changing themselves and/or the area (unit, department, organization) for which they could claim some influence, five postings were from African-American students and two came from a Caucasian student.

Theme Four: Level of Thinking (Practical versus Transformative)

Suggestions for improving situations for minorities, women, or individuals with different political points-of-view could also be distinguished by their nature, being either *practical* or *transformative*. This difference parallels the earlier one focusing on what institutions or individuals can do, but is different in its quality or nature. For example, in a discussion on how to achieve equal representation of all groups in higher education, most suggestions were practical: such as using recruiting methods that focused on grade point average, class rank, socioeconomic status, inner-city schools, or K-12 schools with higher enrollment of different groups. These are all ideas that have been or are being implemented by higher education institutions in their efforts

to enroll diverse college students in the absence of traditional affirmative action tools. They are concrete, practical actions intended to achieve a particular aim.

But contrast these practical methods with the transformation proposed by some of the older students. Several postings (by both African-American and Caucasian students) spoke to the importance of developing, teaching, and practicing compassion: “We must teach compassion and the need to support those who are helpless and do not have a voice in society,” wrote an older African-American student. “Compassion,” wrote an older Caucasian student, “is a powerful skill.” A third older student, quoting Martin Luther King, wrote “I agree with my classmates about compassion . . . MLK was very smart in realizing that he had to appeal to the moral conscience of people in order to reach them. By tapping into a person’s moral conscience, he was able to convince SOME to change their hearts and beliefs.” A different older African-American student wrote, “I know, I’m crazy but I am going to take the simplistic view. And that is to say that . . . the bottom line is mandates will never change what is in the hearts of many. We need a change . . . a cultural change . . . not just in education but the world.” Of course, attempting to change people’s hearts is neither simplistic nor easy, but it does capture some of the older students’ stress on changing hearts and minds and values.

These latter responses are different from the more practical suggestions: they emphasize a change in consciousness or a movement toward “the upper level of mental life” (Merriam Webster, n.d.) or a personal transformation of values, beliefs, emotions, and thoughts that can contribute to a more aware and equitable human being. Such a change in individuals goes well beyond modifying recruitment methods or admission criteria, but gets at the very core of personal transformation and social change that can lead to a more equitable and aware society. These are clearly ideal statements, but ones that resonated with some of the older students in the online discussions.

Discussion

Several theories may explain the differences mentioned in a posting’s tentativeness, complexity, topic, or level of thinking. First, let us consider cognitive development and the instance of tentativeness or caution. Kohlberg (in Crain, 1985) has proposed that an individual’s moral development passes through a conventional stage where conformity and maintaining interpersonal accord is critical. The hesitation in expression by the young student noted above may be due to the need to avoid strong statements that could generate discord. It may also be evidence of Loevinger’s (1976) conformist stage of ego development where the disapproval of others is to be avoided, which might encourage tentativeness in expression.

The second posting (that begins “Great article”) can perhaps be explained by Perry’s (1998) schema of cognitive and ethical development. It is a good example of someone at the multiplicity stage (positions 3 and 4), which allows for accepting or allowing multiple points of view without evaluation or criticism. This student seems to be at this stage, struggling between two values, one which values freedom of speech and the other that seeks to protect youth from harmful points of view. Clearly, with the evidence made possible from the online discussions, these insights are merely suggestive and not conclusive, but they are interesting as an example of pre-Internet developmental theories being used to understand the quandary expressed online by this student.

Second, let us focus on the postings that used more complex thinking or comprehensive views of moral and social situations. King and Kitchener (1994) might place the individual who prepared the first long posting on the reasons for declining African American college enrollments at stage 5 thinking. This stage of thinking describes an individual who recognizes different theories and evidence for those theories, but is unable to coordinate or integrate these theories into a single, abstract position. This particular posting might also be usefully analyzed by use of Perry’s (1998)

scheme of intellectual development as a good example of contextual relativism, where solutions are supported by reasons and the student is attempting to evaluate which solutions may work best to solve the problem of declining African American college enrollments. It is important to note that these classifications have not been made by the preferred methods outlined by King and Kitchener (1994) or Perry (1998), which require more information on the student's thinking and greater in-depth analysis of various artifacts of their reasoning. A posting to an online discussion may not be of sufficient length, depth, or focus to be appropriate for a reliable analysis of the student, but these developmental theories can still be helpful to instructors who want to better understand how and at what level their online students are thinking.

Third, let us consider the postings where there were differences based on race. Table 1 noted that younger students and Caucasians were more worried about hurting others' feelings; African Americans in this class were more willing to disagree. Perhaps the African Americans – six of seven of the mature students – were operating at higher ego development levels such as the individualistic (Loevinger, 1976) level, which includes greater tolerance of self and others and awareness of conflict. Certainly this is difficult to know, but it may be that the African-American students were also exercising an opportunity to speak out about matters that concern them rather than hold back to avoid discomfort in others. Many of these students held advanced positions at their higher education institutions and were likely experienced with handling any number of difficult or uncomfortable matters on the job. Also, it is important to remember that all of these students will be enrolled in future classes together, and maintaining respectful and honest relations is to the benefit of all.

For a different view on the role of differences resulting from race, Chang, Astin, and Kim (2004) found that cross-racial interaction enhanced cognitive functioning by stimulating critical and analytical thinking, or put more simply, when students are exposed to ideas different from their own, it creates cognitive dissonance that requires them to reassess their current set of beliefs (Chang et al., 2004, p. 545). Mejías (2005) would likely put this process into the language of praxis, whereby online discussions can be a tool for moving individuals from communication *about* to communication *with*, which also collapses epistemological distance from what is far and unknowable to what is near and knowable. Discussing topics about race need not generate epistemological distance but can bridge distances when the races engage in online discourse about important but uncomfortable issues. These theories seem to imply that it is important for students to be presented with different views and to be placed in a condition where they might disagree with what is said or have their own points-of-view disagreed with. Feeling discomfort and experiencing differences may be essential to learning.

One theory that might help explain why the older students emphasized individual responsibility is Loevinger's (1976) stages of ego development. Both age groups offered examples of actions that higher education institutions could do to improve a variety of problems (e.g., diversity, affirmative action, to name a few). This focus on institutional responsibility may be an example of Loevinger's stage of self-protectiveness, which emphasizes blaming others. While the students' comments did not always seem to blame higher education institutions (a few postings did but the majority of comments did not), what is important here is their willingness to focus on colleges and universities having the main responsibility for improving matters. As mentioned earlier, because the question was phrased, "What should higher education do about __ [diversity, affirmative action, etc.]" perhaps the predominance of this type of answer reflects less on the students' ego development than on the nature of the initiating question.

However, the older students progressed to posting comments that stressed the importance of individual responsibility, which may capture the next higher stage, or the conscientious stage of Loevinger (1976). The conscientious stage stresses a sense of responsibility and the perception that the self is different from the group. This last is important because personal responsibility

cannot be developed until there is a unique individual – one who is motivated by his/her own ideals rather than a group's – to claim (or see a need for) a role or responsibility in the world.

Two theories may illuminate the difference, also based on the age of the student, between practical and transformative thinking. All of the students, regardless of age, were capable of suggesting practical solutions to problems focusing on rules, policies, and practices. It was only a few of the older students who suggested solutions that stressed changing people's perspectives, values, beliefs, or as one student put it, their "hearts." Such a judgment perhaps reflects advancement beyond Kohlberg's (see Crain 1985) post-conventional stage five thinking, which views others' as holding different opinions and values that must be respected and honored. They may be at stage six, which emphasizes using reasoning to possibly change another, although there is less evidence in the discussions for this placement.

Another useful approach to understanding the difference between persons who propose practical or transformative solutions may be the students' view of how change happens in the world. To some extent, all of the students see problems as open to analysis and understanding and an almost technical solution. To increase diversity in higher education, one needs to understand where to recruit and how to recruit diverse students, and go there and recruit those students. But the comments labeled "transformative" imply a different level of understanding of how change happens, that true diversity requires a change of heart and mind, not just a change in policy or practice. As one student phrased the problem, "Changing a law or policy does not change a person's beliefs." This perspective recognizes that people are not as pliable or responsive to changes in rules or policies as some practical approaches assume, but real change requires a deeper psychological transformation. It is not simply that people are complex, but that people are beings comprised of feelings and values that are difficult to change. Such feelings and values are integral to their selves and they may be unaware of them or find them too confusing or frightening to their old sense of self to change. Transformation is no simple process, but it is clearly a different process and outcome than those brought about by more simple or practical changes which may result in compliance to the new policy or rule but no change in consciousness.

Perhaps Theory U (Senge, Scharmer, Jaworski, and Flowers, 2004) can explain this movement toward transformation. Theory U recognizes that profound change -- whether it occurs in personal, organizational, or social settings -- can bring about deep, fundamental change by going through the U process. Beginning at the upper left point of the "U," one begins with "sensing" one's perception of present reality. By descending the left side of the U, one comes to "presencing," or becoming open to new ways of thinking and doing. Then, one ascends the right side of the U up to "realizing," where one's change of heart becomes implemented in new actions. The comments from the online discussions do not capture every step of this process, but the level of understanding of the comments seems to imply that a process much like that described by Theory U has occurred. What is probably most critical about the practical and transformation approaches – compared to the other stage theories of development discussed earlier – is that students can understand and recognize the value of both approaches at the same time. But it was only a few of the older students who recognized that the problem would be solved by going deeper into the individual and touching and changing their the heart.

Conclusions

This qualitative study explored evidence for age or race differences in online discussions. By carefully analyzing the transcripts of the online discussions, several themes emerged that could be explained in terms of age or race. While some of the themes related to consistent topics that appeared in several of the discussions, others concerned how they tentatively they expressed ideas, how complex those ideas were, and the level of thinking captured by their posting to the

online discussion. Because of the small number of students in the analysis, these results cannot be generalized to all students online. But these insights are suggestive of differences that are worthy of further study by others who teach online and that teachers need to recognize as they create, conduct, and assess their students' online discussions.

Online discussions can be useful for analyzing various phenomena, including student thinking and interactions as well as their grasp of course content. However, they may not be the optimal tool for determining a student's developmental stage. And yet several pre-Internet theories can be very helpful for explaining student responses in the online setting. While exact placement in a stage theory may not be the goal of an analysis, such theories may well be useful for instructors to understand what may be going on in the online discussion and whether they should modify their approach to the discussion and interrupt, explain, summarize, or introduce a new topic. For example, younger students may need to be encouraged to develop more complex and sure responses in subsequent online postings. Older students may need to be pushed to deepen and broaden their understanding of issues. And students of different races may need to be encouraged to discuss difficult topics directly and with sensitivity, if they are not already doing so.

Based on these results, there is modest support for the assertion that we take ourselves online, including warts, virtues, and thought processes. Although the phenomenon of individuals adopting new persona in online contexts is intriguing (see Turkle, 1997), it appears that individuals entering into an educational context do not change themselves in some fashion when they go online. Their personalities, values, beliefs, and sense of humor become evident through their emails and discussions online.

Therefore, faculty teaching online cannot avoid becoming aware of students' beliefs and values. They also need to be aware of students' cognitive and/or developmental levels before entering into controversial discussions. One reassuring insight to this study is that racial or other controversial issues need not be avoided in online discussions, especially if students are older and more mature. This is fortunate since many controversial issues are essential for understanding various disciplines or professional studies. Controversy is also valuable in creating the cognitive dissonance that encourages further thought about these topics, but faculty may need to encourage younger students to not avoid or fear controversy and help them process various points-of-view. But clearly, these discussions can occur online to great benefit.

There does not appear to be any evidence so far that discussion boards are either good or bad by themselves. Their value seems to depend on characteristics of students as well as the skill of the facilitator or instructor, the rules of conducting a discussion, and the initiating conditions of the discussion. In other words, they are a tool and can be used poorly and without a clear learning objective, or they can be designed to support and encourage valuable learning. In any case, online discussions can be a window into students' thinking, and offer faculty an important way to impact the further development of their thought, increase student learning, and improve online courses.

What is perhaps most important about online discussions is that they enable the "exchanging of ideas with other scholars [so that] we are constantly learning about new points of view and looking at issues in a richer way" (Bacalarski, n.d., p. 5). This is based on Vygotsky's (1986) theory of the development of human thought, which Bacalarski (n.d.) argues is particularly applicable to computer-mediated or online learning. This theoretical foundation makes online discussions an essential tool in the development of new and richer thought through the exchange of ideas among students and faculty. The fact the exchange happened in the context of a discussion held online is perhaps less relevant. What is important is the nature of the exchange. Perhaps someday, we can ignore the setting of the discussion – whether it happened face-to-face or online – and focus on the quality of the exchange and the learning that occurred.

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About the Author

Dr. Meyer is currently associate professor of higher and adult education at The University of Memphis and her research interests include online learning and virtual universities. She is author of *Cost-Efficiencies in Online Learning*, a 2006 publication of the ASHE Higher Education Report Series. She can be reached by email at kmeyer@memphis.edu, regular mail at the University of Memphis, 310 Browning Hall, Memphis, TN 38152, or phone (901) 678-2466.

Dr. Katrina A. Meyer
Associate Professor of Higher and Adult Education
University of Memphis
310 Browning
Memphis, TN 38152-3340
(901) 678-2466
kmeyer@memphis.edu

Editor's Note: This paper embodies many theories and best practices related to learning in physical and virtual communities that are invaluable for instructional design and implementation.

Metamorphosis of the Mind of Online Communities via E-Learning

Ayşe Kok
UK

Abstract

Different elements have been attributed to the concept of 'community' throughout the history some of which still apply to the notion of virtual communities. This paper provides an overview of the essential features of both physical and virtual communities and focuses on how intelligent learning may occur in online communities. Based on the Wheelan instrument (1999), the intelligence of an online community can be evaluated from the perspective of problem-solving, goal definition, and feedback. This paper concludes that in order to enhance the spirit, trust, interaction and commonality of learning experiences, instructors can attend to transactional distance (psychological space between teachers and learners), social presence, equality, small group activities, group facilitation, learning stage and community size.

Defining the Concept of "Community"

Different elements have been attributed to the concept of 'community' throughout history. To name a few: environment, social form and patterned behaviour (Arensberg, 1965) or a place to live, a spatial unit, a way of life and a social system (Sanders, 1966). Being a social system, social interaction, common ties and physical co-location are the essential elements of a community (Jones, 1995). So, territorial, social and psycho-cultural bonds exist in communities.

According to the German sociologist Ferdinand Tönnies, there are two main types of social groups (Truzzi, 1971):

- **Community (*Gemeinschaft*):** Groups that are formed around essential will - the underlying, organic or instinctive driving force - in which membership is self-fulfilling such as the family or neighborhood. This social order is based upon consensus of wills, rests on harmony and is developed by folkways and religion. There are enforceable norms regulating the interrelation of wills and that are rooted in family life. Morality is intertwined with the realities of the family spirit and is an expression of religious beliefs.
- **Society (*Gesellschaft*):** Groups in which membership was sustained by some instrumental goal or definite end such as the city or the state. This social order rests on convention and agreement and is safeguarded by political legislation. This is based on the conventional order of trade and similar relations, yet attains its validity via policy instruments. Morality is a product entailing all relations involved in political contrasts.

Physical community is based on people's natural association through sameness and by exclusion of others like a "Gemeinschaft". On the other hand, virtual community is represented by intimate secondary relationships, weaker ties and homogeneity by interest. The society is viewed as an enhancement of social ties as the virtual community preserves ties among those who are physically separate.

Throughout the literature, idealized visions of community such as a physical community based on dynamic reciprocity and responsibility – as Kant stated – a group of people coming together to recognize their common will via a social contract – as Locke argued – and imposing great concern and altruism for the individual – as Rousseau noted. The basic cell from which a society

evolves and develop its own internal logic – as mentioned by Hegel – or a public sphere in which solidarity is created for the general well-being of the society (Katz, Rice, Acord, Dasgupta & David, 2004).

A Look at Virtual Communities

Community networks can either be viewed as whole networks or as personal communities. Whole networks are similar to aliens viewing the earth's people. Relationships linking all members of the population can be observed by an outside observer (Wellman, 1993). This alien's eye or Copernican view of an entire social system is the study of whole networks (Wellman, 1993). On the other hand, the Ptolemaic views of networks put the individual at the center of their world revolving around them (Wellman, 1993). This study of smaller personal (ego-centered) networks defined from the standpoint of focal persons conceptualizes a person's community life as the central node linking together complex interpersonal relationships. The shift in perspective from neighbourhood community to community network allows analysts to examine the extent to which large-scale social changes create new forms of associations (Wellman, 1993). Yet, the definition of ties, boundaries, and the importance of internal links within clusters, are left open (Wellman, 1993).

Social roles and identities within communities can be viewed in terms of information systems that entail patterns of access to social information, determined by a mix of physical setting, media and mental constructs. Within the context of physical and virtual communities, people develop a sense of who they are by imagining how distant others view them. Mediated technologies are likely to affect our notions of community. It should also be taken into consideration that mediated personal communication technology refers to the mobile phone, the Internet and PDAs. As opposed to mass media, these technologies are individual to individual or individual or to group.

Driven from his work on social dilemmas and cooperation, Kollock (1998) suggested that the principles be taken into consideration when building online communities:

- In order for an online cooperation to occur it must be likely that two individuals meet again in the near future. So, ongoing interaction must be promoted.
- Individuals must be able to identify each other as well as be informed about the other person's behavior. The provision of durable records of events and history of the online group, not imposing a length constraint on postings and front-loading the system with talkative people, might increase the extent to which information is distributed.
- Group boundaries must be clearly defined to prevent making use of resources without contributing to the group.
- Rules governing the use of collective resources should be matched to the local needs and conditions. The group participants mostly affected by these should also be able to modify them.
- The rights of the community members to devise their own rules must be respected to some degree by external authorities.
- A system of monitoring the members' behavior and sanctions should be carried out by the community members themselves.
- Low cost conflict resolution mechanisms should be in place so that members can resolve their own disputes without outside interference.

Burt (2003) also argues that, as the ways of thinking are more homogenous within than between groups, people connected to otherwise segregated groups are likely to be familiar with alternative ways of thinking and hence better at selecting and synthesizing alternatives and producing good ideas.

In terms of the lifecycle of an online learning community, Preece (1998) makes the following analysis:

- **Pre-birth:** Development, software and policies of the community are established. The basic structure and operation of the community affect its later stages.
- **Formative:** As new members are brought into the community, the community's identity develops. Threaded discussions may be helpful for nurturing the community.
- **Maturity:** As the community functions independently of guidance, the central role of the facilitator may decrease.
- **Metamorphosis:** The community becomes something that it originally was not.
- **Death:** When members leave or discussion slows to the point that there is not enough participation, the death of the community occurs.

According to Lazar and Preece (1998), in order for an online community to be successful the following factors should be taken into consideration:

- **Good usability:** Not being able to figure out how to join the community or to post a message may make users frustrated. Interactions can also be encouraged through a good design.
- **Appropriate and responsible moderation:** A good moderator should encourage free discussions and know how to step in when inappropriate or harmful behaviour is displayed by members.
- **A reason to communicate:** A shared purpose, experience or interest makes people interact online regardless of whether they would like to communicate face-to-face or not.
- **Distributed nature of resources:** Good conversations and useful resources that are mostly shared and available due to computer-mediated-communication are essential for an online community to be sustained. File backups of community resources should also be made to prevent the members from leaving the community in case of a technological failure.
- **The right level of registration:** A registration process which includes sending a subscription message to a listserver or whereas users have to provide their e-mail address or personal information might be useful when establishing an online community.

Learning in Online Communities

Wilson, Ludwig- Hardman, Thornam, Dunlap (2004) distinguish bounded learning communities from the spontaneous communities by the following characteristics:

- Participation is required in order to obtain a desired end, so learning is intentional.
- Classmates or instructors are not chosen.
- Learners must commit to a fixed length of time, so a course enrolment is required.
- Learners must make an explicit effort to connect with others by coming to courses or connecting online and sharing the resources under the guidance of an instructor.

Learning communities in general allow the students to solve authentic problems collaboratively, to develop an appreciation for multiple perspectives and refine their knowledge through argumentation whereas a sense of community is fostered (Figure 1). By facilitating a joint enterprise, shared repertoire and mutual engagement (Wenger, 1998), an online community can be sustained. So, teachers must model effective knowledge construction and collaboration by establishing trusting relationships with students and providing feedback, supervising, troubleshooting as well as providing the infrastructure for interaction.

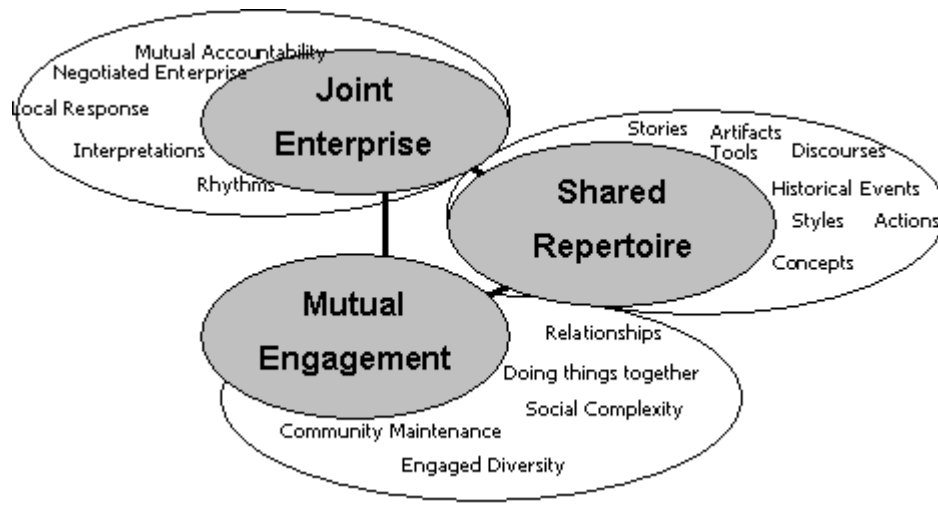


Figure 1 Key components of communities of practice (Wenger, 1998a, p.73)

Moreover, Wilson, Ludwig- Hardman, Thornam, Dunlap (2004) point to shared goals, supportive conditions, a collective identity, collaboration, respectful inclusion, progressive discourse toward knowledge building and mutual appropriation between teachers and students in order to create a sense of a community. The following strategies are suggested for facilitating effective learning communities (Wilson, Ludwig- Hardman, Thornam, Dunlap, 2004):

- **Shared goals:** Authentic and meaningful projects in which learners determine the major goals and create action plans and assessment rubrics for their fulfilment can be built.
- **Safe and supporting conditions:** Once the members post their personal information community discussions should be monitored to ensure that the netiquettes are followed. Learners can also be taught in how to monitor discussions and resolve any conflicts.
- **Collaboration:** Open-ended topics can be utilized whereas learners can be assigned to subgroups and provided with adequate communication tools.
- **Respectful inclusion:** Making learners share stories on a particular theme or interview each other and give feedback about each other in return may be useful. Learners should also be trained in how to negotiate their differences when collaborating on projects that may require multiple perspectives.
- **Progressive discourse toward knowledge building:** Role-plays, debates, progressive writing projects where each learner adds to a story and reflects on it later on might support knowledge construction.
- **Mutual appropriation:** Assigning learners to different expertise groups where they can act both as a mentor and a mentee can help increase the level of mutual appropriation.

The Main Cognitive Activities during Learning

Knowledge resides in human-beings in the form of operators to achieve goals whereas operators are procedures for changing the current state into another that brings human closer to their goals (Kayashima et al, 2005). As multiple operators can be applied to a state selecting which one to apply is a critical task. Cognitive activities can be classified as follows (Kayashima et al, 2005):

- **Rehearsal:** This is a critical task for maintaining contents.

- **Observation:** This refers to the process of watching something carefully and creating products in working memory.
- **Evaluation:** This refers to the assessment of the state of working memory.
- **Virtual application:** This refers to the virtual application of retrieved operators.
- **Selection:** Selection is choosing appropriate operators and generating an action list in working memory.

Cognitive operations are operations to generate a new (cognitive) product by applying operators to the content. Due to the fact that a cognitive operation may become the target of a cognitive activity cognitive operations should be distinguished from cognitive activities.

Within the light of this information, a multi-layer model of cognitive activity can be applied for problem-solving based learning. Accordingly, an individual observes a condition and creates elements in working memory as its model when the learner solves a problem. After evaluating the problem and investigating whether there is some domain knowledge useful to accomplish the task suitable operators are retrieved from the learner's knowledge base and applied to the working memory elements (Kayashima et al, 2005). Based upon the evaluation of the application results an action-list is made by selecting the appropriate operators (Kayashima et al, 2005). This is repeated until the goal is achieved and finally, the learner performs some observable actions in the real world. Based on this multi-layer model, a two-layer model has been suggested by Kayashima et al (2005) where observation of elements in working memory creates elements in another layer of working memory. Such observation is also called as reflection.

Being an active and conscious process reflection can be divided into two kinds (Kayashima et al, 2005):

- **Reflection in action:** This refers to thinking on one's feet. This is also called as conscious observation and entails observing elements in working memory and creating elements at the upper layer.
- **Reflection on action:** This refers to retrospective action. It entails retrospective creation of elements at the upper layer. To exemplify, we sometimes review retrospectively our problem-solving processes to identify the reason for failure.

Cognitive Presence in Online Communities

Based on the community of inquiry model which is based on constructivism and which is developed by Garrison, Anderson, Arcer (2000), community-based learning consists of the social, cognitive and teacher presence (Garrison, Anderson, Archer, 2000). In this model, cognitive presence is defined as the extent to which learners are able to confirm meaning through sustained collaboration and reflection.

Similar to the cognitive activities as described by Kayashima et al (2005), the elements of cognitive presence are exploration, construction, resolution and confirmation. The factors concerning cognitive presence can be summarized as follows:

- Cognitive presence
- Synthesize ideas
- Apply ideas or concepts
- Confirm concept understanding
- Know how to participate

- Identify relevant new information
- Understand the issues being presented
- Understand expectations
- Take responsibility
- Adjust to the context/climate
- Accepting teacher assessment
- Generate tentative solutions
- Stimulate your curiosity

Adapted from the Wheelan instrument (1999), the intelligence of an online community can be evaluated from the following three perspectives:

- Problem-solving and relationships: The problem-solving ability of an online community depends on the following factors:
 - Time it takes to define the problem
 - Availability of a plan
 - Availability of effective decision-making strategies
 - Whether solutions are implemented and evaluated
 - Whether there are group norms to encourage performance
 - The degree of cohesiveness and cooperation
 - The time for accomplishing goals
 - Whether conflicts are dealt effectively
- Goals and roles: When deciding about the roles and goals within a community the following factors should be taken into consideration:
 - Whether the goals of the community have clearly been identified
 - Whether all the community members agree on group goals
 - Whether there is a requirement for working together
 - Whether the roles have clearly been identified
 - Whether the roles have been accepted by the community members
 - The extent to which the assignments match the abilities
 - The extent of openness of communication
- Feedback and structure: This aspect entails the following items:
 - Whether members receive or give regular feedback
 - The degree to which feedback is used for improvement
 - Availability of norms that encourage innovation
 - Whether sub-groups are integrated to small teams
- Taking into account these three perspectives, intelligent learning in online communities may occur by focusing on the following aspects:

- Creating opportunities to enhance spontaneity: By enabling learners to build the course content via use of collaborative tools such as wikis, learners can construct their ideas through spontaneous conversations with others.
- Coaching learners how to learn online: Reminding learners of their important role they have in their discussions, offering them constructive feedback and providing examples of strong community building behaviors are crucial for effective communication.
- Exploring the use of diverse technologies for enhancing communication and social presence: Apart from text-based technologies, web-based audio and video-conferencing and application sharing technologies could be utilized for ongoing communication.
- Managing expectations of the online community: The focus should be on how to achieve the learning objectives and how to foster critical thinking.
- Understanding all learners in online learning environments: Since online learning is not a preferred learning medium the focus must be on helping learners feel confident in the online environment.

Conclusion

Recognizing the learners' input, providing opportunities to develop a sense of group cohesiveness, maintaining the group as a unit and helping learners to work collaboratively may increase the effectiveness of online communities. In order to enhance the spirit, trust, interaction and commonality of learning experiences, instructors can attend to transactional distance (psychological space between teachers and learners), social presence, equality, small group activities, group facilitation, learning stage and community size.

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About the Author:

Ayse Kok is an E-learning Consultant and Researcher in the United Kingdom.

Blog: <http://aysekok.blog.co.uk>

Email: ayshe.kok@gmail.com

Editor's Note: This study validates the ever present need to learn through a number of communication channels and the desirability of designing materials to accommodate different student learning style preferences.

Effectiveness for Learning Styles in Theory and Practice of “PC Hardware Maintenance”

Dr.Vasant G. Wagh

India

Abstract

Self-instructional learning materials are needed for laboratory based topics and subjects. Print and video of lectures are two options now available to a self-learner. The Computer Assisted Learning (CAL) packages currently available in India are primarily demonstrations with a passive approach to learning. Psychology of Learning (Learning Theory) is lacking in design of these CAL packages. The learner is assumed to be equipped with prerequisites and a self evaluation component is generally lacking.

In this study, an Interactive Computer Assisted Learning (ICAL) package is developed based on a Learning Strategy. A prime objective is to involve active learning rather than passive viewing and listening. Different learning mechanisms and approaches are taken into consideration. The present work is multimedia improvisation of Audio-Vision concept (Gaikwad et. al. 1994, 1995) developed and implemented at the YCM Open University, Nashik. Classroom and laboratory simulations are two major components of the ICAL package.

The ICAL package as developed was tried, component by component, on postgraduate degree students of Electronic Science. This paper describes the design and implementation and discusses the results.

Keywords: Learning Theory, Computer Assisted Learning, Audio-Vision, Active Learning, Self Instructional Learning Material, Class Room Simulation, Laboratory Simulation, Cognitive Theory of Multimedia Learning.

Design of CAL: Psychological View

Understanding of a concept, laboratory related techniques, what, why and how-to topics are followed by application in similar and diverse situations. Learning occurs through mental and psychomotor skill development. Often, print material is static and fails to promote understanding of a concept, laboratory related technique, what, why and how-to-do topics. If understanding is not clear, concept application becomes difficult and in some cases impossible. Availability of multimedia and graphical animation has made it possible to look at this problem afresh [18,24].

Development of Computer Aided Learning (CAL) package is looked up on as a mere technique rather than Science. In order to be useful to a learner, a CAL package should be self instructional. It should involve an individual actively in participative learning rather than passive listening and viewing. Hence Computer Aided Learning (CAL) package should be *Interactive Computer Aided Learning* (ICAL). Currently available CAL packages are demo type, containing a video or text with voice. They lack self-evaluation as well, a necessary component to improve self confidence and, in effect, may influence and/or change affective behaviors to some extent.

Addressing problems in “PC Hardware Maintenance & Troubleshooting” needs mental and psychomotor skills. Problem solving performance is basically a process oriented activity which is aided by conceptual knowledge [12]. A cognitive tool that helps problem-solvers should include

the required procedural knowledge as well as conceptual knowledge. Problem solving performance is closely related to contextuality of the problem [17]. Contextuality denotes the meaningfulness of the situation as interpreted by a learner's prior knowledge and experience. For this reason, several problem-solving researchers have focused much of their attention on enhancing the contextuality during problem solving such as design of real problems that he or she solves every day and the transfer of problem solving skills to a new context [21].

Knowledge maps connect concepts called 'nodes', with other concepts by labeled or sometimes unlabelled arrows, called 'links' and have been regarded as more effective representations than others in problem-solving [10]. The knowledge map is especially useful in problem-solving because it enables learners to externalize their internal problem-solving process: to obtain helpful information embedded in a problem, to retrieve and reorganize their prior-knowledge with the new knowledge related to the problem selectively, to identify possible constraints and to generate insightful ideas [9,19,22].

Problem-solving performance can be improved by selectively choosing a combination of conceptual and procedural representations [1,13]. From a cognitive load perspective, Sweller found that learners who were presented with instructional materials that integrated text and graphics solved geometry problems better and with less effort than learners who were presented with instructional materials that provided text separately from graphics illustrations [23]. This principle has been repeatedly demonstrated [2,11] as long as the text and graphics are complimentary, rather than redundant. Jonnassen et. al. [10] argued that procedural knowledge should be based on conceptual knowledge because no action can be performed without the awareness of necessary conceptual information to perform a given procedure.

Learning is an extremely complex process. A learning style is a students' consistent way of responding to and using stimuli in the context of learning. Three learning styles or intelligences that help us to discover different forms of mental representation are:

- VKA (Visual, Auditory Kinesthetic)
- Kolb's learning inventory
- Howard Gardner's Multiple Intelligence

We use learning styles to develop an adaptable learning environment that presents material in variety of methods than trying to determine each learner's personal style. The more styles you address, the easier the instruction will be received by the learners. Learning styles [3] come from three schools of thought:

- Perceptual Modality
- Information Processing and
- Personality Patterns

A learner learns through experiences. Aldrich [3] argues that there are six criteria that compose *an educational experience*:

- Delivery Elements
 - Simulation
 - Games
 - Pedagogy

Pedagogical or didactic elements ensure that learner's time is productive. Game interactions provide familiar & entertaining interactions. Simulation elements provide virtual reality.

- Content Types
 - Systems
 - Cyclical
 - Linear

Content types describe directional flow of the content. Linear content is presented with one event or step following the next. Cyclical content addresses “muscle memory”. System content deals with complex relationships.

Whether multimedia instruction is good or bad depends almost entirely on those who design the multimedia materials and those who teach with them [22,12]. Does a set of rules or an algorithm which can be used in the design of self learning CAL package exist? Does *Learning*, a mental process, have any place in the design of CAL? Can it be designer-as a person, independent? Is it possible to write down step-by-step procedures? Present work is exploring more in this area.

Mayer’s research [14] indicates that students’ ability to “transfer” information that had been presented to them multimedia-style showed a whopping 89 percent improvement in performance over traditional book-based methods. Broken down into categories, when text and graphics were combined in a teaching presentation, students’ transfer ability went up 68 percent; when the information was presented orally rather than read by the student, the transfer rate went up 80 percent. Mayer [14] defines “transfer” of information as the ability of students to integrate the information into their already existing knowledge base and use it to generate ideas or solve abstract problems (i.e. the ability to understand and use the information).

Mayer [14] finds that, when certain types of material are presented using multimedia methods, retention (defined as the ability to recall facts or steps in a process) increases by an average of 23 percent; when text and graphics are combined, retention goes up an average of 42 percent; and if the text of a presentation is spoken rather than read-if students hear the words, rather than read them, retention goes up an average of 30 percent.

Can understanding, hence self learning be improved if the stress of study is controlled? Lipnicki [5] finds that, *noradrenalin*, a hormone produced in the brain by stress, reduces one’s ability to detail and reason. Can ICAL designed with a learner-centered approach help to reduce stress of study? Can any-time any-where use of a properly designed ICAL package facilitate and improve self-learning?

Medium (technology), message (content) and the messenger (presenter or teacher) are inextricably linked [14,20]. Overuse of multimedia (technology) has a detrimental effect [14] on a student’s ability to learn. Technology traps always exist and should be avoided. Mayer’s research [20] suggests that, when used correctly, multimedia both improves information retention and understanding. The solution to avoiding a technology trap is to adopt a Learner-centered approach that is consistent with the way the human mind works. Media selection [24,8,14] plays a vital role in the development of self-instructional material. However, if we accept Mayer [14] and Simons [20] that quality of a content, skill of a presenter will decide if the media can help facilitate understanding or work against it. This suggests we should consider “Learning-Processes, Styles and Environments” in the presentation of “content (message)”.

This present work tries, through the ICAL package, to implement Mayer’s [14] “Cognitive Theory of Multimedia Learning” and incorporate relevant steps of “Learning Processes”.

Design considerations

The ICAL package is organized into the following modules:

- Theoretical Details - Internal and external parts with the help of class room simulation
- Practice session
- Before you buy
- Assembling a PC
- Installation of an OS such as DOS, Windows
- Installation of a new software
- Installation of a new hardware
- Maintenance of hardware parts
- Maintenance of software components
- Troubleshooting
- Different hardware parts
- Different software modules

Each module has been designed with specific learning objective.

- Since the more learning styles you address, the easier the instruction will be received by the learners [3], different modules use different presentation “Styles and Environments”.
- Hardware maintenance and troubleshooting is a cognitive and psychomotor task. Since problem-solving performance can be improved by selectively choosing a combination of conceptual and procedural representations [1,10,13], most of the modules use this learning framework.
- Theoretical background is presented with audio-vision technique [6-8,2,11] in a didactic or pedagogic presentation style [3]. In some places, a dynamic graphic is used to explain the concepts [23].
- Practice session, that occurs before actual PC assembling module, uses *Cyclical Content* presentation mode. Cyclical Content Addresses “muscle memory” and helps in actually learning a skill [1, 3].
- Test yourself component in each module is included at the end of the modules to help the learners in finding their status and improving their self confidence and affective behaviors [21].

Project Details

In the present study, following topics from “PC Hardware Maintenance and Troubleshooting” are included in an Interactive Computer Assisted Learning (ICAL) Package:

Development of ICAL package is organized in two CDs entitled *PCHMTS-1* and *PCHMTS-2*.

PCHMTS-1 Consists of following five Modules:

Module-1: External parts

- 1.1) Monitor, 1.2) Keyboard, 1.3) Mouse, 1.4) Cabinet, 1.5) Speaker, 1.6) Floppy drive,
- 1.7) CD-ROM, 1.8) Test yourself.

Module-2: Internal parts

2.1) Motherboard, 2.2) BUS, 2.3) Expansion card, 2.4) Memory
2.5) I/O Devices, 2.6) POST, 2.7) Test yourself.

Module-3: DOS

3.1) Basic DOS commands, 3.2) Practice of DOS Commands, 3.3) Test yourself.

Module-4: Windows

4.1) Desktop, 4.2) Start menu, 4.3) Task bar, 4.4) Accessories, 4.5) Explorer, 4.6) Control panel,
4.7) Test yourself.

Module-5: Evaluate Yourself

PCHMTS-2 Consists of following six modules:

Module-1: Assemble a PC

1.1) Practice session, 1.2) Video on assembling, 1.3) POST, (Power On Self Test), 1.4) Beep,
1.5) Test yourself.

Module-2: BIOS

2.1) BIOS, 2.2) Test yourself.

Module-3: Installation

3.1) Fdisk/formatting, 3.2) Installation of Operating System, (O.S.) 3.3) Installation of keyboard,
3.4) Installation of printer, 3.5) Installation of MODEM, 3.6) Installation of CD-ROM,
3.7) Installation of sound card, 3.8) Test yourself.

Module-4: Troubleshooting

4.1) Storage devices, 4.2) Safe mode, 4.3) Display problems, 4.4) Sound problems,
4.5) Booting Problems, 4.6) System Slowdown problems, 4.7) MODEM problems,
4.8) Printer problems, 4.9) General Instructions, 4.10) Test yourself.

Module-5: Virus

5.1) Introduction to virus, 5.2) How to handle a virus attack, 5.3) Test yourself.

Module-6: Evaluate Yourself

PCHMTS-1 is organized into five modules. PCHMTS-2 is organized into six modules. All subtopics are linked to a main module. Class room simulation is done with the help of series of interactive animated slides with relevant audios attached. The student is also provided with an option of repeating a whole slide, audio only, or continue. Online self-evaluation is an essential part of each module.

Topic/concept is explained first with the help of audio-vision [6,7] (class room simulation) supported by dynamic graphical animation. It is followed by a formative self evaluation test. The second step is "Learn by Doing". In this part, application of acquired knowledge is checked in a practice session. A step by step solution (a guided walk through) is provided for various common problems. Human memory and learning are co-related mental activities. Short memory is converted in to a long memory by repetitions, practice and application of the knowledge to diverse problems [16].

Graphics are created in Adobe Image Ready and Adobe Photoshop; animations are created in Macromedia *Flash*. Each audio (MP3) file is separate with enabled recompression. Gold Wave

and Adobe-Auditions are used to create audios. Separate video with audio on assembling a PC is included. Practice sessions (sprite) are developed by Image Ready. All Graphics, Audio, Video, Sprite, and Text are linked by using RLE (Reality Learning Engine). RLE is a Learning Management System used to make interactive multimedia lessons.

Hypotheses

The following null hypotheses were set for the present study:

H0: There is no significant difference between learners of PC Hardware, its Maintenance and Trouble shooting using conventional face to face method and method based on ICAL.

H1: ICAL package of PC Hardware, its Maintenance and Trouble shooting improves level of understanding of learners better than conventional face to face method.

Population and Sample for the Study

Students of M. Sc. (Electronic Science) were chosen as a population for this study. Students admitted to M. Sc. may come from B.Sc. (Electronic Science), B.Sc. (Physics) of PUNE University and B.Sc. (General) from other universities. Sampling for the present was done at two stages phase-1 and phase-2. This sample was chosen because some of them have studied the subject in class room with face to face environment and others are totally illiterate in this area. A face to face certificate course of 2 months (48 Hours) was organized before the students were shown the ICAL tool under test.

First phase sample consisted of 21 students of M.Sc. Part-I and 13 of M.Sc. Part-II. of academic year 2004-05. These students were subjected to Pre-tests and Post-tests with the help of self-test modules.

Second phase sample consisted of 22 students of M.Sc.I

Methodology

The present study aims at testing effectiveness of ICAL packages in relation to two independent variable learning styles and level of interactivity. Sampling for the present study was done at two stages. Students of M.Sc.I and M.Sc.II (Electronic Science) of (academic year 2004-05) were chosen as a population in the first phase and students of M.Sc. I for (academic year 2005-06) were chosen as a population in the second phase for this study. The students in the first phase sample were chosen because they had studied the subject in classroom with face-to-face environment. These students were subjected to Pre-tests and Post-tests with the help of self-test modules. In the second phase, students of M.Sc. I were divided into experimental and control groups. The control group was subjected to face-to-face teaching and the experimental group used ICAL learning packages. The retention test was administered again on both groups after three weeks.

Data Collection

In the first phase, a Pre-test was conducted and marks obtained by the students were noted. These students were then asked to study the ICAL package module-wise. Students studied the modules at their own pace. They were given a freedom to repeat a module till their satisfaction. After finishing every module, the post-test was administered. The same procedure was adopted for the complete package. Scores of post and pre-tests were noted module-wise. Figure 1 shows the implementation strategy used.

In second phase, the sample was divided into a control group and an experimental group by the lottery method. The cognitive level of both groups was same because they were from same class and same level. The control group was subjected to face-to-face teaching and the experimental group used the ICAL package for learning. After compilation of the face-to-face and ICAL Post-test, marks obtained were noted for each student. The retention test was administered on both the groups again after three weeks. Figure 2 shows implementation strategy used.

Implementation Strategy

For first Phase

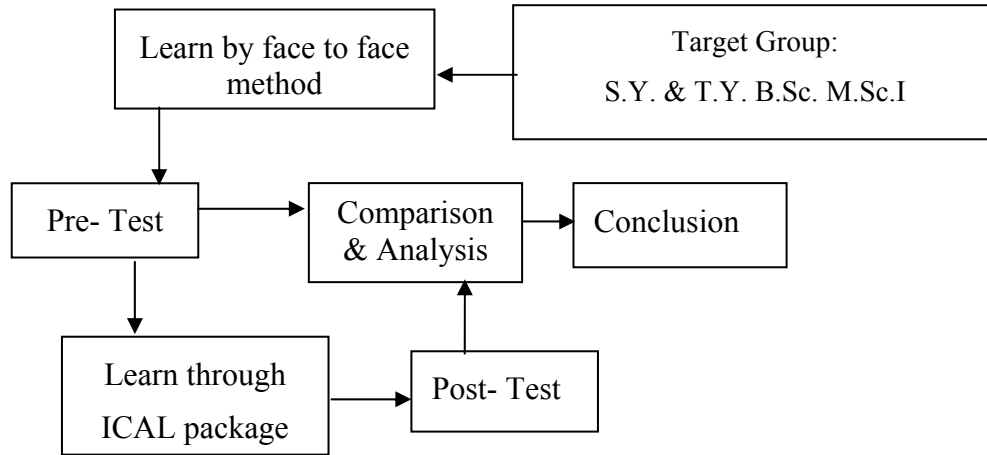


Fig. 1

For second phase

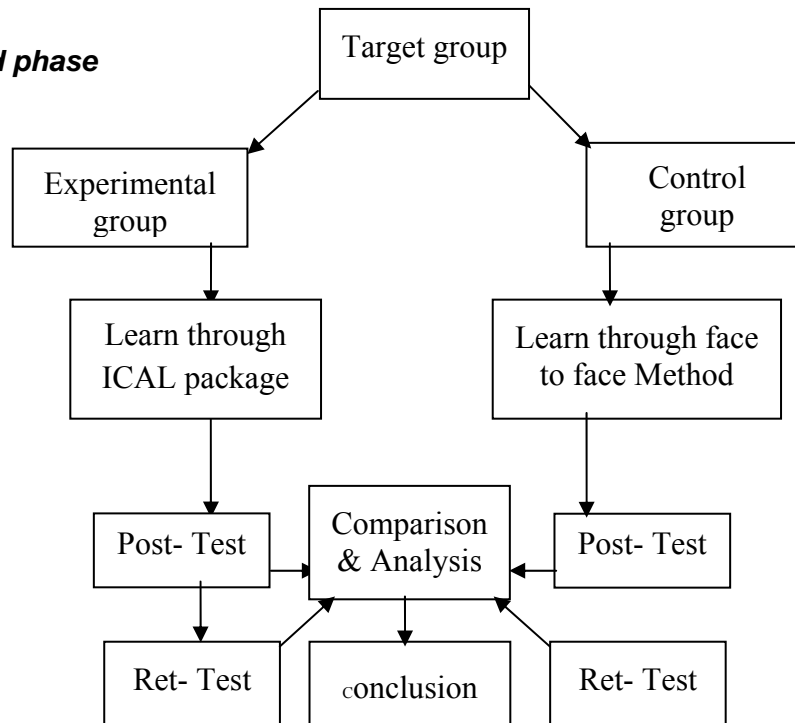


Fig. 2

Observations

In first Phase students of Electronic Science M.Sc.–I and M.Sc.–II form two samples. Scores of individual modules, each CD and aggregate scores of both the CDs were recorded. Figure-2 and Figure-3 show performances of pre and post-tests.

Statistical computations for Paired-T values and Confidence Intervals (CI) are done for both the samples and CDs individually. Tables show the results of the calculations.

Results And Discussions

Table 1: M. Sc. I (for CD1/ PCHMTS-1)

Paired T for C1=Pre-test and C2=Post-test

N= Number of students (Sample)

Table 1
M. Sc.-I (for CD1/ PCHMTS-1)

Description	Number (N)	Mean	Std Dev
(Pre-test) C1	21	53.048	3.057
(Post-test) C2	21	59.571	1.248
Difference	--	-6.523	2.562*

*This does not represent difference between standard deviations of C1 and C2.
It represents std. dev. of (C1-C2).

Range of mean difference for 5% confidence level (CL) (i.e. 95% of confidence interval (CI) is: [-7.690, -5.358].

Computed paired-T Value = -11.67, P-Value = 0.00

From above table, we observe that average score increases significantly. This shows that PCHMTS-1 helps in increasing average score of M. Sc.-I students.

Its T-Value = 11.67 as against table T-values of 1.721 (for 5% level of significance) and 2.518 (for 1% level of significance) show that it is highly significant.

Table 2: M. Sc. II (for CD1/ PCHMTS-1)

Paired T for C1=pre-test and C2=post-test

N= Number of students (Sample)

Table 2
M. Sc.-II (for CD1/ PCHMTS-1)

Description	Number (N)	Mean	Std. Dev.
(Pre-test) C1	13	46.15	5.44
(Post-test) C2	13	58.38	1.85
Difference	--	-12.23	4.07*

*This does not represent difference standard deviations of C1 and C2.
It represents std. dev. of (C1-C2).

Range of mean difference for 5% confidence level (CL) (i.e. 95% of confidence interval (CI) is: [-14.69, -9.77].

Computed paired T-Value = -10.85, P-Value = 0.00

From above table, we observe that average score increases significantly. This shows that PCHMTS-1 helps in increasing average score of M. Sc.-II students.

Its T-Value = 10.85 as against table T-values of 1.771 (for 5% level of significance) and 2.650 (for 1% level of significance) show that it is highly significant.

Table 3
M .Sc.-I (for CD2/ PCHMTS-2)

Description	Number (N)	Mean	Std. Dev.
(Pre-Test) C1	21	51.048	3.795
(Post-Test) C2	21	67.286	1.875
Difference	Not Applicable	-16.238	4.113*

Range of mean difference for 5% confidence level (CI) (i.e. 95% of confidence interval (CI) is: [-18.158, -14.414].
Computed Paired T-Value = -18.15, P-Value = 0.00

From above table, we observe that average score increases significantly. This shows that PCHMTS-2 helps in increasing average score of M. Sc. I students.

Its T-Value = 18.15 as against table T-values of 1.721 (for 5% level of significance) and 2.518 (for 1% level of significance) show that it is highly significant.

Table 4
M. Sc.-II (for CD2 /PCHMTS-2)

Description	Number (N)	Mean	Std. Dev.
(Pre-Test) C1	13	56.38	6.73
(Post-Test) C2	13	66.38	3.99
Difference	Not Applicable	-10.00	5.99*

*This does not represent difference standard deviations of C1 and C2. It represents std. dev. of (C1-C2).

Range of mean difference for 5% confidence level (CL) (i.e. 95% of confidence interval (CI) is: [-13.62, -6.38]. Computed paired T-Value = -6.02, P-Value = 0.00

From above table, we observe that average score increases significantly. This shows that PCHMTS-2 helps in increasing average score of M. Sc.-II students.

Its T-Value = 6.02 as against table T-values of 1.771 (for 5% level of significance) and 2.650 (for 1% level of significance) show that it is highly significant.

Table 5 shows paired-T values for both CDs & samples and Table 6 for a package at 1% level of significance (LOS).

Table 5
Paired-T values for both CDs

		PCHMTS-1	PCHMTS-2
Class	# Students	T-Values	
M.Sc.-I	21	10.85	6.02
M.Sc.-II	13	11.67	18.15

Table 6
1% Level of Significance

Class	# Students	T-value	T-value from Table at 1% L.O.S.*
M.Sc- I	21	8.435	2.518**
M.Sc II	13	14.91	2.650**

** Highly significant $\alpha = 0.05$, * L.O.S = level of significance

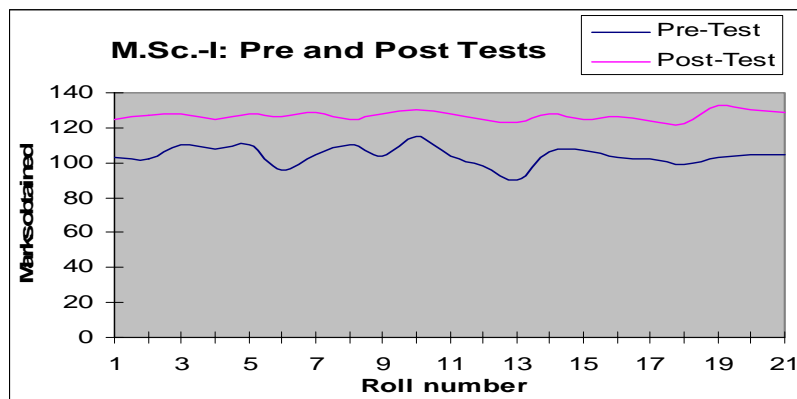


Fig. 3: Performance of Pre and Post Tests (M. Sc.-I)

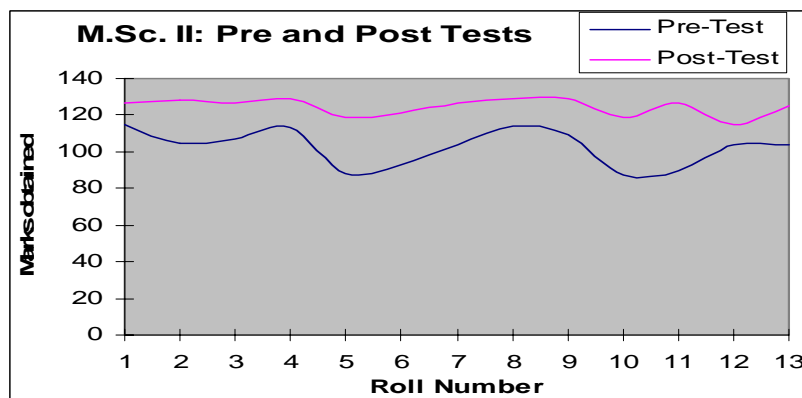


Fig. 4: Performance of Pre and Post Tests (M. Sc.-II)

In second Phase students of Electronic Science M.Sc.-I are divided into control and experimental group. Scores of Post test of ICAL and Face to face were recorded.

Comparison of means of post test for M.Sc.I

Table 6.7
Mean scores of post tests

Test	Number	Mean	S.D.	Paired t-value
Experimental group	11	63	1.79	12.90
Control group	11	52	3.35	

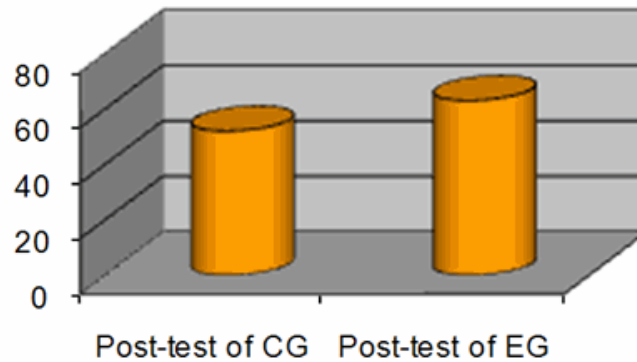


Fig. 5 (Graph-6.12): Comparison of average mean scores M.Sc. I.

Observations:

From above table and graph, we observe that average mean score of post test of experimental group is at higher level than control group.

Statistical analysis for calculating t indicated that $t = 12.90$ for 10 degrees of freedom (for a sample size $N=11$). This value of t is higher than the standard or table values of 1.796 (for 5% level of significance) and 2.718 (for 1% level of significance). It shows a significant difference for learner performance in both stages. It also indicates that the achievement of learners in the experimental group are significantly higher than achievement of control group learner in M.Sc. I. Hence hypothesis H_0 is strongly rejected and H_1 accepted.

Comparison of means of Retention test for M.Sc.I

Retention tests were administered separately for control group and experimental groups.

Table 6.8
Mean scores of retention test.

Test	Number	Mean	S.D.	Paired t-Value
Experimental group	11	61	1.44	20
Control group	11	45	2.68	

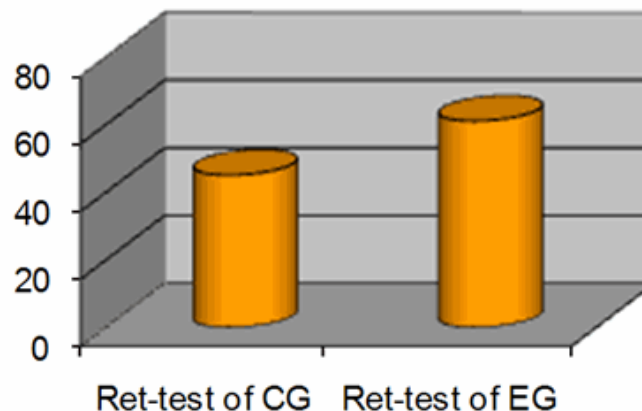


Fig. 6 (Graph-6.13): Comparison of average mean scores M.Sc. I

Observations

From above table, and graph we observe that there is significant difference in the retention of knowledge in PCHMTS for experimental and control group of M.Sc.I

Statistical analysis for calculating t indicated that $t = 20$ for 10 degrees of freedom (for a sample size $N=11$). This value of t is higher than the standard or table values of 1.796 (for 5% level of significance) and 2.718 (for 1% level of significance). It also indicates that the mean score for retention of the experimental group is at higher level than retention and post test scores of the control group. Thus, the results indicate that the ICAL package does help the students to acquire and understand knowledge, acquire skills, and retain what they have learned.

Conclusions

The selected groups scored significantly higher in the post-test than in the pre-test. It shows that ICAL package in PCHMTS is effective in enhancing acquisition of knowledge and understanding and in skill development.

The achievement of the PCHMTS experimental group is significantly higher than achievement of the control group. It shows that ICAL package used as a teaching resource for the experimental group was more successful than the conventional system.

There are differences in knowledge gain and knowledge retention on PCHMTS in both the experimental and the control group. This loss of knowledge is due to the time gap between the post test and retention test stage of the study and also due to absence of reinforcement between these phases.

It should be noted that the retention score of knowledge for the experimental group is higher than post-test and retention-test scores for the control group. Thus, the result indicates that the ICAL package does help students and it enhances their acquisition of knowledge, understanding, skill development, and retention.

About the Author

Vasant G. Wagh Ph.D. is Reader in Electronics Department K.T.H.M. College, Nashik -2, Maharashtra State, India. Dr. Vasant completed his Ph.D. in YCM Open University in subject communication and his M.Sc. in electronic science at Poona University. He has 19 years of teaching experience in senior college. Presently he is working on a Minor Research Scheme supported by the University Grants Commission, New Delhi.

Dr. Vasant G. Wagh,
Department of Electronic Science
K.T.H.M. College, Nashik 422 002
Maharashtra State, India

Email: elekthm@yahoo.co.in, mbm_nsk@yahoo.co.in,

End Notes

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Editor's Note: Team teaching has forms and definitions that range from tandem-teaching through collaboration to carefully planned and integrated activities. Team teaching at it best is a rich and satisfying experience for teachers and students where more learning takes place than in a single-teacher classroom.

Effect of Team Teaching on the Academic Achievement of Students in Introductory Technology

R. Uwameiye, Rukayat Abimbola Ojikutu
Nigeria

Abstract

This study examined the effect of team teaching on the academic achievement of students in introductory technology. Two secondary schools were randomly selected for this study. The instrument used for data collection was the Introductory Technology Achievement Test (ITAT) which contains 50 multiple-choice items. The result of this study showed that there is a significant difference between the mean posttest achievement of students taught using team teaching and those taught in a conventional single-teacher classroom.

Background to the Study

According to Uwameiye (1993), introductory technology helps students at the junior secondary school to explore the world of work, make intelligent career choices, and develop informed patterns of consumption. In this study, introductory technology did not in any way provide training for specific occupations or develop such competencies. Introductory technology exposes students at the junior secondary school (J.S.S) level to technology through exploratory activities. This helps to develop good attitudes in the students towards technology and the industry. Thus the introduction of introductory technology at the junior secondary school in Nigeria supports achievement of Nigeria's quest to build individuals who will:

- adjust to the changing environment;
- deal with forces which influence the future and
- participate in controlling his/her own destiny.

Introductory technology is one of the pre-vocational subjects at the junior secondary school level in Nigeria. Uwameiye and Onyewadume (1999) stated that pre-vocational subjects provide students with a process of orientation in production and consumption through experiences in planning, producing, testing, servicing and evaluating types of consumer and industrial goods. The researchers explain further that, through the exposure of students to pre-vocational subjects, students develop a broader understanding of industrial processes as they explore their individual interests and develop aptitudes. In introductory technology, students at J.S.S level are exposed to various opportunities available in the world of work and are thus oriented, in many occupational areas, to see the need for school continuity at the senior secondary school level and beyond. Introductory technology gives students the opportunity to apply principles of planning and design, construction techniques, and scientific principles, to the solution of problems.

In order to reduce ignorance about technology and lay a solid foundation for true national development, introductory technology is offered in the J.S.S. as a key subject like mathematics and science. The Federal Ministry of Education, Science and Technology (1985) stated the three main objectives of Introductory Technology, to:

1. provide pre-vocational orientation for further training in technology;
2. provide basic technological literacy for everyday living; and
3. stimulate creativity.

The achievement of these objectives will in no small way help to transform Nigeria into a technologically developed country. To achieve this goal, teaching of this subject must be predicated on teaching that seeks to make the learning of Introductory Technology functional.

Teaching can be defined as the action of a person imparting skill, knowledge or giving instruction, or the job of a person who teaches. Clark and Starr (1986) defined teaching as an attempt to assist students in acquiring or changing some skill, knowledge, ideal, attitude or appreciation. Teaching is a challenge that requires long hours of work and preparation. It is a continuous, cyclic process involving three phases:

1. pre-teaching during which the teacher plans what to teach and prepares or collects the materials to be used for teaching;
2. classroom interaction, during which there is purposeful interaction between the materials, the subject-matter, the learner and the teacher; and
3. post-teaching during which the teacher reflects on the task just completed and feeds back his observation into planning the next lesson. This process continues ad infinitum (Obanya, 1980).

All teaching is carried out for a purpose - to generate learning in students in order to produce educated persons. According to Oyediji (1998), the two basic types of instructional methodology are the teacher-centered, and student-centered. Teacher-centered instructional approaches are more traditional and didactic. Students acquire knowledge by listening to the teacher, by reading a textbook, or both. In such an approach, the student is a passive recipient of information. In contrast, student-centered approaches to instruction provide a learning environment that invites students to actively participate in, and help to shape, their own learning experiences. Either of the two instructional approaches can be used effectively to bring about learning. This though depends on the ingenuity of the teachers. Examples of teacher-centered approaches include lecture, Socratic (questioning), team-teaching, and demonstration; while examples of student-centered approaches are discussion, debate, project, role-playing, discovery, inquiry, simulations, individualized and independent study. Ndagana and Onifade (2000) considered no method as being the best for every teaching situation. However, they added that a carefully designed teaching method can make wonders in making learning effective. Ndagana et al (2000) stated that “the success in the use of the method depends on an intelligent analysis of the educational purpose, the pupils in the class, the curriculum content of the moment or the type of subject matter being taught”.

Teaching methods therefore can be defined as the method in which a teacher delivers his/her subject matter to students, based on pre-determined instructional objectives, in order to promote learning in the students. There have been vigorous searches for strategies to improve the quality of instruction in schools and subsequent student learning in place of the traditional one (conventional method).

Conventional method is a traditional method of teaching where the teacher transmits information (subject matter content) verbally to his/her students, sometimes writing on the blackboard or using instructional materials. The students listen and take notes of facts and ideas that are considered important and also sometimes asking the teacher questions for clarification.

On the other hand, team teaching involves harnessing of benefits of co-operation efforts among teachers. Quinn and Kanter (1984) reported that team teaching is simple team work between two or more qualified instructors who together make presentations to an audience. Welch, Brownell and Seridan (1999) described team teaching as a restructuring of teaching procedures in which two or more educators who possess distinct set of skills, work in a co-active and co-ordinate fashion to jointly teach academically and behaviorally heterogeneous groups of students in an educationally integrated classroom setting.

Ajayi, Ajibade and Aniemeka (2002) reported that team-teaching involves a number of instructors (four or five) who shares the same subject matter area, and actively engaged in all aspects of course development from sequencing of topics in a unit plan or scheme of work and lesson plan, generation of learning activities and development of appropriate evaluation instrument. They also went further to explain that in team-teaching the topics or units and other expected activities are divided equitably so that when a member is not teaching, the time taken off teaching could be spent on evaluation, grading, production of instructional materials and assisting whoever is teaching by observing his presentation or supporting the practical exercises, as demonstrators in small group settings.

According to these authors, they suggested that an obvious advantage of team-teaching is the economy of time, space and the rich variety of experiences to which the learners are exposed to, and also shared by the team-teaching members. Considering the advantages of team teaching, this study is undertaken to investigate the effect of team teaching on students' academic achievement in introductory technology

METHODOLOGY

Research Design

The study employed quasi-experimental research design of pre-test, post-test control group. The effects of two strategies (team teaching and conventional) on the academic achievement were examined. The design was specific with non-randomized control group and non-equivalent groups. This was because the subjects were taken as intact groups composed of mixed of low and high achievers.

Population and Sample for this Study

The population for this study consisted of J.S.S II students in Abeokuta South Local Government Area in Ogun State of Nigeria. Purposive sampling technique was adopted and used to select schools for the study. Out of the existing 24 public secondary schools in Abeokuta South Local Government Area, two of them were randomly selected for this study using the table of random numbers. The subjects were intact group from the selected schools. Chosen schools were randomly assigned to experimental and control group while students in the sample schools remained in their in-tact classes.

Instrumentation

The only instrument used for data collection was "Introductory Technology Achievement Test (ITAT)". ITAT contains 50 multiple choice items. The topics which were chosen were taught using team-teaching shared by five introductory technology teachers. During the teaching of these topics in the classroom, one teacher taught at a time while the others stayed in the class to observe and give support where necessary. After each lesson, these teachers came together to critique the lesson for innovations towards next lesson.

Validity of Research Instrument

The instrument was validated by introductory technology teachers in the schools within the target population. Their criticisms and recommendations were affected to produce a final draft. The table of specification can be seen in Appendix I.

Item Analysis

The item analysis was conducted using a pilot group of 40 students drawn from the target population but were not used for the study. The purpose of the item analysis was to standardize the test items. Through the item analysis, the difficulty index and discrimination index of the items were computed.

Selection of Items

In the selection of items for the Introductory Technology Achievement Test (ITAT) instrument the following conditions were considered.

1. any item whose difficulty index falls between the range of 30 and 80 were used.
2. any item with negative discrimination index were removed and were not used.

On the whole 30 items (Appendix II) were finally selected into the ITAT.

Reliability for the Study

The reliability for the study was carried out using the split-half method. The instrument was administered to the same group of respondents twice after an interval of two weeks to ascertain the reliability co-efficient of the instrument using Kuder Richardson's formula 20. A reliability coefficient of $r = 0.71$ was obtained

Procedure for Data Collection

Permission was sought from the principals of the selected schools to allow their schools to be used for the study. The teachers in the experimental group were subjected to training on how to effectively teach the students on team-teaching method. Five introductory technology teachers made up the team teachers, while a one teacher was used for the control class. Each of the control (Conventional group) and experimental group (team teaching group) was taught for six weeks. In the control group, a trained introductory technology teacher exposed the students to the usual conventional method of teaching where he/she did the talking all alone. At the end of each class, the teachers in experimental group held a meeting to critique the teaching. At the end of the six weeks the Introductory Technology Achievement Test (ITAT) was administered as a post-test to the students in the two groups.

Data Analysis

The collected data were analyzed using mean, standard deviation and t-test.

Findings

Research Question 1: Is there a significant difference in the students' pretest mean achievement score and posttest mean achievement score in the experimental and control groups in Introductory Technology?

Hypothesis 1: There is no significant difference in the students' pretest mean achievement score and posttest mean achievement score in the experimental and control groups in Introductory Technology.

Table 1
Pretest, Posttest Mean Achievement Score of Students Taught with Team Teaching Method and Conventional Method?

Group	Variable	N	-X	SD	Z-cal	Z-crit
Experimental	Pretest	30	26.51	0.97	171.23*	1.96
	Posttest	30	70.29	1.01		
Control	Pretest	32	24.25	0.99	138.71*	1.96
	Posttest	32	59.68	1.02		

* **Significant**

Table 1 shows a calculated t-value of 171.23 for experimental group pretest, posttest mean achievement scores as against 1.96 criterion value and the control group calculated t-value was 138.71 as against 1.96 criterion t-value at .05 significant level, to reject the hypothesis of no

significant difference in pretest and posttest mean achievement scores of students taught with team teaching method and conventional method. The difference in pretest, posttest performance scores shows that the result was not due to chance, but to the treatments given.

Posttest Mean Achievement of Students

Research Question 2: Is there a significant difference in mean posttest achievement scores of students taught with conventional method of instruction and team teaching method in Introductory Technology?

Hypothesis 2: There is no significant difference in mean posttest achievement scores of students taught with the conventional method of instruction and team teaching method of instruction in Introductory Technology classes.

Table 2
Mean Achievement Scores of Student Taught with Team Teaching Method and Conventional Method

Group	Variable	N	-X	SD	Z-cal	Z-crit
Experimental	Team Teaching Method	30	70.29	1.01	169.70*	1.96
Control Group	Conventional Method	32	59.68	1.02		

* Significant, $P < .05$

Table 2 indicates a calculated t-test value of 169.70 while the critical t-value is 1.96 at .05 level of significance to reject the hypothesis of no difference in the mean posttest achievement scores of the experimental group taught with team teaching method and the posttest achievement scores of control group taught with the conventional method. This shows a difference in the mean performance scores of students taught with the team teaching method and the students taught with conventional method of instruction, in favour of students taught under the team teaching method of instruction.

Discussions of the Findings

Tables 1, 2, 3, and 4 show the descriptive and inferential statistics on the study. The mean achievement scores are descriptive or representative scores of the group or variables they represent while the t-test provides premise for making inference or deductions on their relevant tested hypotheses. This result indicates that the different treatments given to the experimental and control groups affected positive changes on the students mean achievement scores in posttest introductory technology achievement test.

Table 2 shows that there is a significant difference between the mean posttest achievement score of students' taught using team teaching and those taught using conventional method. The result reveals that team teaching instructional method is more effective than the conventional method as regards the academic achievement.

One of the possible reasons for this is that team teaching is a co-operative system of instruction where two or more teachers team together to share the same subject matter area but teach independently. This finding is in line with Karin (2000), who stated that team teaching is used in increasing the students' level of understanding and retention, in addition to enabling the students to obtain higher achievement. He/she further reported that as a result of the team teaching, the students received more individualized attention from more experienced teachers. The cooperation of students observed between the team teachers serves as a model for teaching students positive

teamwork skills and attitudes. Unlike the conventional method of teaching which does not permit active participation of learners, and it is largely unsuited to the teaching skills, which requires constant practice.

Conclusion and Recommendations

This study has shown that team teaching is effective and has a positive impact on students' academic achievement in introductory technology. Based on findings of this study, this researcher recommends:

1. Team teaching instructional method should be adopted by technology teachers to teach concepts in introductory technology and ensure that the best of the teachers in the cooperative effort of team teaching method of instruction is utilized towards the teaching of introductory technology.
2. Introductory technology teachers should use more practical and hands-on instructional strategies to teach introductory technology.

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About the Authors

Dr. R Uwameiye is a Senior Lecturer in Vocational and Technical Education at the University of Benin, Benin City, Nigeria.

Email: manoj.killedar@gmail.com Web Site: <http://www.ycmou.com/>

Miss Rukayat Abimbola Ojikutu is a postgraduate student in the Department of Vocational and Technical Education, University of Benin, Benin City.

Editor's Note: What works and what does not work is the basis of empirical research studies. By testing ideas in different places and contexts we find universal truths and others that are specific to defined content and populations. Sometimes the results are inconclusive. Comparative studies and basic research are providing a mass of data, some for application, and some for further research.

Critical Assessment of the impact of *Web Technology* on *Total Quality* of Educational and Student Support Services from the *Open and Distance Learning System*

Manoj Killedar

India

Abstract

e-Learning on the World Wide Web is a globally distributed, highly personalized medium for cost-effective delivery of interactive multimedia information and services. The web is expected to have a strong impact on almost every aspect of how we learn. *Total Quality* is the totality of features perceived by customers of a product or service. Totality of features includes the stated and implied needs and expectations of all types of customers. Total Quality of the learning experience in an Open and Distance Education System (ODES) must be expressed in observable and measurable terms that include teaching and learning and a complete spectrum of support and educational services for students.

A model for open and distance education system was used to measure impact of the *Web Technology* on the *Total Quality* of the learning experience in an *Open and Distance Education System*. Evidence indicates that application of the proposed model can simultaneously optimize quality, access and cost. Thus, a quality learning experience can be provided in an open and distance education system which is comparable to the best in traditional education.

Keywords: open education, distance education, online education, elearning, total quality management, quality feedback

Introduction

Impact of any new technology cannot be fully explored unless system is totally redesigned to exploit the benefits of technology. The new design requires full understanding of all quality parameters, their relative effectiveness, and their importance in formulating the perception of total quality for each type of customer. This research hopes to provide this insight for the designers and developers of an Open and Distance Learning System.

Total Quality is the totality of features desired and perceived by the customers for a product or service. Totality of features includes stated as well as implied needs and expectations for all types of customers. No quality improvement is possible without unambiguous measurement. *Total Quality* of the learning experience in *Open and Distance Education Systems* must be expressed in observable and measurable terms which include a complete spectrum of student support and educational services. A model for *Total Quality* of an open and distance education system was used that provides clear guidelines for how to use and integrate various components of web technology to improve and optimize the quality of the learning experience.

Open and Distance Learning Systems are often perceived as a cheap and low quality alternatives to the traditional educational system. Rich multimedia capability, easy interaction and distributed access of web technology have the potential to reverse this perception. This research may help developers to explore appropriate systems and procedures, for world class, highly flexible and cost effective, virtual Open and Distance Learning System of the future.

Total Quality is a subjective term and it is perceived differently by everyone. A number of respondents were asked about their perception of Total Quality in order to measure the perception of the total group. Evidence indicates that application of the proposed model for Total Quality and Web Technology can simultaneously optimize quality, access and cost.

Review of Literature

The Internet is impacting every aspect of how we learn and how we communicate. Quality and efficiency of academic and administrative services can be significantly better when compared with present status. (Killedar M., 2001). It is flexible so that teaching and learning can take place at any time and place convenient to both course instructors and participants. Online learning and teaching are definitely the future direction (Cheng & Myles, 2003). Open and distance learning (ODL) gives learners control of time, place, and pace of learning. It is often characterized as *Flexible Learning*. However, this flexibility goes hand-in-hand with the opportunity for procrastination and non-completion. (Tattersall, Waterink, Höppener, & Koper, 2006).

Prior research shows that equivalent learning activities can be equally effective for online and face-to-face learners (Neuhauser, 2002). Results of this study demonstrate that students can learn equally well in either delivery format, regardless of learning style, provided the course is developed around adult learning theory and sound instructional guidelines (Aragon, Johnson, & Shaik, 2002). Another study conducted two experiments to assess effectiveness of interactive e-learning. Students in a fully interactive multimedia-based e-learning environment achieved better performance and higher levels of satisfaction than those in a traditional classroom and those in a less interactive e-learning environment (Zhang D., 2005).

Managing education effectively requires optimizing of tensions between three vectors of the *Eternal Triangle of Education* so that all three aspects, access, quality and cost, are improved simultaneously. Traditional methods of teaching and learning cannot produce the changes required because, if we put more students in each class, cost may go down, but quality will deteriorate. Conventional ways of improving quality tend to reduce access (class size) and raise costs. The challenge is clear. Can technology simultaneously increase access, improve quality and lower cost? The evidence shows that it can simultaneously optimize all three parameters (Daniel J. , 13 Nov 2003).

TQM is systematic way to guarantee that all activities within an organization happen as planned. It is a management tool that prevents or corrects problems at source, rather than allowing problems to occur and then correcting them afterwards. The essence of TQM is the simple but extremely powerful belief that it is better and hence cheaper, to do every process right at first time, rather than not to do it right and then correct it afterwards. Doing things right at first time requires no money. Doing things wrong is what only costs money. Thus, longer it takes to identify problem, more will be the cost incurred to correct it (Eriksen, 1995)(Killedar M., 2007)

‘Any Where, Any Time’ access to formative feedback about Self-Study, allows the distance learner to concentrate his Self-Study precisely on those content areas where his/her understanding is weak. Immediate recognition of Self-Study achievements of a distance learner in comparison with other fellow students is a strong motivation for further Self-Study. (Killedar M., 2002).

Research Design

Aim

The main aim of the study was to measure the extent to which Web technology has influenced quality of education and student support services through ‘Open and Distant Learning System (ODLS)’.

Scope and Limitations of the Problem

This research focused on “Open and Distance Learning System” of India, with the specific example of electronics and mechanical engineering programmes, offered by the School of Science and Technology, Yashwantrao Chavan Maharashtra Open University (YCMOU), India.

Hypothesis

Assuming that the other factors are kept constant, it is hypothesized that,

- Communication with other ‘students and counselors at different study centers’ is significantly more easy through ‘Discussion Forum’ than through ‘Traditional Classroom’.
- It is significantly difficult to select questions of required difficulty in ‘Traditional Class-Test’ based continuous assessment’.
- Examinee could be evaluated for significantly better outcome by using adaptive algorithm, as high achievers get challenging exam and low achievers get simpler exam, which encourages high as well as low achievers to put more and better learning efforts.
- It is significantly difficult to use adaptive algorithm in ‘Traditional Class-Test’ based continuous assessment.
- Complete evaluation of the understanding of the discipline could not be done by ‘Self-Test Center’ based testing.
- ‘Self-Test Center’ could not measure the understanding of examinee about various terms and concepts.
- ‘Self-Test Center’ based testing could provide significantly faster and better feedback about learning to each examinee than in traditional examination.
- Use of computers for a long period of time hurts eyes in web technology based distance education system.
- Web technology based distance education system could not be used in each and every academic programme of the university.
- Basic training is required in workshop for ‘hands on experience’ to each study center staff and students, in web technology based distance education system.
- ‘Discussion Forum’ could significantly improve writing skills by providing easily accessible anonymous space for writing short assignments, which can be fully edited after receiving counselor’s feedback on it.
- Significantly more number of respondents will prefer to have ‘Discussion Forum’ based ‘Online Counseling’ in addition to regular face-to-face counseling offered at the study centers.

Sample of the Study

Sample selection was not a difficult task because the study is restricted to electronics and mechanical engineering programmes of the “Yashwantrao Chavan Maharashtra Open University Nashik”. Complete admission data was available with the researcher. During July–December 2004, total 2532 students were enrolled for the first batch, which includes 2305 male students and

227 female students. 2156 students (about 85.15% of total enrolled students) were from 4 major urban and industrialized regions of the Maharashtra state.

Both of these academic programmes were technology programmes and thus, it is natural that they attract maximum student enrolment in urban regions having good number of industries. This assumption was strongly supported by the fact that total 85.12 % enrolment was just in 4 regions, that is, Mumbai, Nagpur, Nashik and Pune. All these regions are mostly urban having much higher number of industries.

Hence, researcher decided to use “Purposive Sampling” of only these 4 regions (that is, Mumbai, Nagpur, Nashik and Pune), which are mostly urban with large number of industries as representative samples of the target student population for these academic programmes.

Hence, all students and counselors from all study centers from only these 4 regions were invited for providing their feedback about quality, during the face-to-face contact sessions. But, only 287 male students (about 12.45% of the total 2305 male students during 2004) and 58 female students (about 25.55% of the total 227 female students during 2004), 49 (18.99 % of total 258 Counselors during 2004) counselors, 21 distance education experts provided their feedback willingly. Thus, the total effective sample comprised of those 415 subjects only.

Questionnaire Design

It was decided to prepare a questionnaire following the guidelines given by Likert (1932). Considering variables under study, a scale was constructed and standardized by using psychometric techniques such as item analysis and reliability, and it was administered on the sample of the study.

The researcher was careful to phrase questions clearly and unambiguously so that the respondent has no doubt which answer to give. The researcher purposefully decided to use a four-point scale; which is a forced-choice method where the middle option of "Neither agree nor disagree" or “Undecided” is not available. This minimizes central tendency bias. The researcher carefully organized items in the questionnaire in an unpredictable mixture of positive and negative statements about the attitude object to minimize acquiescence bias.

Relationships of 60 items with major factors were examined and their relevance to the study objectives of was verified. It was found that 48 items best fitted with the 10 major quality factors, and 12 items were closely related to the objectives of study. It was difficult to categorize some items because the statements fitted more than one factor; they were retained because they had high relevance. Analysis of these 12 items was done separately; whereas 48 items were used for determining the reliability of the scale. Split half reliability of the scale was 0.81. Since, no other scale was available, validity could not be determined. The 48 items were given to 5 judges who were experts in this field and considering their opinion the face validity of the scale was finalized, it was 0.69. Because both reliability and validity were high, the scale could be used for collecting data. In the final form of the scale there were 60 items and each item was provided with 4 point scale, ranging from strongly agrees to strongly disagree.

Procedure for Data Collection

For collecting the data, the scale was transmitted in print form during face-to-face contact sessions with all the students and counselors from all study centers in four major geographic regions of the state of Maharashtra, where about 85.15 % students were enrolled. Along with the instructions, the subjects were provided with one or two examples of how to put a tick mark on the answer they have selected. Sufficient time was given to respond to the scale.

Variables under Study

The four variables - male students, female students, counselors, and distant education experts - were associated with the respondent's category. Factors that were treated as dependent variables were as follows: (1) effectiveness in learning process, (2) economy regarding time and money, (3) usefulness in understanding, (4) acquisition of more knowledge, (5) organized approaches, (6) easy access to communication, (7) objectivity, quality and standard, (8) effective examination system, (9) human appeal and (10) attractiveness and interesting. In addition, there were 12 items that were treated independently because they were related to more than one factor. Analysis of only these 12 independent items is the topic of this research paper.

Research Design

A multifactor survey process was used in which between the groups research design was employed. In fact, in one way, this is a kind of attitude survey in which both students and other authorities are involved.

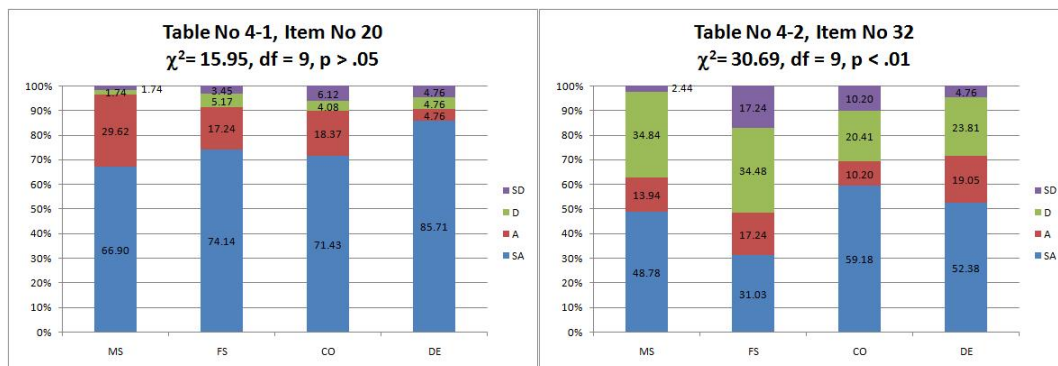
Statistical Treatment of Data

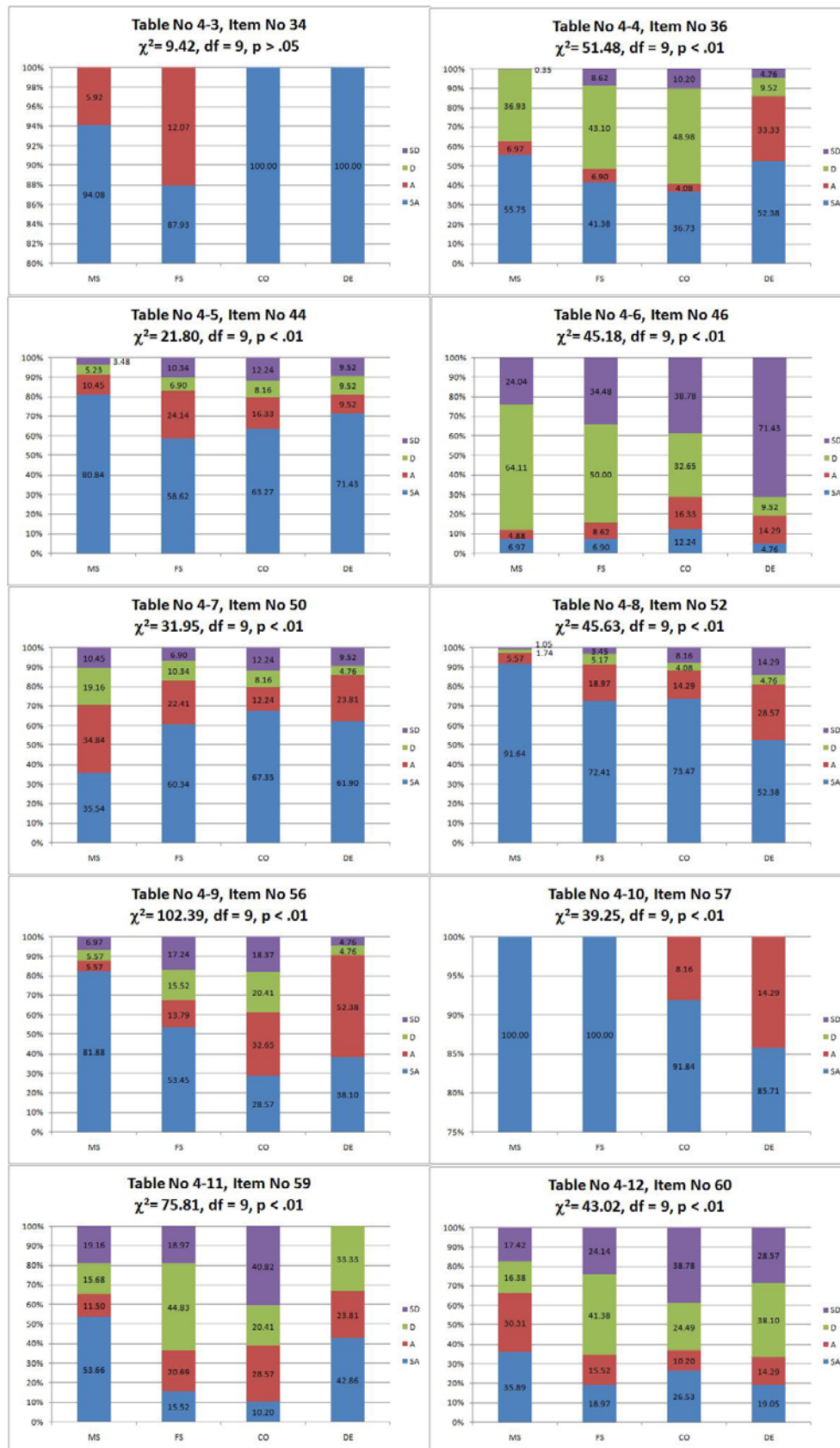
Those statements which were treated independently were treated by frequency counts, percentages, and Chi Square Test of significance. But when each dependent factor of scale was treated then parametric statistical technique was used. Means and standard deviations were computed, One Way Analysis of Variance was used, and finally Duncan's New Multiple Range Test was employed.

Analysis and Interpretation of Data

The study was designed to examine the impact of web technology on total quality of educational and students services in open and distance education system. In such topics it is necessary to have a reference point and in present study, the reference point was conventional educational system. During the last decades through web technology it is possible to impart knowledge and education. It is believed that the total quality could be better through web technology in education system.

The following 12 statements which were treated independently were statistically analyzed by using Chi Square Technique. Since, four different groups of subjects were used the appropriate Chi Square Technique was employed. Summary of the responses is as shown below in graphical format. Detail tables of responses **were not included** in this research paper only due to space and length constraint.





Description of Item in Questionnaire	Summary for the Response Analysis of Chi Square Test
Item No 20: Direct access to communication with other 'students and counselors at different study centers is possible through 'Discussion Forum', which is difficult in 'Traditional Counseling'.	$\chi^2 = 15.95$, this for 9 df, is non-significant. It suggests that many people agreed with the statement.
Item No 32: In 'Traditional Class-Test' based continuous assessment' it is difficult to select questions of required difficulty.	$\chi^2 = 30.69$, this for 9 df, is significant at 0.01 level, suggesting that the reactions given to the statement differ significantly.
<p>Item No 34: Adaptive algorithm selects the next question which is</p> <ul style="list-style-type: none"> • less difficult, if response to previous question was wrong and • more difficult, if response to previous question was right <p>Hence, high achievers get challenging exam and low achievers get simpler exam. Hence, it encourages high as well as low achievers, to put more and better learning efforts. Thus examinee could be evaluated for better outcome by using adaptive algorithm.</p>	$\chi^2 = 9.42$, this for 9 df, is non-significant. It suggests that many people agreed with the statement. About 94.08% male students, 87.93% female students and 100% counselors and distance education experts strongly agreed with the statement.
Item No 36: In 'Traditional Class-Test' based continuous assessment, it is difficult to use adaptive algorithm.	$\chi^2 = 51.48$, this for 9 df, is significant at 0.01 level, suggesting that the reactions given to the statement differ significantly.
Item No 44: Complete evaluation of the understanding of the discipline cannot be done by 'Self-Test Center' based testing.	$\chi^2 = 21.80$, this for 9 df, is significant at 0.01 level, suggesting that the reactions given to the statement differ significantly.
Item no 46: It is not possible to measure, whether the examinee has understood the terms and concepts, with the help of 'Self-Test Center'.	$\chi^2 = 45.18$, this for 9 df, is significant at 0.01 level, suggesting that the reactions given to the statement differ significantly.
Item No 50: Through 'Self-Test Center' based testing, immediate feedback about learning could be easily given to each examinee, which cannot be done in traditional examination.	$\chi^2 = 31.95$, this for 9 df, is significant at 0.01 level, suggesting that the reactions given to the statement differ significantly.
Item No 52: Web technology based distance education system require learner to use computer for a long period of time, which hurts eyes.	$\chi^2 = 45.63$, this for 9 df, is significant at 0.01 level, suggesting that the reactions given to the statement differ significantly.
Item No 56: Web technology based distance education system should be used in each and every academic programme of the university.	$\chi^2 = 102.39$, this for 9 df, is significant at 0.01 level, suggesting that the reactions given to the statement differ significantly.
Item No 57: Web technology based distance education system requires that basic training is provided in workshop for 'hands on experience' to each study center staff and students.	$\chi^2 = 39.25$, this for 9 df, is significant at 0.01 level, suggesting that the reactions given to the statement differ significantly.
Item No 59: 'Discussion Forum' provides easily accessible anonymous space for developing writing skills by writing short assignments, which can be fully edited after receiving counselor's feedback on it.	$\chi^2 = 75.81$, this for 9 df, is significant at 0.01 level, suggesting that the reactions given to the statement differ significantly.
Item No 60: 'Discussion Forum' based 'Online Counseling' should be used in addition to regular face-to-face counseling offered at the study centers.	$\chi^2 = 43.02$, this for 9 df, is significant at 0.01 level, suggesting that the reactions given to the statement differ significantly.

Discussions

1. The first hypothesis of the study was “Communication with other ‘students and counselors at different study centers’ is significantly more easy through ‘Discussion Forum’ than through ‘Traditional Classroom’.” As significant majority of groups agree with this, there is enough evidence to strongly support this hypothesis.
2. The second hypothesis of the study was ““It is significantly difficult to select questions of required difficulty in ‘Traditional Class-Test’ based continuous assessment’.” Groups differ significantly from each other and thus, evidence does not support this hypothesis.
3. The third hypothesis of the study was “Examinee could be evaluated for significantly better outcome by using adaptive algorithm, as high achievers get challenging exam and low achievers get simpler exam, which encourages high as well as low achievers to put more and better learning efforts”. As significant majority of groups agree with this, there is enough evidence to strongly support this hypothesis.
4. The forth hypothesis of the study was ““It is significantly difficult to use adaptive algorithm in ‘Traditional Class-Test’ based continuous assessment.” Groups differ significantly from each other and thus, evidence does not support this hypothesis.
5. The fifth hypothesis of the study was ““Complete evaluation of the understanding of the discipline cannot be done by ‘Self-Test Center’ based testing” Groups differ significantly from each other and thus, evidence does not support this hypothesis.
6. The sixth hypothesis of the study was ““Self-Test Center’ cannot measure the understanding of examinee about various terms and concepts” Groups differ significantly from each other and thus, evidence does not support this hypothesis.
7. The seventh hypothesis of the study was ““Self-Test Center’ based testing could provide significantly faster and better feedback about learning to each examinee.” Groups differ significantly from each other and thus, evidence does not support this hypothesis.
8. The eight hypothesis of the study was ““Use of computers for a long period of time hurts eyes in web technology based distance education system.” Groups differ significantly from each other and thus, evidence does not support this hypothesis.
9. The ninth hypothesis of the study was ““Web technology based distance education system could not be used in each and every academic programme of the university.” Groups differ significantly from each other and thus, evidence does not support this hypothesis.
10. The tenth hypothesis of the study was ““Basic training is required in workshop for ‘hands on experience’ to each study center staff and students, in web technology based distance education system.” Groups differ significantly from each other and thus, evidence does not support this hypothesis.
11. The eleventh hypothesis of the study was ““Discussion Forum’ could significantly improve writing skills by providing easily accessible anonymous space for writing short assignments, which can be fully edited after receiving counselor’s feedback on it.” Groups differ significantly from each other and thus, evidence does not support this hypothesis.
12. The twelfth hypothesis of the study was ““Significantly more number of respondents will prefer to have ‘Discussion Forum’ based ‘Online Counseling’ in addition to regular face-to-face counseling offered at the study centers.” Groups differ significantly from each other and thus, evidence does not support this hypothesis.

Web technology is useful in many ways and it should be introduced in most of the fields of knowledge. However, in a country like India it is not possible to rely totally on the web technology, both traditional classroom techniques and virtual classroom must function in collaboration with each other.

Conclusions

On the basis of the result of the study, regarding 12 independent quality factors, the following conclusions were drawn:

1. Compared to traditional classroom, discussion forum was reported as more effective for direct access to communication by significantly large number of respondents.
2. The four groups of subjects failed to agree upon the assertion that selecting questions of required difficulty in traditional class-test is difficult.
3. Adaptive algorithm could be used more efficiently and effectively with web technology than with traditional class-tests.
4. Although it is possible to measure the understanding of various concepts, significantly large number of subjects believed that evaluation of understanding of the discipline is not possible in self-test based testing.
5. Immediate feedback could be provided to the examinee through self-test center based testing and not through traditional examination.
6. Significantly large number of subjects believed that exposure to computer for longer period hurt eyes.
7. Imparting all kinds of education through web technology could be done, but basic training about it must be provided to them.
8. Four classified groups of subjects failed to agree upon the point that discussion forums provide an easily accessible anonymous space to develop writing skills.
9. Four classified groups of subjects failed to agree upon the assertion that counseling through web technology should be used in addition to traditional face to face counseling.

Suggestions for Future Research

On the basis of results of the study the following suggestions are made:

1. In order to make 'Virtual Classroom' approach more acceptable among students and teachers, extra efforts are necessary. Future research can indicate appropriate strategic approaches regarding this.
2. Relevance and utility of 'Virtual Classroom' approach need further investigation in rural area with severe shortage of electrical power and other disciplines like social sciences or humanities. There is a need of more research in these areas.

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About the Author

Mr Manoj Killedar has, since 1993, been Director, School of Science and Technology at Yashwantrao Chavan Maharashtra Open University, Nashik, India. He completed graduate work in "Electric Drives and Machines" from the Indian Institute of Technology Mumbai, in 1984. His total 23 years of professional experience includes 8 years in industry and 15 years in distance education. His present research interests are eLearning and its applications in Open and Distance education systems of India.

Email: manoj.killedar@gmail.com