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Editorial

Breaking the Mold

to change the shape of Education as we knew it

Technology is, in itself, a change agent. The telescope opened up the universe; the microscope revealed yet another universe too small to be seen by the naked eye. Photography made it possible to preserve an image; cinematography made it possible to preserve an event, a performance, a moment of history. Motion pictures also enabled us to expand and compress time; to see motions too slow for normal observation, or to analyze motions too quick for the eye to see. X-rays and other invisible radiations enabled us to explore human anatomy and diagnose medical problems. Lasers enable us to dissect without a knife, and communicate with incredible bandwidth along fibers. Technology includes machines, processes, and new patterns of organization to make better use of time and resources. This editorial is about an educational technology called distance learning. Distance learning in one form or another has existed for over a century, starting with correspondence schools around 1840 when reliable postal services came available, and expanding with the introduction of audio, visual, motion, and more recently, hypermedia, interactive multimedia and the internet.

In 1997, the California State University and Colleges discovered that growth in student numbers was increasing three times faster than its already impacted campuses could grow. The principal constraints were funds and time for construction. At that time, it was determined that 67% of future growth should be served by distance learning (DL). DL has a minimal impact on facilities, is quickly scalable, and can achieve high quality learning without substantial increase in overhead. The major constraint in 1997 was faculty support for distance learning. Like continuing education, it was considered inferior in quality to full-time on-campus programs. Also, distance learning required something in scarce supply on many campuses – state-of-the-art communication technologies.

There were two basic kinds of distance learning programs; Those based on television where participants learned at the same time separated by distance; and those using the computer where learning was available anywhere and anytime to any person or group with a computer and (later) the Internet. As computer networks increased in bandwidth, television became video on the Internet. Traditional faculty saw the value of distance learning tools for classroom use. As a result, distance learning became more widely accepted, and research showed the performance of distance learning students was equal to those from traditional education settings. By the new millennium, most colleges and universities were offering parts of their program using distance education. However, higher education as a whole was slow to realize that global reach presented opportunities for growth that could eclipse the scope and quality of universities built with bricks and mortar. But to do so, we must break the mold to have a more flexible and relevant educational experiences.

Virtual institutions such as the Open University proved the viability of distant and hybrid learning models. While some traditional universities decided to focus on their local community of scholars, others reached out to become multi-national or global in scope. Consortia like the Commonwealth of Learning have long shared resources and ideas. The Internet stimulated global reach, *de facto* global standards, international collaboration, and competition. The Internet brought higher education to millions of un-served and under-served learners. It offers choice, breadth, and depth of experience to people everywhere. It has attracted full-time professionals, who are extremely competent but under-qualified, to seek higher degrees. In the process, they are sharing their experiences and ideas with their peers and the next generation of learners, adding relevance and quality to the education experience.

Editor's Note: This study could be generalized to many institutions of higher learning throughout the world. Adoption of technology is improving the process, but this is a work in progress. Instructors use computer technologies to prepare materials for classroom instruction, but the dominant use is for group presentations. Adoption is more complete for younger faculty and there is growing use of communication technologies to enhance teaching and learning.

Technical University Faculty's Use of Technology and Perceptions Regarding Instructional Impact

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Taiwan

Abstract

Digital instructional technology has made a strong impact on how students learn and how instructors teach at colleges and universities. This study had three primary purposes. The first purpose was to investigate Taiwanese technical university faculty members' use of technology tools in the classroom and in lesson preparation. The second was to examine the factors that promote or inhibit the use of technology tools. The third was to explore the perceived instructional impact resulting from faculty members' use of technology. The population of the research was comprised of 354 faculty members from a selected technical university in Taiwan. A total of 197 surveys were returned for an overall response rate of 53.9%. A 50-item survey was developed and used for data collection. Descriptive analyses and inferential analyses including *t* test and one-way ANOVAs were performed to answer the research questions. Results showed that workload, educational resources, and administration inhibit the use of technology. It was indicated that enhancing student learning was the reason that faculty used technology in the teaching process. It is concluded that classes that applied technologies were more effective than traditional lectures from the perspectives of the faculty. A more digitalized learning environment can be considered advantageous for technical universities.

***Keywords*:** Instructional technology; Educational technology; Instructional design; Information technology; Impact of technology; Technology education; Computer technology; Technological literacy; Faculty development; Higher education

Introduction

The beginning of the new millennium is an exceptional time in human history; global and western societies have been massively affected by computers, networking, and communication technologies (McCain & Jukes, 2001). Digital technology has played a major role in how education is taught and the media in which the education is delivered. According to the U.S. Department of Labor (1992), essential skills for the workplace include organizing, using, interpreting, and communicating information effectively. In order to achieve success, it is pertinent to use technology to process information and to work with and apply a variety of technologies. Schools must accommodate these upgraded expectations and train teachers to raise their students to new technological standards that social changes demand (Privateer, 1999). Information literacy is not a new idea, but in the Digital Age it has became more important than ever and has expanded types of literacy (Smith, 2002). Honey and Talley (1999) pointed out four essential types of digital literacy, which must be explicitly taught, learned, and assessed by teachers and students in order to be prepared for the knowledge society: technological literacy, information literacy, communication literacy, and media literacy.

Many college and university administrators and faculty members believe that technology use in the classroom enhances teaching and learning and increases access to new populations of students to reduce cost (Twigg, 2003). Several studies have shown that educational technology precisely sways students' attitudes and performance, and promotes an elevated level of thinking skills (O'Donnell, 1996; Schacter, 1999). Therefore, it is very important for faculty to choose the appropriate pedagogies and technologies, ensuring all students have the necessary skills and knowledge to become fully participating members of the digital age (Schlechty, 1990).

Films, slides, and overhead projectors have been replaced by the World Wide Web, email, digital photographs, digital video, and other digital technologies (Hueth, 1998). With digital technology, course information can be accessed from a distance through web pages, email, chat rooms, and electronic bulletin boards to extend discussion, to coach, to add practice exercises, and to provide more timely and individualized feedback (Deden & Carter, 1996). Many faculty members use digital technology in a traditional classroom setting in order to improve teaching strategies. However, some do not agree on the numerous benefits of classroom technology because they are still concerned whether the technology is simple and reliable enough to use for sophisticated learning projects (Newman & Scurry, 2001). Some faculty have thought that lack of time, expertise, resources, and support are serious obstacles in implementing technology in the classroom and that the reward structure in higher education has provided no incentive for faculty to engage in it to improve the quality of teaching (Cummings, 1996; Parker, 1997; Topp, Mortenson, & Grandgenett, 1995).

Since the 1950s, the Taiwanese government administration has focused on education and technology development (Chow, 2002), Taiwan transformed their economy from an agricultural industry to an export-oriented industry (Tang, 1981). During this shift from a labor-intensive industrial country to a skill-and-capital-intensive country, technology-minded college students have played a very important role in reaching this achievement (Tsao, 2001). In order to overcome the more difficult challenges of global competition and to supply enough manpower with specific expertise for the high-tech industry, the Taiwanese Ministry of Education (MOE) has successfully upgraded 54 junior colleges to the Institute of Technology level in the period from 1996 to 2000 (Taiwanese Ministry of Education, 2001). The next step for the Taiwanese education administration is to determine how to increase the quality of higher education. Digital technology implementation in technology education could be the path to reach the goal.

The e-learning environment of Taiwan is growing rapidly. In 2003, the personal computer ownership rate of Taiwan reached 58.72%, and 48.23 % of all families' PCs were connected to the Internet. The connection rate was nearly 100% for government offices, public institutions, schools, and research institutes (Directorate General-Budget and Statistics' Executive Yuan, R.O.C, 2004).

Under new technologies and pedagogies, education tends to shift from teacher-focused to student-centered (Johnson, 1995). On the other hand, Taiwan has been influenced deeply by Chinese educational philosophy, in which the teacher is the center of learning and the authority of knowledge. Under such a conflicting situation, the Taiwanese Institute of Technology faculty members' use of digital technology and perceptions of its impact on instruction are worth investigating.

This study had three primary purposes. The first purpose was to investigate Taiwanese technical university faculty members' use of technology tools in the classroom and in lesson preparation. The second was to examine the factors that promote or inhibit the use of technology tools. The third was to explore the perceived instructional impact resulting from faculty members' use of technology. The findings of this study may show technical university administrators the contributions of technology as they develop their IT agenda. The study may also assist administrators and faculty members in creating new strategies for deploying teaching methods that are consistent with contemporary technologies.

Methodology

This section contains the methodology and procedures of the study. It includes the research questions, population, instrumentation, data collection, and data analysis.

The following seven research questions guided this study:

1. What types of technology tools do faculty use in the classroom and in lesson preparation?
2. How frequently do faculty use technology tools in the classroom and in lesson preparation?
3. What types of technology or media do faculty use to communicate with students?
4. What factors promote or inhibit the use of technology in the classroom?
5. What differences exist in faculty perceptions regarding factors that promote or inhibit the use of technology based on demographic characteristics?
6. What are the reasons that faculty use technology?
7. To what degree do faculty perceive instructional impact resulting from their use of technology?

Population

The technical university selected for this study provides mainly a four-year program along with two- and three-year undergraduate programs, and a masters-level program. The population for this study consisted of all full-time faculty members of the selected technical university in Taiwan. According to an announcement of the personnel office of this selected technical university, there were 354 faculty members in the academic year of 2004-2005.

Instrumentation

The survey instrument was developed by the researcher to accomplish the purposes of the study. The content of the survey was designed to answer the research questions. This survey instrument consists of six sections: Section A – demographics, Section B – types of technology use in classroom and lesson preparation, Section C – areas that promote and/or inhibit technology, Section D – reasons for using technology, Section E – perceptions of instructional impact, and Section F – perceptions of student learning.

A multiple choice format was used for section A in order to collect respondents' demographic characteristics, and also for section B to obtain the types and frequency of faculty use of technology in classroom and lesson preparation. Five-point Likert scales were used for section C, section D, and section E. In section C – areas that promote and/or inhibit technology, the scales range as follows: 1 represented *strongly inhibit*, 2 represented *inhibit*, 3 represented *neither inhibit nor promote*, 4 represented *promote*, and 5 represented *strongly promote*. In section D – reasons for using technology, section E – perceptions of instructional impact, and section F – perceptions of student learning, the scales range as follows: 1 represented *strongly disagree*, 2 represented *disagree*, 3 represented *uncertain*, 4 represented *agree*, and 5 represented *strongly agree*.

The survey instrument was developed in English; however, in order to elicit the most accurate responses, it was translated into Chinese, which is the official language of Taiwan. Three Taiwanese instructors with English proficiency were asked to review the Chinese version of the survey instrument, and then a member of the foreign language department of the selected institution was asked to translate the Chinese version back into English. Any discrepancies between these two language versions were reconciled.

The survey instrument was given to a panel of experts in the subject area to examine its content validity. The panel of three experts examined the questionnaire to determine whether it contained items that would measure the variables identified in the research questions. A critique sheet was used to collect information regarding ambiguity, relevance, missing items, verbiage, and to review the instruments to ensure that answers to each item provided useful information for answering the research questions of the study. The information gathered by the critique was used in refining the final survey instrument. In this manner, content validity of the survey was ensured for this study.

Data Collection

Print copies of the survey instruments were distributed by the assistant of the personnel office at the selected technical university to each department chair. The survey instruments were redistributed from the departments in mailboxes. An introduction letter was included with the survey instrument to introduce the purposes of the study. A statement also was included in the letter indicating that participation in the study was voluntary and respondents could withdraw at any time. Return of the survey instrument implied consent of the participants. Participants were also assured that the results would be reported for group analysis; no individuals would be identified. Respondents were asked to return the survey instruments to the assistant of the department office.

The survey was conducted during May 2005. Follow-up emails with the survey instrument attached were sent to all faculty on May 31 that provided a second chance to collect data from those who did not return the original survey instrument. Data collection lasted for six weeks.

Data Analysis

The survey responses collected from the respondents were coded and entered into a computer data file for analysis by the SPSS 11.0 statistical package. Survey data were analyzed by descriptive and inferential statistical methods to answer the research questions. Descriptive analyses including frequencies, percentages, means, and standard deviations were used. Inferential statistics including an independent sample t test, analyses of variance (ANOVAs), and Tukey's HSD tests were performed for data analysis. The .05 level of significance was used for inferential statistics.

Research questions one, regarding the types of technology tools faculty use in classroom and in lesson preparation, two, regarding the frequency of faculty use of types of technology tools in the classroom and in lesson preparation, and three, regarding the types of technology or media faculty use to communicate with students, were answered by computing frequencies and percentages. Research question four, regarding the factors that promote or inhibit the use of technology in the classroom, was answered by calculating means and deviations. Research question five, regarding differences existing in faculty perceptions regarding factors that promote or inhibit the use of technology based on demographic characteristics, was answered using t tests and one-way analyses of variance (ANOVAs). A t test for independent means was used to compare perceptions by gender. All other differences were determined using one-way ANOVAs. All significant ANOVAs were followed by Tukey's Honestly Significant Difference (HSD) test to determine which groups differ from the others. The .05 level was used for all t tests, ANOVAs, and Tukey's HSD tests. Research question six, regarding faculty's reasons for technology use, and research question seven, regarding faculty' perceived instructional impact resulting from faculty technology use, were answered by computing means and standard deviations.

Findings

In this section, the results of the data analysis that emerged from the study are presented. The results are given for each of the seven research questions that guided the investigation.

Response Rate

The survey was distributed to all 354 full-time faculty members at a selected technical university in Taiwan. One hundred and ninety-seven surveys were returned, for a response rate of 55.6%; six surveys were not usable because of missing responses so the usable return rate was 53.9%.

Demographic Data

Respondents' demographic information including gender, age group, academic rank, and discipline area are presented in Table 1. The majority of the participants were male (142, 74.3%), leaving 49 females (25.7%). There were 29 (15.2%) participants in the 35 years old or under age group, 116 (60.7%) in the 35 to 50 years old age group, and 46 (24.1%) in the 51 years old or above age group. Sixty-four (33.5%) were professors or associate professors, 36 (18.6%) were assistant professors, and 91 (47.6%) were instructors. The largest number of useable surveys was from the Engineering School (66, 34.6%); the smallest number of useable surveys was from the Physical Education Office (11, 5.8%).

Table 1
Respondents' Characteristics

Characteristic	*N*	*%*
Gender		
Male	142	74.3
Female	49	25.7
Age Group		
Under 35	29	15.2
36 to 50	116	60.7
Over 51	46	24.1
Academic Rank		
Instructor	91	47.6
Assistant Professor	36	18.8
Full or Associate professor	64	33.5
School		
Business	38	19.8
Design and Space	22	11.5
Engineering	66	34.6
Fine Arts	20	10.5
General Education Center	34	17.8
Physical Education Office	11	5.8

Data regarding faculty's experience of technology use and daily computer use are presented in Table 2. Ninety-three (48.7%) faculty members have been using technology in teaching for more than three years; only 12 (6.3%) never used technology in teaching. The majority of faculty members (117, 61.2%) used computers more than three hours daily.

Table 2
Experience of Technology Use and Daily Computer Use

Years	*N*	%	Hours	*N*	%
Never	12	6.3	Under 1 hour	16	8.4
Under 1 Year	30	15.7	1 to 3 hours	58	30.4
1 to 3 years	56	29.3	4 to 5 hours	60	31.4
4 to 5 years	41	21.5	More than 5 hours	57	29.8
More Than 5 Years	57	29.8			

Use of Technology Tools

Data regarding types of technology use in classroom and in lesson preparation are presented in Table 3. In lesson preparation, 82.7% of faculty used search tools, 80.2% of faculty used data processing tools, 72.8% of faculty used process tools, 95.3% of faculty used computers, and only 13.1% of faculty used digital cameras and scanners. In classroom teaching, 89.5% of responding faculty used process tools, 74.9% used data processing tools, and 82.7% of faculty used computers.

Table 3
Types of Technology Use in Classroom and in Lesson Preparation

Type of Tool	*N* (Lesson Preparation)	%	*N* (Use in Class)	%
Search Tools	158	82.7	93	48.7
Communication Tools	126	66.0	59	30.9
Word Processing Tools	154	80.2	171	89.5
Data Processing Tools	139	72.8	143	74.9
Computer	182	95.3	158	82.7
LCD Projector	47	24.6	54	28.3
DVD, CD, MP3 Player	34	17.8	51	26.7
Digital Camera and Scanner	25	13.1	34	17.8

Frequency of Technology Tool Use

Data regarding frequency of technology use in lesson preparation and in classroom are presented in Table 4 and Table 5. In lesson preparation, 24.1% of faculty used search tools, 30.9% used word processing tools, and 69.6% used computers more than 67.0% of the semester. In class teaching, 23.6% used word processing tools, 26.7% used data processing tools, and 33.0% used computers more than 67% of the semester.

Table 4
Frequency of Technology Use in Lesson Preparation

Technology	In A Semester			
	Never	Less 33%	34% to 66%	More Than 67%
Search Tools	17.3	26.7	31.9	24.1
Communication Tools	34.0	24.1	26.7	15.2
Word Processing Tools	19.4	11.5	38.2	30.9
Data Processing Tools	27.2	21.5	34.6	16.8
Computer	4.7	5.2	20.4	69.6
LCD Projector	75.4	21.5	2.6	0.5
DVD, CD, MP3 Player	82.2	14.7	2.1	1.0
Digital Camera and Scanner	86.9	9.4	2.6	1.0

Table 5
Frequency of Technology Use in Classroom

Technology	In A Semester			
	Never	Less 33%	34% to 66%	More Than 67%
Search Tools	51.3	20.9	20.9	6.8
Communication Tools	74.3	14.1	9.9	1.6
Word Processing Tools	10.5	23.6	42.4	23.6
Data Processing Tools	25.1	18.8	29.3	26.7
Computer	17.3	28.3	21.5	33.0
LCD Projector	71.7	20.9	4.7	2.6
DVD, CD, MP3 Player	73.3	20.4	4.7	1.6
Digital Camera and Scanner	82.2	9.4	5.8	2.6

Communication with Students

Data regarding media and communication type are presented in Table 6. There were 91 faculty (47.6%) who prefer students to hand in their assignments/projects in paper form, 59 (29.3%) prefer students to use email, and only 20 (10.5%) prefer students to hand in their assignments through the Internet. Regarding type of communication, 177 (92.7%) faculty members used dialogue to communicate with students and 170 (89.5%) faculty members used email to communicate with students. Only 16 (8.4%) used discussion boards to communicate with students.

Data regarding faulty response to emails are presented in Table 7. For class issues, 33.0% of faculty replied to emails the same day and 51.5% of faculty replied within a week. For personal issues. 25.1% of faculty replied to emails the same day and 46.1% of faculty replied to emails within a week.

Table 6
Media and Communication Type

Assignments Media	*N*	%	Communicating Type	*N*	%
Disk/CD-R	24	12.6	Discussion board	16	8.4
Email	59	29.3	Email	170	89.0
Paper	91	47.6	Phone	144	75.4
Internet	20	10.5	Dialogue	177	92.7

Table 7
Faculty Response to Emails

Issues	Reply within a Day %	Within a Week %	Do not reply %
For Class	33.0	51.3	15.7
For Personal Use	25.1	46.1	28.8

Perceptions Regarding Factors that Promote or Inhibit Technology Use

Data regarding perceived factors that promote or inhibit technology use are presented in Table 8. The means and standard deviations were calculated for the six factors. A five-point Likert scale was used where a mean response of 3.50 or above indicated the factor promoted technology use and 2.50 or below indicated the factor inhibited technology use. It was indicated that faculty workload (M = 2.36, SD = .865), educational resources (M = 2.15, SD = .894), and administration (M = 2.34, SD = .948) had mean values below 2.50, indicating some level of inhibiting the use of technology in teaching. None were perceived as promoting the use of technology in teaching.

Table 8
Perceived Factors That Promote or Inhibit Technology Use

Factor	*M*	*SD*
Faculty Workload	2.36	.865
Educational Resources	2.15	.894
Finances	2.57	1.018
Faculty Development	2.54	.904
Administration (Institutional Support)	2.34	.948
Institutional Culture	2.87	.753

Perceptions Regarding Factors that Promote or Inhibit Technology Use Based on Demographics

Data regarding differences in perceptions based on gender are presented in Table 9. A series of t tests were conducted using gender as the independent variable and the means of each of the six factors as dependent variables. Statistical analysis revealed faculty workload was a significantly more inhibiting factor for females (M = 1.90, SD = .797) to use technology than males (M = 2.52, SD = .831), t (189) = 4.572, p = .000. There was no significant difference between males and females regarding educational resources, finances, faculty development, administration, or institutional culture.

Table 9
Differences in Perceptions Based on Gender

Factor	Mean		*t* value	Prob.
	Male	Female		
Faculty Workload	2.52	1.90	4.572	.000 *
Resource	2.17	2.08	.589	.557
Finances	2.56	2.59	-.210	-.035
Faculty Development	2.59	2.41	1.226	.183
Administration	2.30	2.45	-0.930	1.146
Institutional Culture	2.82	3.00	-1.415	-.176

* Denotes significant difference at .05.

Data regarding differences in perceptions based on age are presented in Table 10. Ages were grouped into under 35, 35 to 50, and over 51 categories. ANOVAs were conducted using age as the independent variable and the means of each of the six factors as dependent variables. There were significant differences between age groups regarding educational resources F (2,190) = 12.53, p = .000, and faculty development F (2,190) = 4.214, p = .001. The other four factors showed no significant difference.

The Tukey post-hoc test was conducted on educational resources and the results indicated that the 35 to 50 and over 51 groups were significantly more inhibited by issues related to educational resources than the under 35 age group; also, the over 51 group was significantly more inhibited by issues related to faculty development than the other two age groups.

Data regarding differences in perceptions based on academic rank are presented in Table 11. There were three categories of academic rank: full or associate professor, assistant professor, and instructor. There was a significant difference in educational resources based in academic rank, F (2,190) = 3.287, p = .04. The Tukey post-hoc test, however, was not able to identify which groups were significantly different.

Table 10
Differences in Perceptions Based on Age

Factor /Age	*M*	*SD*	*F*	Prob.
Faculty Workload			.356	.701
Under 35	2.41	.946		
36 to 50	2.32	.861		
Over 51	2.43	.834		
Educational Resources			12.530	.000 *
Under 35	2.83	.966		
36 to 50	2.09	.844		
Over 51	1.85	.759		
Finances			0.017	.983
Under 35	2.59	1.241		
36 to 50	2.57	.971		
Over 51	2.54	1.005		
Faculty Development			4.241	.001 *
Under 35	2.97	.966		
36 to 50	2.55	.878		
Over 51	2.35	.900		
Administration			.682	.507
Under 35	2.45	1.021		
36 to 50	2.28	.974		
Over 51	2.43	.834		
Institutional Culture			.397	.673
Under 35	2.90	.673		
36 to 50	2.90	.806		
Over 51	2.78	.664		

* Denotes significant difference at .05.

Table 11
Differences in Perceptions Based on Academic Rank

Factor / Academic Rank	*M*	*SD*	*F*	Prob.
Faculty workload			.584	.558
Full or Associate Professor	2.30	.888		
Assistant professor	2.47	.910		
Instructor	2.39	.809		
Educational resources			3.287	.04
Full or Associate Professor	2.23	.804		
Assistant professor	2.33	1.049		
Instructor	2.15	.894		
Finances			.648	.525
Full or Associate Professor	2.48	.935		
Assistant professor	2.58	1.105		
Instructor	2.67	1.085		
Faculty development			.821	.441
Full or Associate Professor	2.55	.922		
Assistant professor	2.09	.822		
Instructor	2.45	.925		
Administration			.056	.970
Full or Associate Professor	2.35	1.058		
Assistant professor	2.31	.889		
instructor	2.34	.821		
Institutional Culture			.397	.945
Full or Associate Professor	2.88	.786		
Assistant professor	2.85	.728		
Instructor	2.87	.753		

* Denotes significant difference at .05.

Data regarding differences in perceptions based on academic discipline are presented in Table 12. The disciplines used in this study included the Business School, Engineering School, Design and Space, Liberal Arts, General Educational Center, and Physical Education Office. ANOVAs were performed using discipline areas as the independent variables and the means of each of the six factors as dependent variables. There were significant differences among discipline areas regarding faculty workload $F(2,190) = 3.324$, $p = .007$ and faculty development $F(2,190) = 5.136$, $p = .000$. The other four factors showed no significant difference. The Tukey post-hoc test was performed for faculty development. The results indicated that Liberal Arts faculty were significantly more inhibited than Business School's faculty by issues related to faculty workload. The Design and Space School's faculty were significantly less inhibited by issues related to faculty development than both the Liberal Arts School's and General Education Center's faculty; and the Engineering School's faculty were significantly less inhibited by issues related to faculty development than the General Education Center's faculty.

Table 12-1
Differences in Perceptions Based on Academic Discipline

Factor / Academic Discipline	*M*	*SD*	*F*	Prob.
Faculty Workload			3.324	.007 *
Business School	2.68	.826		
Design and Space	2.41	.796		
Engineering School	2.44	.897		
Liberal Arts	1.95	.759		
General Education Center	2.06	.886		
Physical Education Office	2.55	.820		
Educational Resources			1.405	.224
Business School	2.45	.891		
Design and Space	1.95	.722		
Engineering School	2.06	.875		
Liberal Arts	2.05	1.050		
General Education Center	2.09	.965		
Physical Education Office	2.36	.674		
Finances			.126	.986
Business School	2.61	1.001		
Design and Space	2.50	1.225		
Engineering School	2.56	1.040		
Liberal Arts	2.70	.865		
General Education Center	2.50	1.052		
Physical Education Office	2.55	.820		
Faculty development			5.136	.000 *
Business School	2.42	.889		
Design and Space	3.05	.899		

* Denotes significant difference at .05.

Table 12-2
Differences in Perceptions Based on Academic Discipline

Factor / Academic Discipline	***M***	***SD***	***F***	**Prob.**
Engineering School	2.80	.948		
Liberal Arts	2.20	.894		
General Education Center	2.18	.626		
Physical Education Office	2.18	.603		
Administration			1.845	.106
Business School	2.26	1.032		
Design and Space	2.82	.733		
Engineering School	2.24	.912		
Liberal Arts	2.20	.768		
General Education Center	2.26	1.024		
Physical Education Office	2.73	1.104		
Institutional Culture			1.958	.087
Business School	2.87	.777		
Design and Space	3.18	.733		
Engineering School	2.74	.730		
Liberal Arts	3.15	.745		
General Education Center	2.74	.790		
Physical Education Office	2.91	.539		

* Denotes significant difference at .05.

Table 13
Reasons for Technology Use

Reason	***M***	***SD***
Personal Interest in Technology	3.39	1.02
Department Policy	3.15	1.03
Student Expectation	2.91	1.03
Enhancing Student Learning	3.70	.85
Classroom Management	2.80	1.01
Saving Time on Class Preparation	2.40	.99

Reasons for Technology Use

A five-point Likert scale where 1 = strongly disagree and 5 = strongly agree was used to measure participant responses for research question six regarding reasons for using technology. A response mean at or above 3.50 indicated some level of agreement with the reason, while a mean at or below 2.50 indicated some level of disagreement with the reason. Data regarding reasons for technology use are presented in Table 13. Faculty indicated that enhancing student learning (M = 3.70, SD = .85) was the most important reason that they used technology. Faculty indicated that saving time on class preparation (M =2.41, SD = 1.01) was not a reason for using technology.

Instructional Impact of Technology

Data regarding faculty's perceptions of instructional impact of technology are presented in Table 14. Faculty members perceived that technology is more effective than traditional lectures, except for creating situational experience in a safe setting (M = 3.45, SD = .87). Faculty perceived the other five aspects of technology to be more effective than traditional lecture.

Table 14
Perceptions of Instructional Impact of Technology

Instructional Impact	***M***	***SD***
Engaging Students in Active Learning	3.60	.88
Expanding Course Content with Supplemental Graphs and Information	4.02	.76
Connecting Learning with Real Life Experiences	3.94	.77
Tailoring Teaching Style to Student Needs	3.66	.98
Covering Previous Material for Easy Review	3.77	.89
Creating Situational Experience in a Safe Setting	3.45	.87

Data regarding faculty's perceptions of impact on student learning are presented in Table 15. Faculty agreed with the notion that technology can enhance students' understanding of course content (M = 3.78, SD = .855) and real-life application of the course content (M = 3.72, SD = .791).

Table 15
Perceptions of Impact on Student Learning

Learning Outcome	***M***	***SD***
Organizational Ability	3.42	1.012
Better Learning Efficiency	3.37	.985
Understanding of the Course Content	3.78	.855
Real-Life Application of the Course Content	3.72	.791
Faster Student Learning	3.92	.816
Slower Student Learning	3.44	.903

Discussion

Results of this study indicate that the majority of faculty frequently use process tools, such as word processing and spreadsheets in the classroom teaching process, which is consistent with a previous study by Groves and Zemel (2000). Faculty feel comfortable using those types of technology tools to help them organize course content because this incorporation of technology does not require them to change their teaching style.

The physical library is not the dominant educational resources; faculty can use the Internet to obtain a variety of resources in lesson preparation. Most faculty who used computers daily for more than three hours indicate that the personal computer has become standard operating equipment in higher education. This study also found that faculty would like to communicate with students by dialogue and email. This would indicate that faculty use technology for electronic communication. However, the use of email cannot replace dialogue with the students. Email should be considered another communication channel between faculty and students. This study also found that faculty preferred students to hand in assignments/projects in paper form. However, a quarter of the faculty liked students to submit the assignment via email or to post them on a website. Following an increase in team projects and diversity of data formats, students will be forced to digitalize assignments and projects in order to share with and present to other students.

This study found that faculty perceived workload, educational resources, and administration inhibit their use of technology. This finding was supported by a study conducted by Schifter (2000). He found that lack of time was a barrier. In reality, faculty need time to learn new technologies (Moskal, Martin, & Foshee, 1997). They also need time to incorporate technology into the teaching process (Cardenas, 1998). This study found responding to students' emails add to the faculty's workload as faculty are expected to answer students' questions within a short time.

Compared to the pre-digital age, faculty can now use more educational resources; today, faculty can use tools to organize and present their understanding in interesting ways and can use tools for locating, accessing, and manipulating resources (Jonassen & Reeves, 1996). However, this study found that faculty perceived educational resources inhibit the use of technology. Because too many different forms of resources existed and that faculty worry about whether or not they use the proper resources.

This study indicated that enhancing students' learning is the reason that faculty used technology. Enhancing students' learning is always the first concern of the teacher.

Learning technologies have the potential to improve the relationship between the teacher and the student. This may also place more control over the acquisition of knowledge to the learner. This study found that faculty believe using technology is more effective than traditional lectures. Aworuwa (1994) reported that professors used computers for a variety of purposes related to their profession, and perceived that the use of these tools in instruction had positive results on both teaching and learning. In this study, faculty agreed that technology can enhance students' understanding of course content, applying course content to real life, and enable students to learn faster. These findings were consistent with the arguments by Newman and Scurry (2001).

Conclusions

The following conclusions emerged from the findings of the study. First, it was found that most Taiwanese technical university faculty incorporate a wide variety of technological tools into their lesson preparation and classroom teaching. Despite this, most Taiwanese technical university faculty do not use that technology for interactive instruction and communication; rather the findings show that they use it only in their own presentation of classroom material to enhance student learning.

This research also found that Taiwanese technical university faculty find using technology in the classroom to be more effective than simply giving a traditional lecture. Despite this use of technology, this research found that Taiwanese technical university faculty believe that faculty workload, educational resources, and administration all inhibit the use of technology to a slight degree. Finally, this study showed that there are no significant divergent perceptions among the demographic of Taiwanese technical university faculty sampled in regards to technology use.

Recommendations

Based on the conclusions of this study, the authors offer the following recommendations for institutions. First, institutions should unify their software and hardware systems in order to provide a more cohesive digital learning environment. Second, the institution should encourage faculty to use technology in teaching by offering appropriate rewards and reducing the faculty workload.

This faculty development program regarding instructional technology should be designed for different discipline areas. Additionally, a redesign of curriculum and standards may be necessary in order to increase students' digital literacy and prepare students with the required skills and competencies in the digital age. Finally, institutions should create a new position, the technical teaching assistant, who can assist faculty to overcome the challenges of adopting new technology by training students and teachers to use technology effectively.

Based on the findings of this study, the authors present two recommendations for faculty. First, faculty should always focus on course content first. Faculty use of technology should come afterwards, based on teaching and learning theory, in order to enhance student learning. Second, faculty should attend workshops to enforce their technology skills and knowledge. This should allow them to use technology more effectively in classroom preparation and instruction.

The findings of this study warrant several issues for further study. First, further studies should explore students' perceptions regarding faculty use of technology in teaching. Additionally, further studies could be undertaken that compare faculty members' perceptions and students' perceptions regarding use of technology in teaching and learning. Finally, because this study sampled only from one institution, further studies should compare the perceptions of students and faculty among multiple Taiwanese institutions.

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Editor's Note: This study by Saritas and Akdemir relates student variables, contextual variables, and design options that influence learning and relate them to mathematics achievement. Their results highlight the need to customize instruction to optimize the performance of each individual student. Instructional designers need to develop flexible teaching and learning based on awareness of students' experience and background, subject matter, and instructional communications and technology.

Identifying Factors Affecting the Mathematics Achievement of Students for Better Instructional Design

Tuncay Saritas and Omur Akdemir
Turkey

Abstract

The quality of teaching and learning mathematics has been one of the major challenges and concerns of educators. Instructional design is an effective way to alleviate problems related to the quality of teaching and learning mathematics. Knowing the factors affecting math achievement is particularly important for making the best design decisions. This study was conducted to identify the factors affecting the math achievement of students through collecting the opinions of math department students. Results revealed that instructional strategies and methods, teacher competency in math education, and motivation or concentration were the three most influential factors that should be considered in the design decisions.

Introduction

As is the case in the past, most people today still believe that mathematics is all about computation. However, computation, for mathematicians, is merely a tool for comprehending structures, relationships and patterns of mathematical concepts, and therefore producing solutions for complex real life problems. This perspective of mathematicians has gained more attention and importance with rapid advancements in information and communication technologies. It has become necessity for people of all ages to reach, analyze, and apply the mathematical knowledge effectively and efficiently to be successful citizens in our information age. In particular, students need to be well-equipped with higher-order mathematical knowledge.

The quality of teaching and learning in mathematics is a major challenge and for educators. General concern about mathematics achievement has been evident for the last 20 years. The current debate among scholars is what students should learn to be successful in mathematics. The discussion emphasizes new instructional design techniques to produce individuals who can understand and apply fundamental mathematic concepts. A central and persisting issue is how to provide instructional environments, conditions, methods, and solutions that achieve learning goals for students with different skill and ability levels. Innovative instructional approaches and techniques should be developed to ensure that students become successful learners.

It is important for educators to adopt instructional design techniques to attain higher achievement rates in mathematics. (Rasmussen & Marrongelle, 2006). Considering students' needs and comprehension of higher-order mathematical knowledge, instructional design provides a systematic process and a framework for analytically planning, developing, and adapting mathematics instruction (Saritas, 2004). "[Instructional design] is an effective way to alleviate many pressing problems in education. Instructional design is a linking science – a body of knowledge that prescribes instructional actions to optimize desired instructional outcomes, such as achievement and effect" (Reigeluth, 1983, p.5).

Instructional design alone cannot produce better learning and achievement. The instructional designer must know crucial factors that affect student learning and build a bridge between goals and student performance. Identifying these factors will help to utilize limited resources including financial resources and time more effectively (Libienski & Gutierrez, 2008).

In an effort to understand the factors associated with mathematics achievement, researchers have focused on many factors. (Beaton & Dwyer, 2002; Kellaghan & Madaus, 2002; Kifer, 2002). The impact of various demographic, social, economical and educational factors on students' math achievement continues to be of great interest to the educators and researchers. For instance, Israel et al. (2001) concluded that parents' socioeconomic status is correlated with a child's educational achievement. Another study by Jensen and Seltzer (2000) showed that factors such as individual study, parents' role, and social environment had a significant influence on "further education" decisions and achievements of young students'. In another study, Meece, Wigfield & Eccles (1990) investigated cognitive motivational variables that influence high school students' decisions to enroll in advanced math courses. Their findings revealed that math ability perceptions affect students' valuing of math and their expectations for achievement.

A growing body of research provides additional factors which could have an impact on students' achievement such as *gender, family structure, parents' educational level, socio-economic status, parent and student attitudes toward school*, and *parent involvement* (Campbell et al. 2000; Epstein, 1991; Fennema & Sherman, 1976, 1986; Fluty, 1997). Three factors or predictors in math achievement, are divided into sub factors: Demographic Factors (gender, socio-economic status, parent's educational level), Instructional Factors (teacher competency, instructional strategies and techniques, curriculum, school context and facilities), and Individual Factors (self-directed learning, arithmetic ability, motivation). These are examined in the literature review below.

Purpose of the Study

A growing body of research findings indicates that demographic, individual and instructional factors have an impact on the mathematical achievement of students. Identifying factors that affect mathematics achievement is particularly important to effectively educate new generations in, what is for many,a difficult subject. It also provides instructional designers better inputs for their design decisions. The purpose of the present study was to find answers to the following research questions:

1. How much do mathematics department students think demographic factors, including gender, parents' educational level and socio-economic status, influence their achievement in mathematics?
2. How much do mathematics department students think instructional factors including curriculum, instructional strategies and methods, teacher competency in math education, and school context and facilities influence mathematic achievement?
3. How much do mathematics department students think individual factors including self-directed learning, arithmetic ability, and motivation or concentration influence mathematic achievement?
4. What are the three most influential factors on the mathematics achievement of students?
5. Is there a difference in the perceived effects of demographic factors among freshmen, sophomores, juniors and seniors?
6. Is there a difference in the perceived effects of instructional factors among freshmen, sophomores, juniors and seniors?
7. Is there a difference in the perceived effects of individual factors among freshmen, sophomores, juniors and seniors?

Demographic Factors

Various demographic factors are known to be related to mathematics achievement. Gender, socio-economic status, and parents' educational level are factors that have been analyzed in this study as predictors of math achievement.

Gender

Many variables have long been studied as predictors of mathematics achievement. However, gender issues on math achievement are studied most frequently by researchers. For instance, a study through a meta-analysis reveals that males tend to do better on mathematics tests that involve problem-solving (Hyde, Fennema, and Lamon 1990). Females tend to do better in computation, and there is no significant gender difference in understanding math concepts. Another study shows that females tend to earn better grades than males in mathematics (Kimball, 1989).

Some recent studies have revealed that gender differences in mathematics education seem to be narrowing in many countries. However, studies indicate that as students reach higher grades, gender differences favor increase in math achievement by males (Campbell, 1995; Gray, 1996; Mullis, Martin, Fierros, Goldberg, & Stemler, 2000). For instance, the results from the Third International Mathematics and Science Study showed that mathematics achievement scores of each gender group were close to each other at the primary and middle school years (Beaton et al., 1996; Mullis et al., 1997). However, in the final year of secondary school, evidence was found for gender differences in mathematics achievement. Another study, which was conducted to analyze factors that affect math achievement of 11th-graders in math classes with an identified gender gap, also showed that males scored higher than females on 11th grade math achievement test, but this difference decreased from 10th grade (Campbell & Beaudry, 1998).

In addition, gender differences in attitudes and perceptions of the usefulness of mathematics for middle school students were found statistically important (Lockheed, Thorpe, Brooks-Gunn, Casserly, and McAloon 1985; Oakes 1990). For example, female students show less interest in mathematics and have negative attitude toward mathematics. It is also reported that girls tend to learn mathematical concepts by means of rules or cooperative activities, while boys have a tendency to be in a competition to master mathematical concepts (Fennema & Peterson, 1985; Hopkins, McGillicuddy-De Lisi, & De Lisi, 1997).

The literature on gender differences provides evidences that gender issues impact achievement in mathematics. Hence, it is crucial for educators and researchers to pay attention to gender differences in the design of mathematics instruction.

Socio-Economic Status

Socio-economic status is determined to be a predictor of mathematics achievement. Studies repeatedly discovered that the parents' annual level of income is correlated with students' math achievement scores (Eamon, 2005; Jeynes, 2002; Hochschild, 2003; McNeal, 2001). Socio-economic status was found significant in primary math and science achievement scores (Ma & Klinger, 2000). Another study found poor academic achievement of Canadian students to be attributable to their low socio-economic status (Hull, 1990). Socio-economic status was examined and found to be one of the four most important predictors of discrepancy in academic achievement of Canadian students (aged 15) in reading, mathematics, and science by the Program for International Student Assessment (Human Resources Development Canada, Statistics Canada, & Council of Ministers of Education Canada, 2001).

A number of studies showed that parents with higher socio-economic status are more involved in their children's education than parents of lower socio-economic status. This greater involvement results in development of positive attitudes of children toward school, classes, and enhancement of academic achievement (Epstein, 1987; Lareau, 1987; Stevenson & Baker, 1987). It is believed that low socio-economic status negatively influences academic achievement, in part, because it prevents students from accessing various educational materials and resources, and creates a distressing atmosphere at home (possible disruptions in parenting or an increased likelihood family conflicts) (Majoribank, 1996; Jeynes, 2002). For these reasons, socio-economic status of a student is a common factor that determines academic achievement.

Parents' Educational Level

Parents' educational level has been shown to be a factor in academic achievement. Parents serve as a role model and a guide in encouraging their children to pursue high educational goals and desires by establishing the educational resources on hand in the home and holding particular attitudes and values towards their children's learning. In this case, the educational attainment of parents serve as an indicator of attitudes and values which parents use to create a home environment that can affect children's learning and achievement.

A number of studies indicated that student achievement is correlated highly with the educational attainment of parents (Coleman, 1966). For instance, students whose parents had less than high school education obtained lower grades in mathematics than those whose parents had higher levels of education (Campbell, Hombo, & Mazzeo, 2000). Research has shown that parents' educational level not only impact student attitudes toward learning but also impact their math achievement scores.

Instructional Factors

Curriculum

Many concerns have been emphasized in the literature about the existing math curricula that emphasize

> *. . . not so much a form of thinking as a substitute for thinking. The process of calculation or computation only involves the deployment of a set routine with no room for ingenuity or flair, no place for guess work or surprise, no chance for discovery, no need for the human being, in fact (Scheffler, 1975, p.184).*

The concerns here are not that students should never learn to compute, but that students must learn how to critically analyze mathematical problems and produce effective solutions. This requires them to learn, how to make sense of complex math concepts and how to think mathematically (Cobb et al., 1992). Many mathematics curricula overemphasize memorization of facts and underemphasize understanding and application of these facts to discover, make connections, and test math concepts. Memorization must be raised to conceptualization, application and problem-solving for students to successfully apply what they learn. An impressive body of research suggests that curriculum that considers students to be incapable of metacognitive actions (e.g., complex reasoning) should be replaced with the one that sees students who are capable of higher-order thinking and reasoning when supported with necessary and relevant knowledge and activities (Bransford et al., 1994; Schauble et al., 1995; Warren & Rosebery, 1996). Research has also revealed evidence that curricula in which students' knowledge and skills grow is significantly connected to their learning, and therefore their achievement (Brown & Campione, 1994; Lehrer & Chazan, 1998).

Instructional Strategies and Methods

Being successful in math involves the ability to understanding one's current state of knowledge, build on it, improve it, and make changes or decisions in the face of conflicts. To do this requires problem solving, abstracting, inventing, and proving (Romberg, 1983). These are fundamental cognitive operations that students need to develop and use it in math classes. Therefore, instructional strategies and methods that provide students with learning situations where they can develop and apply higher-order operations are critical for mathematics achievement.

In the literature, it is pointed out that for students to accomplish learning, teachers should provide meaningful and authentic learning activities to enable students to construct their understanding and knowledge of this subject domain (Wilson, 1996). In addition, it is emphasized that instructional strategies where students actively participate in their own learning is critical for success (Bloom, B. 1976). Instructional strategies shape the progress of students' learning and accomplishment.

Teacher Competency in Math Education

Many studies report that what teachers know and believe about mathematics is directly connected to their instructional choices and procedures (Brophy, 1990; Brown, 1985; National Council of Teachers of Mathematics, 1989; Thompson, 1992; Wilson, 1990a, b). Geliert (1999) also reported that "in mathematics education research, it seems to be undisputed that the teacher's philosophy of mathematics has a significant influence on the structure of mathematics classes" (p. 24). Teachers need to have skills and knowledge to apply their philosophy of teaching and instructional decisions.

In the 21st century, one shifting paradigm in education is about teachers' roles and competencies. Findings from research on teacher competency point out that

> *If teachers are to prepare an ever more diverse group of students for much more challenging work--for framing problems; finding, integrating and synthesizing information; creating new solutions; learning on their own; and working cooperatively--they will need substantially more knowledge and radically different skills than most now have and most schools of education now develop (Darling-Hammond, 1997, p. 154).*

Teachers not only need knowledge of a particular subject matter but also need to have pedagogical knowledge and knowledge of their students (Bransford et al., 2000). Teacher competency in these areas is closely linked to student thinking, understanding and learning in math education. There is no doubt that student achievement in math education requires teachers to have a firm understanding of the subject domain and the epistemology that guides math education (Ball, 1993; Grossman et al., 1989; Rosebery et al., 1992) as well as an equally meticulous understanding of different kinds of instructional activities that promote student achievement. Competent math teachers provide a roadmap to guide students to an organized understanding of mathematical concepts, to reflective learning, to critical thinking, and ultimately to mathematical achievement.

School Context and Facilities

School context and its facilities could be an important factor in student achievement. In fact, identifying factors related to the school environment has become a research focus among educational practitioners. For instance, research suggests that student achievement is associated with a safe and orderly school climate (Reyonds et al., 1996). Researchers also found a negative impact on student achievement where deficiencies of school features or components such as temperature, lighting, and age exist. In a study by Harner (1974), temperatures above 23° C (74° F) adversely affected mathematics skills. In terms of the condition of school building, Cash (1993) found student achievement scores in standard buildings to be lower than the scores of students in above standard buildings. In addition, Rivera-Batiz and Marti (1995) conducted multiple regression statistical analysis to examine the relationship between overcrowded school buildings and student achievement. The findings indicated that a high population of students had a negative effect on student achievement.

Individual Factors

Self-Directed Learning

Self-directed learning could be a factor in students' math achievement. Mathematics learning requires a deep understanding of mathematical concepts, the ability to make connections between them, and produce effective solutions to ill-structured domains. There is no perfect, well-structured, planned or prescribed system that lets students think and act mathematically. This can be done if, and only if, students play their assigned roles in their learning progress. Self-directed learning has an important place in successful math learning. Self-directed students can take the initiative in their learning by diagnosing their needs, formulating goals, identifying resources for learning, and evaluating or monitoring learning outcomes (Knowles 1975). The teacher's role is to engage students by helping to organize and assist them as they take the initiative in their own self-directed explorations, instead of directing their learning autocratically (Strommen & Lincoln, 1992).

Arithmetic Ability

Arithmetic ability could also be another predictor of math achievement. Arithmetic ability includes the skills such as manipulating mathematical knowledge and concepts in ways that transform their meaning and implications. It allows students to interpret, analyze, synthesize, generalize, or hypothesize the facts and ideas of mathematics. Students with high arithmetic ability or mathematical reasoning can engage in tasks such as solving complex problems, discovering new meanings and understanding, and arriving at logical conclusions.

Arithmetic ability was determined by various studies as a critical factor on students' math achievement. For instance, in a study by Kaeley (1993), arithmetic ability gave the highest correlation coefficient with mathematics achievement. Similarly, student achievement scores were found to be most strongly predicted by level of ability (Schiefele & Csikszentmihalyi, 1995). Some other researchers have also investigated the relationship of gender issues and arithmetic ability on math achievement. For instance, Mills (1997) conducted a study to investigate longitudinal data gathered over 10 years with an aim at asking whether personality traits were related to gender differences in long-term achievement in mathematics and the sciences. The study revealed that math ability was the most significant predictor of long-term achievement in math for young women. However, the level of math ability did not seem to be a factor of long-term math achievement for young men.

Motivation or Concentration

Mathematics education requires highly motivated students because it requires reasoning, making interpretations, and solving problems, mathematical issues, and concepts. The challenges of mathematics learning for today's education is that it requires disciplined study, concentration and motivation. To meet these challenges, learners must be focused and motivated to progress. Broussard and Garrison (2004) examined the relationship between classroom motivation and academic achievement in elementary-school-aged children (122-first grade and 129-third grade participants). Consistent with previous studies, they found that for a higher level of mastery, motivation was related to higher math grades.

The teacher's role in students' motivation to learn should not be underestimated. In helping students become motivated learners and producers of mathematical knowledge successfully, the teacher's main instructional task is to create a learning environment where students can engage in mathematical thinking activities and see mathematics as something requiring "exploration, conjecture, representation, generalization, verification, and reflection" (Carr, 1996, p.58).

Method

Participants

The subjects for the study included 250 undergraduate students enrolled in the mathematics department of a public university located in Turkey. 42.4% of the participants were females, and 57.6% were males. Subjects for the study were retrieved from freshmen, sophomores, juniors and seniors randomly. The distribution of the subjects by the grade level was 70 freshmen, 80 sophomores, 60 juniors and 40 seniors. 94.8% of the participants' age was between the years of 18 and 25, and the rest of them were above 25. Participants enrolled the mathematics department based on their scores on the nationwide university entrance exam.

Instrument

A Likert scale survey was conducted in this study for the data collection. The first part of the survey consisted of three questions (gender, age and grade level) to learn about participants' demographic distribution. For demographic purposes?. The second part of the survey was adapted from Dursun & Dede (2004)'s study to determine the effectiveness of demographic, instructional, and individual factors on students' mathematics achievement. In the second section of the survey instrument, three questions were asked for examining demographic factors, four questions for instructional factors, and three questions for individual factors on students' math achievement. Likert scale items with response categories ranging from "very effective" to "ineffective" were designed for the second part of the survey.

Procedure

The data collection instrument was organized and pilot-tested to obtain reliability. Course calendar was reviewed to identify the most appropriate date and time of participants for the subjects' retrieve. Prospective participants were reached through randomly visits to classes at a mathematics department of a public university. The purpose of the study was explained to mathematics department students, and their voluntary participation was requested. All students in these mathematics classes volunteered to participate in the study. Printed survey instruments were distributed to the students. All students completed and returned survey on the same day.

Analysis

Collected instruments were reviewed for any missing data entry or errors. No missing data or error were detected. Then collected data were imported to the statistical analysis package (SPSS 13) for later analysis. Descriptive analysis, ANOVA and Post Hoc Multiple Comparison LSD test were used to answer the research questions. All statistical analyses were conducted with a significant level of 0.05.

Results

The first research question investigated students' perceptions whether or not demographic factors including gender, parents' educational level, and socio-economic status have an effect on mathematics achievement. Participants' responses were reviewed to identify the most frequently answered response for demographic factors. Most of the participants, 39.6%, indicated that the gender has no effect on students' mathematics achievement. In contrast to the gender, 26.4%, of the participants indicated that parents' educational level, and 31.2% of participants also stated that socio-economic status, were effective factors on the mathematics achievement of students (see Table-1).

Table 1
Effects of Demographic Factors on Students' Mathematic Achievement

	Very Effective		Effective		Less Effective		Ineffective		No Comment	
Demographic Factors	N	%	N	%	N	%	N	%	N	%
Gender	21	8.4	30	12	51	20.4	99	39.6	49	19.6
Parents' Educational Level	40	16	66	26.4	63	25.2	57	22.8	24	9.6
Socio-Economic Status	48	19.2	78	31.2	61	24.4	54	21.6	9	3.6

The second research question investigated mathematics department students' believes on the effectiveness of instructional factors including curriculum, instructional strategies and methods, teacher competency in math education, and school context and facilities on the mathematic achievement. Participants' responses were reviewed to identify the most frequently answered response for instructional factors. Participants indicated that all instructional factors were very effective on the mathematic achievement of students (See Table-2). Among the instructional factors, instructional strategies and methods emerged as the most influential factor on the mathematic achievement of students.

Table 2
Effects of Instructional Factors on Students' Mathematic Achievement

	Very Effective		Effective		Less Effective		Ineffective		No Comment	
Instructional Factors	N	%	N	%	N	%	N	%	N	%
Curriculum	122	48.8	93	37.2	19	7.6	12	4.8	4	1.6
Instructional Strategies and Methods	193	77.8	35	14.1	16	6.4	4	1.6	0	0
Teacher Competency in Math Education	168	67.2	63	25.2	14	5.6	4	1.6	1	0.4
School Context & Facilities	88	35.2	88	35.2	53	21.2	16	6.4	5	2

The third research question investigated mathematic department students believes about the effectiveness of individual factors including self-directed learning, arithmetic ability, and motivation or concentration on the mathematic achievement. Participants' responses were reviewed to identify the most frequently answered response for instructional factors. Participant indicated that they believe all individual factors identified in this study were very effective on the mathematic achievement of students (See Table-3). Motivation or concentration emerged as the most effective factor on the mathematics achievement of students.

Table 3
Effects of Individual Factors on Students' Mathematic Achievement

	Very Effective		Effective		Less Effective		Ineffective		No Comment	
Individual Factors	N	%	N	%	N	%	N	%	N	%
Self-Directed Learning	123	49.2	88	35.2	19	7.6	15	6	5	2
Arithmetic Ability	124	49.6	93	37.2	22	8.8	9	3.6	2	0.8
Motivation or Concentration	180	72	50	20	17	6.8	0	0	3	1.2

The fourth research question investigated mathematic department students believes about the three most influential factors on the mathematic achievement of students. 72% of the participants reported instructional strategies and methods used to teach the mathematic courses as the most influential factor on the mathematic achievement of students. The second most influential factor emerged was the motivation and concentration of students. The teacher competency in math education was reported as the third the most effective factor on the math achievement of students (see Table-4).

Table 4
Factors Affecting the Mathematics Achievement

	Very Effective		Effective		Less Effective		Ineffective		No Comment	
Demographic Factors	N	%	N	%	N	%	N	%	N	%
Gender	21	8.4	30	12	51	20.4	99	39.6	49	19.6
Parents' Educational Level	40	16	66	26.4	63	25.2	57	22.8	24	9.6
Socio-Economic Status	48	19.2	78	31.2	61	24.4	54	21.6	9	3.6
Instructional Factors										
Curriculum	122	48.8	93	37.2	19	7.6	12	4.8	4	1.6
Instructional Strategies and Methods	193	77.8	35	14.1	16	6.4	4	1.6	0	0
Teacher Competency in Math Education	168	67.2	63	25.2	14	5.6	4	1.6	1	0.4
School Context & Facilities	88	35.2	88	35.2	53	21.2	16	6.4	5	2
Individual Factors										
Self-Directed Learning	123	49.2	88	35.2	19	7.6	15	6	5	2
Arithmetic Ability	124	49.6	93	37.2	22	8.8	9	3.6	2	0.8
Motivation or Concentration	180	72	50	20	17	6.8	0	0	3	1.2

The fifth question investigated whether there was a difference in the perceived effects of demographic factors among freshmen, sophomores, juniors and seniors. Freshmen, sophomores, juniors, and seniors students' responses for the demographic factors were compared using Analysis of Variance (ANOVA). Results of the One-Way ANOVA for three demographic factors revealed that gender and parents' educational level were not stated as a significant factor on the mathematic achievement of students. However, differences among freshmen, sophomore, junior and senior students' thoughts for the effects of socio-economic status on the mathematic achievement of students were found (see Table-5).

Table-5
Comparison of Demographic Factors Affecting the Mathematics Achievement

		Sum of Squares	Df	Mean Square	F	Sig.
Gender	Between Groups	2.148	3	.716	.513	.674
	Within Groups	342.093	245	1.39		
	Total	344.241	248			
Parents' Educational Level	Between Groups	1.667	3	.556	.367	.777
	Within Groups	370.582	245	1.51		
	Total	372.249	248			
Socio Economic Status	Between Groups	45.838	3	15.279	13.7	.000*
	Within Groups	272.379	245	1.112		
	Total	318.217	248			

In order to identify where the differences were, Post Hoc Multiple Comparison LSD (Least Significant Difference t-test) was conducted. Results of the test revealed that except for the senior and sophomore students' opinions, differences were found among other student groups' opinions (see Table-6).

Table-6
Post Hoc Multiple Comparison LSD for the Socio-Economic Status

(I) GradeLevel	(J) GradeLevel	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Freshman	Sophomore	-.71429(*)	.17257	.000	-1.0542	-.3744
	Junior	-1.16429(*)	.18550	.000	-1.5297	-.7989
	Senior	-.72711(*)	.21069	.001	-1.1421	-.3121
Sophomore	Freshman	.71429(*)	.17257	.000	.3744	1.0542
	Junior	-.45000(*)	.18007	.013	-.8047	-.0953
	Senior	-.01282	.20592	.950	-.4184	.3928
Junior	Freshman	1.16429(*)	.18550	.000	.7989	1.5297
	Sophomore	.45000(*)	.18007	.013	.0953	.8047
	Senior	.43718(*)	.21688	.045	.0100	.8644
Senior	Freshman	.72711(*)	.21069	.001	.3121	1.1421
	Sophomore	.01282	.20592	.950	-.3928	.4184
	Junior	-.43718(*)	.21688	.045	-.8644	-.0100

* The mean difference is significant at the .05 level.

The sixth research question investigated whether there was a difference in the perceived effects of instructional factors among freshmen, sophomores, juniors and seniors. Freshmen, sophomores, juniors, and seniors students' responses for the instructional factors were compared using Analysis of Variance (ANOVA). Results of the One-Way ANOVA for four instructional factors revealed that only school context and facilities was a significant factor on the mathematic achievement of students (see Table-7).

Table-7
Comparison of Instructional Factors Affecting the Mathematics Achievement

		Sum of Squares	df	Mean Square	F	Sig.
Curriculum	Between Groups	.303	3	.101	.199	.897
	Within Groups	124.71	245	.509		
	Total	125.02	248			
Instructional Strategies Methods	Between Groups	1.463	3	.488	1.098	.351
	Within Groups	108.83	245	.444		
	Total	110.29	248			
Teacher Competencies	Between Groups	7.117	3	2.372	2.399	.069
	Within Groups	242.30	245	.989		
	Total	249.42	248			
School Context Facilities	Between Groups	6.640	3	2.213	2.713	.046
	Within Groups	199.86	245	.816		
	Total	206.50	248			

Post Hoc Multiple Comparison LSD (Least Significant Difference t-test) was conducted to identify where the differences were. Results of the test revealed that only senior-freshman and senior-junior students' opinions were statistically different for the effect of school context and facilities on the mathematic achievement of students (see Table-8).

The seventh research question investigated whether there was a difference in the perceived effects of individual factors among freshmen, sophomore, junior and senior students. Freshmen, sophomores, juniors, and seniors students' responses for the individual factors were compared using Analysis of Variance (ANOVA). Results of the One-Way ANOVA for three individual factors revealed that none of the factors was different among freshmen, sophomores, juniors and seniors (see Table-9).

Table-8
Post Hoc Multiple Comparison LSD for the School Context and Facilities

(I) GradeLevel	(J) GradeLevel	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Freshman	Sophomore	.0892	.14782	.546	-.2019	.3804
	Junior	-.1523	.1589	.33	-.465	.160
	Senior	.36557(*)	.18048	.044	.0101	.7210
Sophomore	Freshman	-.08929	.14782	.546	-.3804	.2019
	Junior	-.24167	.15425	.118	-.5455	.0622
	Senior	.27628	.17639	.119	-.0712	.6237
Junior	Freshman	.15238	.15890	.339	-.1606	.4654
	Sophomore	.24167	.15425	.118	-.0622	.5455
	Senior	.51795(*)	.18578	.006	.1520	.8839
Senior	Freshman	-.36557(*)	.18048	.044	-.7210	-.0101
	Sophomore	-.27628	.17639	.119	-.6237	.0712
	Junior	-.51795(*)	.18578	.006	-.8839	-.1520

* The mean difference is significant at the .05 level.

Table-9
Comparison of Individual Factors Affecting the Mathematics Achievement

		Sum of Squares	df	Mean Square	F	Sig.
Self-Directed Learning	Between Groups	1.856	3	.619	.670	.571
	Within Groups	226.200	245	.923		
	Total	228.056	248			
Arithmetic Ability	Between Groups	2.531	3	.844	1.63	.182
	Within Groups	126.457	245	.516		
	Total	128.988	248			
Motivation or Concentration	Between Groups	1.430	3	.477	.672	.570
	Within Groups	173.759	245	.709		
	Total	175.189	248			

Discussion and Conclusion

Instructional design is a challenging procedure requiring the consideration of all elements of the learning to bring about the desired change (Colakoglu, & Akdemir, 2008). It is accepted that changing the quality of teaching and learning mathematics in positive direction is one of the major challenges and concerns of educators and instructional designers. They ought to seek innovative and alternative ways to meet the evolving demands and needs of students in mathematics education. Identifying the factors that possibly affect the mathematics achievements of students could help instructional designers and instructors to select the best instructional strategies to design the most effective and efficient instruction. Existing studies suggested many variables that can have effects on the math achievement of students. Opinions of mathematics department students were collected in this study to identify the factors affecting achievement of students in math courses. Also opinions of freshman, sophomore, junior and senior students in the math department were compared in this study.

Effects of demographic factors including gender, parents' education level and socio-economic status on math achievement were investigated. In contrast to other studies (Campbell, 1995; Gray, 1996; Kimball, 1989), gender was not found an important factor influencing the math achievement of students. Similar results were found by Beaton et al., (1996) and Mullis et al., (1997). Parents' education level was found to be an effective factor in achievement of students in math courses similar to the results of Coleman, (1966) and Campbell, Hombo, & Mazzeo, (2000). Parents with higher level of education could be a role model for their children to accomplish high levels of achievement in math courses. Similar to the Eamon, (2005); Jeynes, (2002); Hochschild, (2003) and McNeal, (2001), socio-economic status in this study was reported as an important factor affecting the math achievement of students in math courses. Parents with high income seem to provide richer instructional resources to their children which may eventually help to improve the math scores of students. Significant differences were found for the effects of socio-economic status among freshman, sophomore, junior and senior students. As the grade level increases, math students' opinions about the effects of socio-economic status on the math achievement increases. This finding illustrates that math students need more financial resources as they get close to graduate in math department. Deficiency of financial resources is reported as a factor that has an effect on their math achievement.

In terms of demographic factors, the findings revealed that parents' education level and socio-economic status were two vital factors for math achievement. These are the factors that instructional designers should not ignore since they are important for math achievement. Students from different socio-economic strata with different levels of parent education may exhibit very different attitudes, needs, and other characteristics for learning and studying mathematics. Thus, achievement of those students in math courses depends on instructional design that can successfully transmit crucial mathematical skills and knowledge to students from different backgrounds.

Significant factors in math instruction and student achievement include curriculum, instructional strategies, methods, teacher (math) competency, school context and facilities. The mathematics curriculum contains specific subject-matter and instructional design principles to enable students to develop logical and mathematical skills needed to understand fundamental mathematical concepts. In other words, designing an instruction based on a curriculum that is in harmony with instructional design can scaffold student learning and promote their achievement in mathematics. Instructional strategies and methods are important for the achievement of students. The literature suggests that learning situations ought to be selected and implemented in a way that allows students to apply higher order operations (Wilson, 1996). Another important factor math achievement is teacher competency. Similar studies reported that teachers should have good understanding of subject domain to improve the math achievement of students (Ball, 1993;

Grossman, et. al., 1989; Rosebery et. al., 1992). School context and facilities are also reported to influence math achievement in this study. School safety and facilities (Reyonds et. al., 1996), temperature of the class (Harner, 1974), features of the school buildings (Cash, 1993), and crowdedness of school (Rivera-Batiz and Marti, 1995) were also reported to influence the achievement of students. Collectively, these results point out that attention should be given to school context and facilities to improve the math achievement of students.

Knowing and understanding the opinions of math students is important to identify factors they perceive to be effective for achievement in mathematics. Findings of this study revealed three factors that contribute to mathematics achievement: instructional strategies and methods, teacher competency in math education, and motivation or concentration. Further investigation of these three factors, through experimental studies, should enable instructional designers and math educators to continue to improve mathematics instruction.

This study reported that instructional design of a mathematics course is important and should be compatible to the factors identified for mathematics achievement. Educators need to adapt and create alternative innovative learning and teaching strategies for effective mathematics education. The findings also suggest that different instructional design strategies should be studied and applied in different contexts. Experiment with new instructional design models in a variety of different circumstances is vital to optimize mathematics instruction. One-size-fits-all instructional design strategies are not as efficient as those that are customized to meet specific learner needs. It is important to embody diagnostic and prescriptive tools to determine the best-fit design for each individual learner, and to make learning more meaningful based on known critical factors that affect mathematics achievement.

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Editor's Note: This is a pilot study with a single class that raises important questions about collaborative learning that deserve further study. The theoretical base, design, and experimental techniques pave the way for a series of controlled studies to determine how widely these findings can be applied to other student populations and other subject matters.

Collaborative Learning Communities: Evidence of Theory-into-Practice in Instructional Design

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Abstract

In recent years, the concept of learning communities has gained popularity among many academics in the classroom. However, this raises a number of issues about the design of learning environments. For example, the student assumes the responsibility to make sense of the body of knowledge associated with the instructional content being delivered. The instructor supports this process using assignments designed to foster collaboration, facilitation of active discussion, and promote development of critical thinking and research skills.

This study examines the experiences and achievements of 16 first-year graduate students participating in a collaborative learning community while engaged in problem-solving activities. The findings produced a new model titled the Learning Community Model. The findings also indicate that students tend to adopt a theory that fits their own personal view of instruction and learning. Participants reported gaining new knowledge and an appreciation for instructional theory as it pertains to design.

Introduction

In the research literature on collaborative and peer-assisted learning communities, there is a broad acceptance of instructional practices in which the teacher guides and directs learners about ways to work together in order to achieve an instructional goal or learning outcome. Dillenbourg (1999) states, "The broadest (but unsatisfactory) definition of 'collaborative learning' is that it is a situation in which two or more people learn or attempt to learn something together" (p. 1). There are four aspects of learning that might apply to a collaborative learning community. They are: 1) interactions between teacher and student; 2) interactions between student and student; 3) learning mechanisms that support collaboration and design to engage learners; and 4) promote opportunities for students to engage and take ownership of their own learning and become critical thinkers (Gokhale, 1995; Totten, Sills, Digby & Russ, 1991). Thus, acceptance of collaborative learning by students and its ultimate success often depends upon resolving the question of how learning can be assessed in ways that are credible and that also enhance its use (Boud, Cohen, & Sampson, 2001).

Review of Literature

"In a learning-communities approach the goal is to foster a culture of learning, where both individuals and the community as a whole are learning how to learn" (Bielaczy & Collins, 1999, p. 3). The most compelling theoretical rationale for learning communities comes from the educational theories of Vygotsky. His theories of value, knowledge, human nature, learning and society provide the foundation for his overall goal of education which is to "generate and lead development which is the result of social learning through internalization of culture and social relationships" (Communiquè 25, 1997). The purpose of this article is to explore use of selected instructional theories as they are tested in community-learning practice. Based on the four aspects of collaborative learning, a few instructional theories can be empirically tested.

In a collaborative learning community, the instructor models expert learning and problem-solving strategies explicitly in group activities and in direct interaction with smaller groups. Students observe how an "expert" approaches a learning task, a problem-solving task, a presentation task. The chance to reflect on what they have observed, then discuss and apply the strategies in realistic, relevant activities increases the likelihood that students will apply them more consistently in the classroom as well as outside the instructional setting. Especially effective for older students, this observe-reflect-discuss-apply pattern promotes gains for students of all ability levels, especially in analysis and solution of problems (Heller & Hollabaugh, 1992).

There have been several studies that report that higher education is “declining by degrees” and it is “underachieving” (Johnson, Johnson & Smith, 2007, Hersh & Merrow, 2005, and Bok, 2005). Johnson et al. (2007) state, “While the conclusion seems to be that postsecondary education is not performing well, there is a lack of focus on how to improve it” (p. 15-16). The author addresses this claim and provides an example using theory-into-practice as one step towards improvement.

The focus of the study examines the use of a learning community among graduate students. The author uses the Topping and Ehly’s *Theoretical Model of Peer-Assisted Learning* (Topping, 2005). This theoretical model begins by identifying five groups of processes that influence effectiveness in a learning community. They are: organization and engagement, cognitive conflict, scaffolding and error management, communication, and affect. In a waterfall approach, each process flows through iterative cycles in a top-down and circular manner. The processes are: situated accretion, retuning, restructuring, inter-subjective cognitive construction, practice/fluency/automaticity/retention, general-ization, feedback and reinforcement, self-monitoring/self-regulation, metacognition and self-attribution/self-esteem. These processes will be further defined in the next section.

Community learning has been defined as “educational practice in which students interact with other students to attain educational goals” (O’Donnell & King, 1999, p.3). When students work together toward a common objective, their mutual dependency often motivates them to work harder to help the group succeed (Thousand, Villa, & Nevin, 1994). The importance of good team climate as a basis for discussion is an essential factor for communication and collaboration in peer-learning groups (Frankenberger and Balde-Schaub, 1999). According to Topping (2005), “Peer [Community] learning can be defined as the acquisition of knowledge and skill through active helping and supporting among status equals or matched companions” (p. 631). He continues, “The longest established and most intensively researched forms of peer learning are peer tutoring and cooperative learning” (p. 632).

There have been numerous studies that have compared the performance of learners working individually versus working in pairs. For example, Blaye et al. (1991) found that peer-learning based on a computer-based problem had a beneficial effect which transferred to later individual work. Similar beneficial effects have been reported by Amigue and Agostinelli (1992), Mevarech, Stern and Levita (1978) and Mevarech (1993). However, Jackson and Kutnick (1996) report a study on the effects of peer interaction that found that individuals performed better than pairs. They report that the beneficial effects of peer interaction are dependent on the nature of the task (Joiner, Issroff and Demiris, 1999).

This article examines the experiences and achievements of first-year graduate students participating in learning communities while engaged in problem-solving activities. The findings indicate that students tend to experience difficulty in adopting theory into practice while at the same time demonstrating success in an application-based learning community. However, students provided feedback that stated high satisfaction while participating in a learning community.

Method

This article describes current research-into-practice in a learning community. The population for this study was 16 graduate students enrolled in a graduate-level course titled, *Principles of Multimedia Technology*. The purpose of this learning community was to give students an opportunity to develop new knowledge and problem solving skills using the framework of an instructional theory. Each learning community was dyadic. Students (learners) were expected to select an instructional theory and then design an instructional module using a multimedia application.

Learners were guided through the Theoretical Model of Peer-Assisted Learning (Topping and Ehly, 2001). Beginning with Organization and Engagement, learners articulated goals, objectives, and learning outcomes using their selected instructional theory as a guide. Each instructional theory was examined for appropriateness in the areas of goals and preconditions, values, and methods. For example, in Nelson's Collaborative Problem Solving Theory (Reigeluth, 1999) the primary goal is to develop content using problem-solving and critical thinking skills. The values of this theory are based on learning to use natural collaborative processes in social contexts. This theory focuses on learning environments that are situated, learner-centered, integrated, and collaborative. Learners selected this theory based on these attributes.

The next phase was the delivery of instructional design example based on the Theoretical Model of Peer-Assisted Learning. Each area of the model is a process. The first process is Cognitive Conflict. Learners were expected to discard old myths and false beliefs about instructional and learning theory. Next, in Scaffolding and Error Management learners designed and developed their instructional module using a constructivist approach. Learners built their designs on previous knowledge and experience. The next process is the Communication phase. Each learning community implemented its own language, listening, adopting, and implementing skills necessary for the learning community to survive. The final process is the Affect stage. Learners were motivated and developed a sense of accountability to their learning community through ownership of the instructional design.

The Theoretical Model of Peer-Assisted Learning uses a waterfall approach where each process flows through iterative cycles in a top-down and circular manner. These processes are: Surface, Strategic, Deep, Declarative, Procedural, and Condition. "This development into fully conscious explicit and strategic metacognition not only promotes more effective onward learning, it should make helper and helped more confident that they can achieve even more, and that their success is the result of their own efforts. . . The five sub-processes offer a continuous iterative process…The model should continue to apply as the learning move from the surface level to the strategic and on to the deep level, and from the declarative into the procedural and conditional" (Topping, 2001, p. 683).

The ADDIE (Analysis, Design, Development, Implementation, and Evaluation) Model presents a cyclical process that evolves over time and continues throughout the instructional planning and implementation process. Five stages comprise the framework, each with its own distinct purpose and function in the progression of instructional design (Peterson, 2003). Figure 1 shows a correlation between the Theoretical Model of Peer-Assisted Learning and the ADDIE model used by many instructional designers. The author labels this new model as: the Learning Community Model.

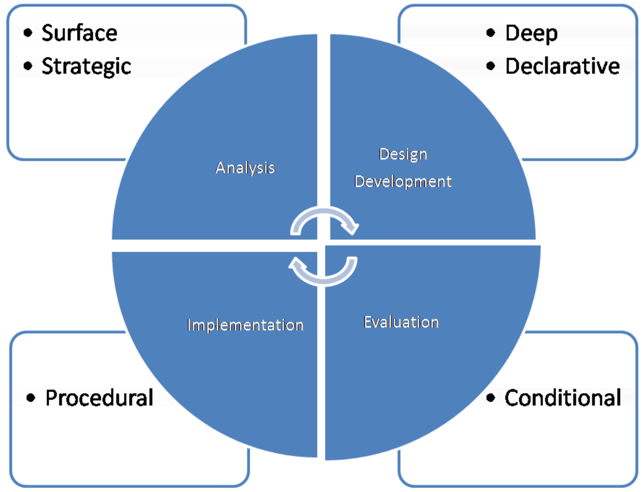

Figure 1. **Learning Community Model**

The ADDIE instructional design process is embedded in the Theoretical Model of Peer-Assisted Learning. Surface and Strategic processes are found in the Analysis phase of the model, Deep and Declarative processes are in the Design and Development phase, the Procedural process is in the Implementation phase, and the Conditional process is in the Evaluation phase.

Each process and phase in this Learning Community model is iterative.

Using a constructivist approach, learners were guided through each phase of the Learning Community Model. The first phase of the process described the instructional theories found in Table 1. The second phase provided instruction and examples on writing objectives and learning outcomes using an instructional module on graphic design. The third phase was the presentation of the instructional module. The instructional module presentation allowed learners to experience the context in which an instructional module might be delivered in the required time frame for their delivery. Each Learning Community was given forty-five minutes to present their module.

Once the outlying processes of the Learning Community Model were addressed and the instructional module example had been presented, each learning community began to address the inner process (ADDIE) to design and develop their instructional modules. The first requirement was to have students review selected instructional theorists and conduct focused research into the writings of these theorists. Table 1 shows a list of instructional theorists presented to the students. Learners demonstrated high levels of engagement and interaction which contributed to the positive results from their learning communities.

Table 1
Instructional Theories

Theorist	Theory
Benjamin Bloom	Taxonomy of Learning Domain
John Dewey	Theory of Experience
Robert Gagne	Nine Events of Instruction
Malcolm Knowles	Andragogical Learning Theory
Laurie Nelson	Collaborative Problem Solving
Roger Shank, Tamara Berman, Kimberli Macpherson	Learn by Doing
B.F. Skinner	Behaviorism

Students were expected to deliver instructional module presentations to the peers using step-by-step instructions in the area of multimedia technology applications to achieve learning outcomes they had identified. Using a constructivist approach, students were introduced to the various stages of developing an instructional design topic. Using the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model, students moved through each phase week-by-week as they developed their instructional design module. During the Analysis phase, students were expected to conduct research on several instructional theories. The evidence from their research consisted of published articles that discuss, use or evaluate each theory. Students were expected to discuss how their instructional theory would influence their module. During the Design and Development phases students created their instructional design modules. The modules consisted of a Pre-test, a pre-instructional strategy to assess the learner's prior knowledge and Post-test, to determine the level of learning that actually occurred (Morrison, Ross, Kemp, 2004).

Table 2
Learner Adopted Theories

Learning Community	Adopted Theory	Instructional Design Module
1	Dewey-Experiential Learning	Basic Web Design using XHTML
2	Social Learning Theory	Special Effects Video
3	Cooperative Learning	Interactive Web Design
4	Learn by Doing	Basic Web Design using CSS
5	Cooperative Learning	Editing Digital Audio Samples
6	Social Learning Theory	Stereoscopic video on YouTube
7	Collaborative Problem Solving	Graphics Design Photo Restoration
8	Andragogy	Animation Kinesthetic Techniques

Each learning community was given forty-five minutes to present their module in the Implementation phase. The Evaluation phases consisted of a 10 item Likert style questionnaire. This questionnaire was used to evaluate the performance of the learning community's presentation.

Results

This study produced a new Learning Community Model. The model fuses the Theoretical Model of Peer-Assisted Learning and the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) used by many instructional designers. The findings also indicated that students tend to adopt a theory that fits their own personal view of instruction and learning. Students reported gaining new knowledge and an appreciation for instructional theory as it pertains to design.

Students were required to deliver a formal report documenting their learning community experience and instructional design module. In addition to the documentation, students were required to assess pre-and post-test learning, present and discuss peer-evaluations on their modules and delivery style, and provide self-reflection and self-evaluation. Table 3 presents pre- and post-test gains from each learning community.

Table 3 contains pretest-posttest data showing the results from each learning community instructional module presentation. Each learning community reported gains in new knowledge; from 14 to 58. In each learning community, students were asked to remain in the room during the delivery of pre- and post tests, asked each participant to complete the questionnaires individually, and record and summarize the responses for their report.

Table 3
Learning Community Data

Learning Community	Adopted Theory	Instructional Design Module	PreTest Scores	PostTest scores	Gain
1	Dewey-Experiential Learning	Basic Web Design using XHTML	46	84	38
2	Social Learning Theory	Special Effects Video	58	90	32
3	Cooperative Learning	Interactive Web Design	76	90	14
4	Learn by Doing	Basic Web Design using CSS	50	94	44
5	Cooperative Learning	Editing Digital Audio Samples	80	94	14
6	Social Learning Theory	Stereoscopic video on YouTube	30	88	58
7	Collaborative Problem Solving	Graphics Design Photo Restoration	68	98	30
8	Andragogy	Animation Kinesthetic Techniques	36	84	48

Discussion

The ability of students to work in a learning community is the keystone to building a solid foundation in higher education. This study describes the development of collaborative learning or peer-learning communities among 16 graduate students enrolled in a graduate level course titled, Principles of Multimedia Technology.

Limitations of the Study

Because this was a one-group, pre-test post-test study, there was minimal control for this experiment. A single selected group was used for observation with careful measurement being done before applying the experimental treatment and then measuring the results. This design has minimal internal validity, controlling only for selection of subject and experimental mortality. It has no external validity. Any surface threats to validity for both the pre/post evaluation instruments were minimized reviewing the wording of each question asked. The results are not generalizable among the participants due to the unique nature of the instructional content. The loss of external validity comes from the fact that the participants were selected from a small sample obtained from a single geographic location. Because of this, it is not certain if these results would apply to participants in other geographic locations or higher education settings.

Conclusions

The author recommends future research using the Learning Community Model with both undergraduate and continued graduate populations. Research should be conducted using this model in blended learning communities (integrating online learning and face-to-face meetings). Areas that might be addressed are: 1) the deeper the personal relationships between learners and the collaborative learning experience; and (2) the relationship between learners and group interactions (using technology) before and/or after a face-to-face meeting. The learning community experience in higher education serves to enhance the college experience for students. This practice is worthy of continued research to ensure student success.

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About the Author

Joseph Defazio's research Interests are in Instructional Design, Music and Audio Technology, Multimedia Design and Production, Interactive Media Design, Learning and Cognition, Knowledge Information and Intellectual Capital. He has been involved in project development and management within the School of Informatics, Media Informatics. His focus is multi-faceted in that it encompasses graphics, animation, sound, video, 3D environments, authoring, programming toward interactive simulation and game applications. His project development efforts have been primarily Media Informatics students; both graduate and undergraduate. Together they have worked on informative, instructional, entertaining, and simulation productions.

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Editor's Note: Moodle solves a number of problems for potential users. It is open source, which means free; and the code is open so that many organizations around the world are constantly improving this technology. The fact that it can be modified to meet specific institutional needs is attractive organizations where programmer assistance is available. Some administrators argue that they have more confidence in the commercial product and they are willing to pay the costs. Others feel that open source is inferior. They do not realize that the core of IBM server technology is Linux, an open source program. It was adopted after IBM spent millions of dollars developing its own software because Linux had benefited from its attentions from a global community of programmers.

Use Your Noodle to Learn Moodle:

How Moodle can help Saudi Arabian universities create online communities for collaboration, learning and social knowledge management

Osman Z. Barnawi
Saudi Arabia/Great Britain/USA

Abstract

Although many universities and colleges in Saudi Arabia have incorporated a Virtual Learning Environment (VLE) or Course Management System (CMS) either as an adjunct to traditional EFL courses, usually called a "blended" or "hybrid" course system, or as a tool for their distance education programs. In today's economy, such programs seem to have some major issues. Specifically, these programs are rigid in the way they can be used and too expensive for colleges and universities to obtain licenses, handle technical support, and build customized learning programs. Also, they are too demanding of designing, programming skills and time. One system that will save time and money for colleges and universities, and help them adapt their programs according to their institutional needs, is Moodle, a free, open source software that does not require universities and colleges to go through a commercial vendor to obtain it. This paper attempts to draw the attention of university and college EFL teachers and educators toward Moodle and its pedagogical potential for creating online communities for collaboration, EFL teaching and learning, and social knowledge management in Saudi higher education community.

Keywords: Moodle, online communities, social constructionist, collaboration, EFL instruction

Introduction

In recent years, it has been a trendy feature for higher education institutes in Saudi Arabia, such as Kind Saud University for Health Sciences, and Yanbu Industrial College, to incorporate a Virtual Learning Environment (VLE) or Course Management System (CMS) as an adjunct to traditional EFL courses, usually called a "blended" or "hybrid" course system, or as a tool for its distance education program (Robb, 2004). Noticeable examples of such VLE and CMS are the integration of smart board, bulletin board, Bodington, IT technology and Internet techniques into EFL classrooms. Nevertheless, in today's economy such programs (e.g., Bodington or CMS) are not only rigid in the way that they can be used, they are too expensive for colleges and universities to obtain licenses, handle technical problems, and build customized learning programs. They are also too demanding in terms of designing, programming skills and time. Moodle will save these colleges and universities money, time, and help them adapt their programs according to their institutional needs. Moodle is a free, open source software that does not require universities and colleges to go through a commercial vendor to obtain it.

Thus, this paper attempts to draw the attention of university and college EFL teachers and educators toward Moodle and its pedagogical potentials for creating online EFL teaching and learning communities. To achieve this end, I will provide an operational definition for Moodle to familiarize reders of this paper with the Moodle system. I will call Saudi EFL teachers and educators' attention to the need of incorporating Moodle into their colleges and universities.

Specifically, I will argue how Moodle can be an effective tool for creating online communities for collaboration, learning and social knowledge management in Saudi higher education.

I will present the basic installation and major functions of Moodle. Next, I will provide a sample of learning tasks that can be created with Moodle to foster critical thinking and self-voicing in college EFL writing classrooms. I will conclude with possible technical and pedagogical challenges that Saudi teachers and educators may face when using Moodle in conventional EFL classroom instruction.

What is Moodle?

Moodle stands for Modular Object-Oriented Dynamic Learning Environment. It is an enormously flexible and adaptable system for course and learning management. Its development emerged in 2002 as doctoral research by the Australian Martin Dougiamas. On its official website, Moodle is defined as: "a course management system (CMS) - a free, open source software package designed using sound pedagogical principles, to help educators create effective online learning communities" (http://moodle.org/). Since then it has been implemented in more than 193 countries and offered in more than 75 languages.

It is a free, open-source, e-learning, cross-platform course management system, Moodle has widely been implemented in both Eastern (e.g., China, Taiwan) and Western (e.g., Australia, America and British) higher education institutions. Among its international users, it has already become a term of its own synonymous with a software package designed to help educators, teachers, and administrators build full online classes. This can be accomplished in advance or as the course is being taught (Baskerville, & Robb, 2005; Brandle, 2005;Wu, 2008). With its enormously flexible and adaptable features, Moodle can be incorporated in a variety of ways depending on the needs and capabilities of a particular university or college. This suggests that Saudi universities and colleges have a variety of choices for incorporating Moodle into their conventional EFL classroom instruction. These range from simple classroom management to fully interactive e-learning, or a combination of the two. Moodle is a free online course management system aimed at fostering social interaction between (Saudi) teachers and their students and among the students themselves. Questions that need to be addressed include: "why do Saudi colleges and universities need to incorporate Moodle into conventional classroom instruction?" And "What are the pedagogical outcomes for incorporating such innovation?" I will tackle these questions in the next section.

Incorporating Moodle into the Saudi Arabian Higher Education Community

In cultures such as Turkey, China, Japan, and Saudi Arabia, social values such as authority, social harmony and deference to the elders and teachers are highly valued. As a result, traditional methods of EFL teaching and learning that are teacher-centered still prevail in academic settings. Also, most university and college EFL teachers believe that a classroom in which they are dominant will guarantee pedagogical success. As the philosophy of teaching and learning in the Saudi context inculcates passivity, dependence, *a priori* respect for authority and unquestioned attitudes. EFL students in classroom settings perceive their teacher as a figure of authority, the only source of knowledge, and their teachings should not be questioned. As a result, interaction between teachers and their students, and among students is limited, and debate is often absent as a source of knowledge construction. Consequently, most college EFL students lack skills such as self-assessment, monitoring their own process of language learning, and have little motivation to undertake their learning outside of the classroom.

It is assumed that language learning is a lifelong endeavor in which teachers should become aware of the worth of independent learning both inside and outside the classroom, so that students can gain the habit of learning continuously and maintaining it after they have accomplished their formal study (i.e., college or university). More importantly, knowledge is socially and discursively constructed and co-constructed. "Teaching is a public, socially-constructed role, subject to the perceptions and expectations of learners, colleagues, schools and the community" (Roberts 1998 p. 309). This notion of social constructivism has shaped "pedagogical transformation in a sense that student-centred, collaborative task-oriented, and engaged learning substituted traditional instructions where passive learning and teacher centeredness prevail" (Barnawi, 2009, p.52). Thus, it is imperative to foster the autonomy of Saudi EFL students by incorporating educational technologies that create an environment of interaction and collaboration both inside and outside the classroom.

Moodle is a free open system and a low cost solution for effective e-learning. Moodle, with its emphasis on constructivist and social constructionist approach to education, offers mediating tools which help it to achieve the objectives of a social constructivist-based classroom in many ways. One is its enormous flexibility in which teachers, educators and administrators can incorporate it into their classrooms according to the socio-cultural, linguistic and political needs of their own institutions (Baskerville, & Robb, 2005; Brandle, 2005). More importantly, it integrates many different systems like webpage, wiki, blog, and bulletin board into a rich learning experience.

In addition to the above benefits, Moodle transforms traditional teacher-centered pedagogy into a dialogic learner-centered pedagogy - a pedagogy whereby teacher and learner become mediators in co-constructing and navigating knowledge construction. For example, when students comment on entries in databases or work collaboratively in a Wiki, they can construct, de-construct, re-construct, and co-construct knowledge with teachers and peers. Furthermore, Moodle makes all language learning resources available to all students and allow them to explore and investigate beyond their subject (i.e., English). It also allows teachers and administrators to open up parts of their educational system to other institutions (joint courses, joint research projects) so that they can co-construct the knowledge, i.e., language learning materials can be in a centrally accessible repository, sharable and searchable by other universities and colleges. Moodle offers quality, reliability, accuracy, accountability, collaboration, and greater communication to its users as it helps the education world set, follow, and maintain standards.

A thorough evaluation of the pedagogical outcomes of Moodle conducted by Goba, Nimrod, and Gareth (2004) conclude that: (i) Moodle is a free open source that teachers can use it according to their institutional socio-political, linguistic and cultural needs, (ii) it offers a collaborative learning space where students and teachers, and students among themselves can meet, read, and write. In this way, students and teachers become critical co-investigators in dialogue with each other, i.e., all teach and all learn*,* (iii) it allows teachers to easily save and archive many of the mechanics of classroom operation—such as assignments, activities, scheduling, and quizzes, (iv) it reaches its full potential only if it becomes a place where data can be shared and processed by automated tools as well as by people (i.e., semantic Web), (v) it is a self-explanatory program in which users, by clicking the help option, can find answers for all their questions, and (vi) it is easy to install on any computer, i.e., Windows, Macintosh or Linux and the Interface can be switched to more than 50 languages.

From the above discussion, it could be argued that Moodle has great potential to successfully accommodate teachers, educators, and a wide variety of teaching structures. It does not pigeon-hole EFL students into modules and courses, and it embraces interdisciplinary studies and variety of student roles. Having discussed the pedagogical assumptions for infusing Moodle into EFL classrooms, we must also ask technical questions as to how well Moodle runs on different computers and operating systems.

Functionality of Moodle

Unlike web-designing tools that require a specific features and operating systems, Moodle is easily and quickly installed on PCs and Apple computers and it can be scaled up to accommodate a large user base. It runs without modification on Unix, Linux, FreeBSD, Windows, Mac OS X, NetWare and any other system that supports PHP computer scripting language (e.g., web host providers). In early versions of Moodle (1.6 and 1.7) MySQL and PostgreSQL were the only feasible options. The version released in January 2008 (Moodle 1.8.4) contains improvements that make Moodle more flexible and stable (Baskerville, & Robb, 2005; Brandle, 2005;Wu, 2008). There are four easy steps to get a Moodle system.

1. Determine the available server, IP address, domain name, and database tools: for example: (Apache) +MySQL+PHP+ Moodle.
2. Convince decision makers at your college or university about the pedagogical potential of Moodle and how it will enrich conventional classroom instruction.
3. Have users download the software from Moodle.com to set it up on their machine.
4. Find a free host.

The author’s Moodle system – Open source for Educators – is free. Subscription-based media libraries, external web links, and other commercial software products can potentially be integrated into Moodle courses according to the needs of your college or university progams.

Major features of Moodle

One of the most distinctive features of Moodle, as mentioned earlier, is its enormously flexible and adaptable nature. Thus, it can be incorporated in a variety of ways depending on your institution’s needs and capabilities. With its template-based CMS, both students and teachers can add content. Moodle’s navigation interface is user-friendly and intuitive. EFL teachers with limited computer literacy can use it to build dynamic and collaborative EFL learning communities. Some of Moodle’s major features related to creating online communities for collaboration, language learning and social knowledge management are introduced below.

Layout

Figure 1 below shows a typical Moodle screen. All elements on the page are template-based so that EFL teachers can easily add, modify, reposition, or delete blocks of text and graphics. Resources and special functions selected for that course or college are displayed on both sides of the screen (Robb, 2004). Each section in a Moodle course has lessons, quizzes, assignments, and forums that are linked to a built-in grade-book. All resources on the page can be individually organized, and elements within each section can be easily moved around or hidden.

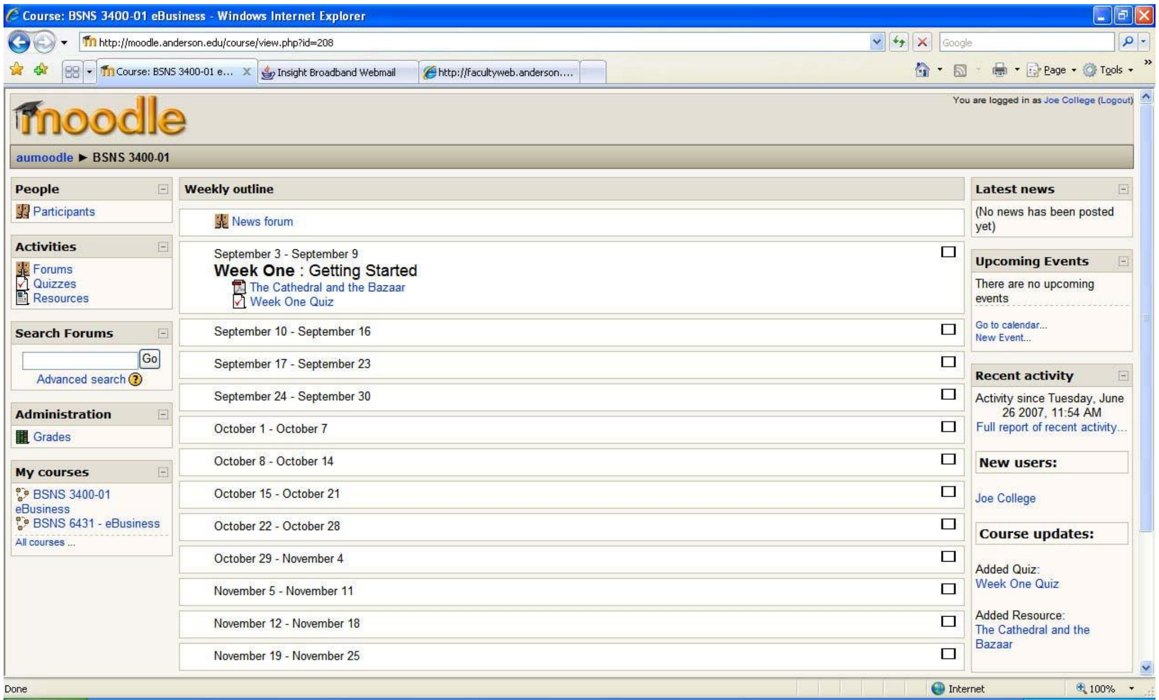

Figure 1: Moodle home page showing menu and resources.

Course Management System (CMS)

Moodle, by and large, is a powerful and miscellaneous CMS and EFL teachers can effectively trace and manipulate its functions to make their lessons, assignments and quizzes (e.g., reading and writing) and set time-or-password-restrictions. Moodle keeps automatic log reports of each student's work and the teacher knows not only when students have completed or uploaded a writing assignment, but how much time was spent on assigned tasks or quizzes as shown in Figure 2 below. Furthermore, EFL teachers can set deadlines or timeframes for students to complete assignments and restrict access when the deadline has passed. Students can look up their grades after the teacher downloads them (e.g., in Excel format). They can trace their daily or weekly assignments and quizzes on a calendar by moving the cursor over a given day to display assignments and quizzes. Moodle is an interactive management and communication tool to increase effectiveness, quality, reliability, accuracy, accountability, collaboration, and communication for both teachers and students.

Content

While using Moodle in EFL instruction, teachers have a wide range of choices to integrate any kind of resources into it. For instance, they can include any kind of text-based or html-formatted documents, multimedia resources such as graphics, video or audio (e.g., MP3 files), PowerPoint, or Flash-based applications. Additionally, EFL teachers can link and upload their lesson tasks within Moodle to one's server or these are available on the Internet. In this way, students can easily access the content-based resources by using *Moodle both inside and outside of their colleges or universities.*

Assessment techniques

Interestingly enough, Moodle allows for a wide range of assessment strategies (Robb, 2004; Wu, 2008). Among these strategies, the quiz module comprises fill-ins, multiple-choice in which more than one answer can be chosen, true-false, matching, short-answer (exact matching).

Overview Regrade attempts Detailed statistics Simple statistics

	Name	Attempts	Highest grade /10
	Klaus Brandl	8.0 3 June 2004, 11:31 PM (1 min 30 secs) 0.0 20 July 2004, 06:49 PM (238 days 14 hours)	8.0
	Paloma Borreguero	10.0 4 June 2004, 02:10 PM (1 min 3 secs)	10.0
	Jay Waltmunson	6.0 4 June 2004, 02:53 PM (1 min 28 secs) 4.0 8 June 2004, 08:38 AM (28 secs)	6.0
	Paul Aoki	4.0 8 June 2004, 09:39 AM (1 min 22 secs) 2.0 8 June 2004, 09:42 AM (35 secs) 10.0 8 June 2004, 09:43 AM (22 secs) 4.0 22 July 2004, 02:22 PM (45 secs)	10.0
	Carmina Brandl	6.0 10 June 2004, 09:36 AM (45 secs) 10.0 10 June 2004, 12:43 PM (41 days 20 hours) 4.0 22 July 2004, 09:37 AM (55 secs)	10.0
	Kaoru Ohta	8.0 10 June 2004, 11:24 AM (2 mins 45 secs)	8.0

Figure 2: Student data in Learning Management System.

In the words of Brandle (2005), the workshop module is also seen as another wonderful evaluation strategy that is designed on the basis of peer assessment. All of these assessment types (e.g., workshop, fill-ins, multiple-choice) can be time and password restricted, and allow for limited or multiple re-submission. This will further help EFL teachers to trace student performance both inside and outside the classroom.

Cooperative learning

As mentioned earlier, Moodle is designed from a social constructivist learning perspective. It provides useful tools such as Wikis, forums, chats, blogs, and workshops so that EFL teachers can implement different formats of social interaction and collaboration into their teaching. For instance, students can be divided into subgroups (either visible or separate), interact with each other synchronously in chat activities, and engage in asynchronous discussions in Wikis and forums. The teacher can save all the written dialogues in chat rooms for later reference (e.g., collaborative feedback and critical reflection). Students often complain about the lack of enough feedback, in conventional classroom settings. Through asynchronous discussions in Wikis and forums, learners are able to construct, de-construct, re-construct and co-construct knowledge (e.g., collaborative feedback in EFL writing).

EFL teachers can post persuasive writing along with online collaborative feedback tasks in the assignment section of Moodle. This offers a social constructivist-based learning space where students and teachers, and students among themselves can meet, read, and write. In this way, the students and teachers will become critical co-investigators as they dialogue with each other, i.e., all teach and all learn. One possible example of persuasive writing task is depicted below.

Instructions:

Choose a community organization that is physically close to you.

Identify a specific need or problem that you want to solve.

Persuade us why you think it is a problem and why it needs to be solved.

Support your claims/arguments based on your personal observation, experience, prior knowledge and other information sources.

Figure 3. Sample of learning tasks that can be created with Moodle:
Fostering critical thinking and self-voicing in college EFL writing classrooms

Persuasive writing

The above persuasive writing task should help a student-writer gain critical thinking and self-voicing skills in EFL. Such tasks will help the student-writer brainstorm, identify, analyze, evaluate, construct and support arguments using his or her prior knowledge and experience and other sources of information. They will also help in self-assessment and in monitoring his or her own learning process. These tasks engage the student-writer with discourses that are both real and significant in his or her daily lives. Such tasks urge the student-writer to work enthusiastically to meet the real needs and expectations of a community audience by taking his or her writing beyond the classrooms.

The student-writer may experience difficulties in identifying or choosing a specific organization or identifying problem to write about. In this regard, I agree with Yarbrough's (1999) assertion that "in most cases [college or university] students already perceive problems they want to be able to solve and have questions they want to be able to answer" (p. 240). If it appears that a student-writer could not recognize a specific organization or problem, scaffolding by peers and teachers may be necessary.

Online collaborative feedback tasks

Indisputably, treatment of EFL writers' errors is a challenge for writing teachers in a face-to-face classroom or an online-based course. Treatment of EFL writers' errors is controversial in that some researchers perceive it as an ineffective strategy. Those who argue against feedback contend that it is not effective and may de-motivate students to write because students blame themselves as ignorant or incapable writers (e.g., Polio, Fleck, & Leder, 1998; Truscott, 1996). They further argue that providing feedback on writing does not develop language accuracy in student writing long-term. Students continue to make language mistakes in subsequent drafts after they received considerable feedback in face-to-face classroom or an online course.

On the other hand, those who argue for feedback in students' writing (e.g., Bitchener, 2008; Ferris, 2008) maintain that although providing students with feedback "in the form of written commentary, error correction, teacher-student conferencing, or peer discussion" (Hyland & Hyland, 2006, p. xv) may not help students to avoid making mistakes, it can raise students' awareness of correct writing. In this regard, I believe as other researchers (Ferris, 2008) contend, mistakes always take place while learning foreign or second language writing. Not everyone can avoid making mistakes in writing although she or he may have a high level of language proficiency. As writing teachers, we cannot assume that students will automatically notice or realize their gaps or problems without social mediation through teacher or peer feedback. Therefore, it is imperative to seek possible strategies such as those offered in Moodle to help student-writers improve their writing accuracy and fluency.

Moodle is, without doubt, an excellent tool to foster online-based collaborative feedback communities. In Moodle, student-writers can easily communicate with each other synchronously and asynchronously and share their writing online with peers and teachers. Both teachers and students have a dynamic environment to interact with each other, to give/get support and build rapport through discussion and negotiation about gaps or ways to improve their writing. When students collaboratively find problem(s) in draft documents, they provide different feedback strategies to their peers. For example, one student may be good at identifying form problems (mistakes in grammar and vocabulary); another may be good at recognizing structural problems in content or logic. Collaboration allows students to support one another in recognizing problems. Second, online collaborative feedback stimulates critical thinking. If students have different interpretations of gaps or problems, they will negotiate them by expressing their ideas or arguments, and in turn they will justify such arguments with lines of evidence. This process helps students to develop critical thinking by noticing gaps or problems in writing. Third, this task helps students be aware of their own or their peers' drafts, which in turn will help to enhance awareness of writings that may present difficulties for a reader.

The above tasks have enormous benefits with regard to critical thinking and self-voicing skills in writing/composition classrooms. The negotiation between peers and teachers encourages students to do critical discussions for finding solutions and improving their writing. Moreover, conflict or disagreement in that negotiation provides impetus for students to re-examine their language use, arguments, organization and clarity in their writing (Swain & Lapkin, 2002).

Challenges to using Moodle in EFL teaching and learning

Undoubtedly, innovations such as Moodle do not automatically spread in the contexts where they are supposed to be adopted, but need to be adequately endorsed and communicated (Barnawi, 2009; Rogers 1995; Lepori, Cantoni & Succi 2003). As Baylor and Ritchie (2002) convincingly argue, "regardless of the amount and sophistication of technology, faculty members must have the skills and knowledge to use it" (p.398). Therefore, a series of workshops on the use of Moodle, from both a technical and pedagogical point of view, is necessary in order to equip Saudi EFL teachers and administrators with skills and knowledge to implement these technologies.

Although the Moodle website provides detailed instruction on how to set up Moodle in EFL classroom, some technical issues may require a teacher to possess a high-level of computer literacy skills to address them. Wu, (2008) points out that EFL teachers "should have a high-level computer as a server and know how to install database software, such as MySQL or Microsoft SQL, on the same server, which is quite a formidable challenge for most English teachers without the help of technical support. Even if IT professionals help English teachers install Moodle and database software, English teachers may also feel frustrated debugging computer- or Internet-related problems that teachers of the web-based English classes may face" (p.53).

This suggests that, in addition to the series of workshops, an online module about the technical features of Moodle should be developed and put at the disposal of e-Courses users so that teachers can refer to them when necessary. More importantly, one-to-one assistance with *ad hoc* modules should be offered to assist teachers who need further assistance in using Moodle in their EFL classrooms.

In conclusion, Moodle, with its emphasis on constructivist and social constructionist approaches to education, offers media tools to achieve the objectives of a social constructivist-based classroom. It is a platform to access and manage collaborative materials for teaching and learning online. It is a platform where teachers and students can learn together. Innovative teachers should not wait for their institutions to install a perfect CMS; instead they should join the Open Source movement to construct and co-construct knowledge using Moodle. More importantly, they should join the Moodle online community of be updated by participating, interacting, and sharing their experiences, needs and interests. This will further help them think locally and act globally. This is because "the key to successful use of technology in language teaching lies not in hardware or software but in humanware" (Warschauer & Meskill, 2000, p. 307), instead in participation and interaction to experience and feel that you are among like-minded people who share the same curiosities, needs and interests.

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Editor's Note: This article was reported in *Issues in Informing Science & Information Technology* in January 2007. It has a large sample to validate its value in the country or origin. Additional research is needed to determine its applicability elsewhere.

Inmates' Attitudes to Distance Education Whilst in Prison in the Kingdom of Saudi Arabia

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Abstract

This research explores inmates' attitudes to undertaking distance learning whilst in prison, and considers both the benefits and the difficulties experienced by inmates as a result of their academic work. It is based on over 35 questionnaires completed by 500 inmates. The research was conducted in five prisons throughout the Kingdom of Saudi Arabia in five different provinces. In addition to providing an in-depth account of the role that education can play during a prison sentence and beyond, it is intended that the experiences shared by these inmates will provide the basis for additional guidance and support for future distance learning among inmates. The data of this study shows that inmates in general demonstrate positive attitudes toward using distance education whilst in incarceration. The remarkable finding was that the prisoners were motivated to engage in the computer and Internet use to continue their academic studies whilst in prison and learn new skills to get a job upon release. This finding supports the possibility of the inmates' engagement in distance education courses offered in prisons.

Keywords: distance education, attitude toward distance education, inmates, motivating factors, inhibiting factors

Introduction

Most governments around the world attempt to educate inmates in prison so that they will be something other than inmates in their post-incarceration life. Offenders come to prison with much less education than the general population. This lower educational level does not compel these persons to commit crimes, but it is a factor in the criminal decision-making process. It creates a favorable context in which an individual sees limited options, and therefore, does not believe that he or she has much to lose. Furthermore, lack of education is often associated with lack of regard for the self, manifested in a limited respect for others and for institutions. According to Johnson (2001), a number of studies confirmed that educational programs are directly responsible for the recent rise in the rate of dropouts and the decrease in crimes because many of those who drop out of high school or fail to qualify for admission to college or university do not possess the skills necessary to compete for jobs.

Statement of the Problem

In Saudi Arabia, there is a prison in each main city in the country equipped with a number of classrooms and textbooks to provide a learning opportunity similar to the educational system applied outside prisons. Studying in prison is available for offenders, who are interested in resuming their education beside others duties. Since this educational system within prisons follows the overall educational system in regular schools, this learning opportunity, however, is not available in all the prisons especially for those who have never been to school. In addition, learning and training opportunities in prisons are limited to certain subjects such as religious and self-development education, and electricity and plumbing skills, which teach them basic skills in such subjects. Although, there is a lot of learning and training programs provided by some governmental agencies, schools, and community colleges, offenders do not enjoy such opportunities. Therefore, this study attempts to fill the gap between inmates and the community outside prison by offering learning and training opportunities in prisons. Thus, this study attempts to explore the opportunities of and difficulties in applying distance education in prisons by examining the offenders' attitudes to distance education as a system course delivery. Distance education should provide inmates with learning and training opportunities available outside prison, including formal and informal education.

Implications of Distance Education

Distance education has been defined from different perspectives over the years. In this regard, the Office of Educational Research and Improvement of Distance Education defines distance education as "the application of telecommunications and electronic devices which enables students and learners to receive instruction that originates from some distance location" (Simonson, 1997, p.1). A number of studies have discussed the uses of distance education in a variety of contexts and its implications for different levels of learning. Distance education has become a popular technique in educational environments and communities and more accessible for every educational level from K-12 to higher education. In higher education, a great deal of distance education instructional activity is taking place today as a local phenomenon.

Many classroom instructors have established their web courses using online pedagogical techniques such as chats, discussions, web-based testing, or simulation sites on the Internet in order to create new opportunities for their students (Eastmond, Nickel, & Du Plessis, 2000). If prisoners have the ability to utilize technology effectively, they can use distance education either as an aid to promote learning in the traditional classroom, or as a distance educational tool. In such environments, instructors can utilize technology such as Web-Based Instruction (WBI) to post course materials such as a course syllabus, course schedule and meetings, reading materials, and course requirements. They can also use WBI to test inmates' in-class learning so that they can receive instant feedback in order to adjust their lecture plans. In some classes, instructors can use a stylus-based laptop, which incorporates the use of notes handwritten directly into the computer, when they lecture. At the end of each class, instructors can send their notes as e-mails to their students, which helps students focus on the lesson, rather than taking notes (T.H.E. Journal, 1997 as cited in Khan, 1997).

Objective of the Study

The primary purpose of this study is to identify the attitude of inmates toward using distance education in prison in the Kingdom of Saudi Arabia as schematized in Figure 1 below:

Figure 1: Hypothesized relationships between inmates characteristics, educational background, technology use and skills, education whilst in prison, training experiences, potential situations, distance education advantages, distance education disadvantages.

The following research questions will be addressed:

1. What are the relationships between selected inmates characteristics (demographics) including educational background and inmates skills and access of technology (computer skills and access, Internet skills and access)?
2. What are the relationships between selected inmates characteristics (demographics) including education background and inmates education whilst in prison?
3. What are the relationships between selected inmates characteristics (demographics) including educational background and potential situations?
4. What are the relationships between selected inmates characteristics (demographics) including educational background and distance education advantages?

5. What are the relationships between selected inmates characteristics (demographics) including education background and distance educational disadvantages?
6. What are the relationships between selected inmates characteristics (demographics) including educational background and training experiences?

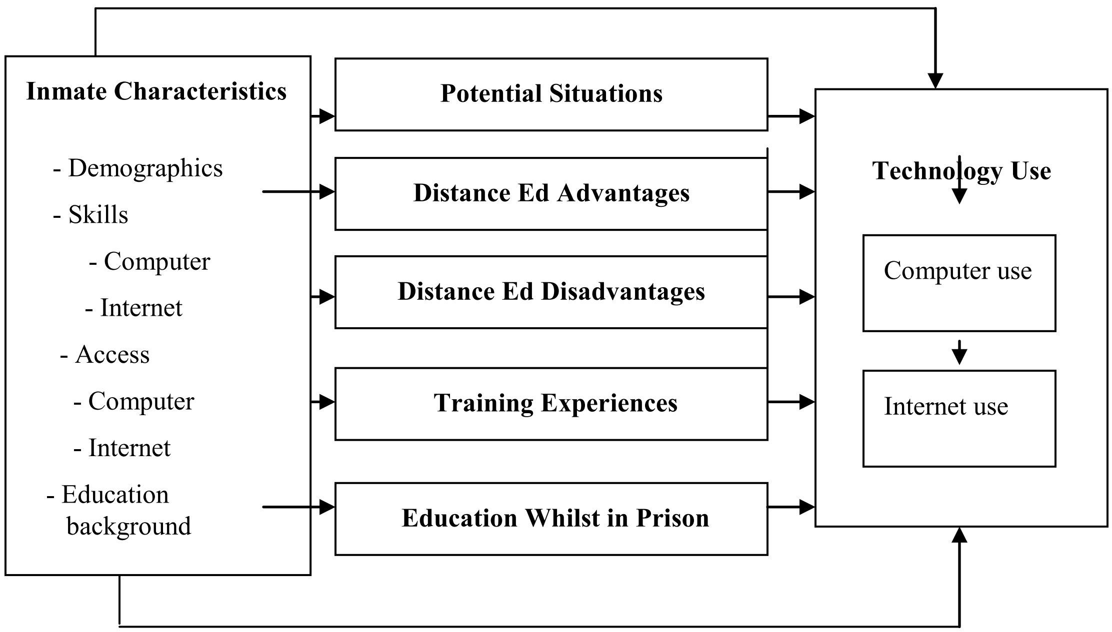

Figure 1. Attitudes of Inmates toward Distance Education

The following research questions will be addressed:

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3. What are the relationships between selected inmates characteristics (demographics) including educational background and potential situations?
4. What are the relationships between selected inmates characteristics (demographics) including educational background and distance education advantages?
5. What are the relationships between selected inmates characteristics (demographics) including education background and distance educational disadvantages?
6. What are the relationships between selected inmates characteristics (demographics) including educational background and training experiences?

Methods

Participants

The participants of this study included inmates (n = 500). These participants included female and male inmates from five main prisons in five provinces of Riyadh, Makkah, Dammam, Qassim, and Abbha. The inmates participating in this study have been incarcerated for varied periods of time ranging from one year to fifteen years.

Research Design

A survey has been used for this study. Using data collected from the survey, the relationship between the dependent, independent, and antecedent variables have been explored. The key variables of the study are:

Dependent Variables = (1) Computer and Internet access
(2) Computer and Internet use
(3) Education whilst in prisons.

Independent Variables = (1) Potential situations
(2) Distance education advantages
(3) Distance education advantages
(4) Training experiences

Antecedent Variables = Inmates characteristics and education background.

Instrumentation

The data has been collected using a survey as the main instrument. The survey consists of seven parts:

1. *Profile Characteristics*: This part of the survey consists of items (1-5), which are intended to provide the personal and professional characteristics of a participant in terms of age, gender, province of origin, period of imprisonment, and educational background.
2. *Technology Skills and Access*: This part consists of six items (6-11), which are intended to provide information about the participants' computer skills and access. The participants rate their skills and access on a 5-point Likert scale (1= none and 5= too high).
3. *Education in Prison*: This part consists of four items (12- 15), which are intended to provide information about the participants' education in prisons. The participants rate their education from: never studied at prison to studied up to college graduation.
4. *Training Experiences:* This part consists of three items (16-18), which are intended to provide information about the training sessions that the participants have had in prisons, including stating whether or not they had computer training, plumbing training, electricity training, carpentry training, and others.
5. *Potential Situations*: This part consists of five items (19-23), which are intended to provide information about the attitude of the participants toward some potential situations in distance education. The participants rate their usage on a 5-point Likert scale (1 = strongly disagree, and 5= strongly agree).

6. *Advantages of Distance Education*: This part consists of six items (24-29), which are intended to provide information about the attitude of the participants toward some advantages of distance education. The participants rate their usage on a 5-point Likert scale (1 = strongly disagree, and 5= strongly agree).
7. *Disadvantages of Distance Education*: This part consists of six items (30-35), which are intended to provide information about the attitude of the participants toward some disadvantages of distance education. The participants rate their usage on a 5-point Likert scale (1 = strongly disagree, and 5= strongly agree).

Data Analysis

Based on the research questions, the data of this study collected through the seven variables of the survey has been analyzed descriptively and inferentially using a statistical analysis. In the descriptive analysis, the data have been analyzed using measures of central tendency (mean) and measures of variability (standards deviation) as well as frequency distributions of the responses. However, the inferential statistical analyses have addressed the seven research questions, examining the relationships among the major components.

Results

The classification of inmates into five groups based on their educational background seemed to offer very useful insights into the main lines of investigation for this research. The attitudes of the different groups of inmates towards distance education have been summarized in the appendix.

The results indicate clearly a positive relation between the computer skills of inmates and their educational levels. Thus for the five groups the means for computer skills (com1) on the likert scale were 3, 2.8, 1.8, 1.1 and 1 in descending order for the different educational levels. Interestingly, the availability of computer at home is also wound up with the educational level. The relevant means rank of computer availability at home (com 3) at the likert scale were 4.3, 2.8, 1.8, 1.1 and 1 in descending order for the different educational levels. The inmate responses were very positive to the survey item of probable cases. Most notably, inmates of all educational backgrounds expressed confidence in their ability to benefit and gain useful experience from a distance education program. They also expressed confidence that they could complete their education to graduation level through the distance education system. However, and perhaps not surprisingly, inmates appeared to be leaning towards the opinion that the distance education method is inferior to regular education which is based on direct attendance, a perception which seems to originate from deeply rooted social beliefs that may perhaps need to be subjected to public discussion.

The results also indicate that the inmates were very appreciative of the advantages of distance education with the ling hest approval rate going to the freedom and flexibility afforded by the distance education system in choosing the desired time for studying and solving homework problems. This variable (pro 5) received a mean of 5 on the likert scale for the highest educational group and a mean of 4 for the lowest educational group. Other variables for this survey item received comparably favorable ratings.

Lastly, inmates also expressed their dismay about the disadvantages of distance education, abcit to a lesser extent than their satisfaction with the advantages. In particular, inmates were wary about three main obstacles: (1) the difficulty of studying in prison for lack of assistance and encouragement for inmates in addition to the many obligations and distractions. (2) the conflict distance learning and other activities deemed very necessary by inmates, and (3) the limited interaction between the inmates and their instructors within the distance learning framework.

In terms of how the findings of the research correlate with the research hypotheses, the following can be stated:

1. A) Accepting the first hypothesis, which states that there are relationships between educational background and inmates skills and access of technology (computer skills and access, Internet skills and access),

   B) Accepting the first hypothesis, which states that there are relationships between age and inmates' skills and access of technology (computer skills and access, Internet skills and access).
2. A) Accepting the second hypothesis, which states that there are relationships between educational background and inmates' education whilst in prison.
   B) Accepting the second hypothesis, which states that there are relationships between age and inmates education whilst in prison .
3. A) Rejecting the third hypothesis, which states that there are relationships between educational background and potential situations.
   B) Rejecting the third hypothesis, which states that there are relationships between age and potential situations.
4. A) Rejecting the fourth hypothesis, which states that there are relationships between educational background and distance education advantages.
   B) Rejecting the fourth hypothesis, which states that there are relationships between age and distance education advantages.
5. A) Rejecting the fifth hypothesis, which states that there are relationships between education background and distance education disadvantages.
   B) Rejecting the fifth hypothesis, which states that there are relationships between age and distance education disadvantages.
6. A) Rejecting the sixth hypothesis, which states that there are relationships between education background and training experiences.
   B) Accepting the sixth hypothesis, which states that there are relationships between age and training experiences.

Discussion

Although imprisonment as a tool of punishment has come under increasing criticism by some scholars (Russ 2003, Cavatina and Dignan 1997, Carlen 1994), it nevertheless continues to be an acceptable way of dealing with those who fail conform to the norms of society or commit offences that are deemed to be a serious threat to the life and well-being of other individuals. But punishment is not the only objective of imprisonment. Rehabilitation and deterrence are the two other important dimensions that hang in the balance.

Clearly, Prisoners must be rehabilitated so that they get readapted and play constructive roles in the community on their release. In Saudi Arabia One very promising option in this regard is to use the tool of distance education in order to enhance the abilities and skills of prison inmates in training opportunities not available in the educational programs which are offered by Prisons in Saudi Arabia.

The effectiveness of this distance education program turns Critically on inmate attitudes towards the distance learning process. As it turns out through the research findings, inmate attitudes towards distance education turns critically on the computer and internet access and computer and internet use. For example inmates with superior educational background and greater computer and internet skills (dubbed Group 5 in the results) were more receptive and approving of engaging in distance education. This group averaged 3 on the liker Scale in terms in terms of their computer skills and abilities (com1), while its average for the effectiveness of a distance education program (pro4) was about 4. The respective figures for the least educated group (Group1)were 1 and 4 on the Likert scale. It appears that inmates of all educational backgrounds were all agreed on their ability to gain useful experience and knowledge from distance education. This probably reflects the rising popularity of, and the public interest in, technology oriented activities in Saudi Arabia.

Inmates with high educational background greatly appreciated the advantages of distance education (the means were between 5 and 3 on the likert scale for Group 5) and also showed high concern about the disadvantages of distance education with the means ranging from 4 to 3 for all disadvantages. The least educated group (Group 1) similarly showed great appreciation for the advantages of distance education although they seemed to be less concerned about the disadvantages.

The findings of the present research are well in line with those found by other researchers on the subject. To take a few examples of the relatively recent literature on the subject, Yaman (2009) found an overall positive attitude towards distance education by students of physical education although the effectiveness of this mode of education was found to be contingent upon the kind of technology used. The research by Richardson (2009) found no significant difference between students who received face-to-face tuition and those who received online tuition in their altitudes towards courses studied or learning approaches taken.

Shin and Lee (2009) also found a very positive attitude on the part of the students they surveyed towards online education with the flexibility of "being able to study around their work and personal schedules" being cited as the major advantage. This ties in very nicely with our present study of prison inmates. Finally, the study by Wuench et.al showed that students greatly appreciated certain positive features of online education which make it superior to face–to- face education although they were also wary about the weaknesses or disadvantages of online education.

Conclusion

This study has attempted to assess the attitudes of inmates in five Saudi prisons towards distance education and its effectiveness as a mode of instruction for prison inmates. Although the inmates had different educational backgrounds, (they were accordingly classified into five different groups), they all seemed to voice strong approval of the distance education paradigm and greatly appreciated the potential experience and expertise obtainable from this king of education although they considered regular face-to-face education to be a superior method of Learning. By and large, the success of a distance education program based on on-line instruction hinges on the availability of computers in prisons, and the skills and capacity of inmates for using them along with internet services. As has been revealed by the results of the present research, the availability of computers at prisons is minimal or almost nonexistent. Additionally, There seems to be considerable variation in the computer skills of inmates in line with their educational levels. Thus these skills dwindle with lower levels of education.

To enhance the quality of on-line based distance education, the point of departure therefore, may be one of increasing the availability of computers in Saudi prisons. This is expected to raise computer use and internet access for inmates. Additionally and perhaps more importantly, an intensive training program appears to be in order, for the purpose of upgrading the skills and abilities of inmates at computer use. This aspect appears to be of special importance for the less educated inmates than for the highly educated ones.

There may also be a need to address some of the issues or disadvantages render distance education less desirable than regular education in the eyes of inmates as well as others. Among these, one may cite the choice of programs to be offered, the extent of communication with instructors, adequate coordination between distance education and other programs and activities, facilitating studying cooperation between student inmates. This study also reveals the need for increasing the awareness of student inmates about the importance of on-line based distance learning in a world which is moving some what slowly but surely towards this educational paradigm.

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Appendix 1
Means of Inmate Responses

Standard Deviations between Brackets

	G1	G2	G3	G4	G5
Item	M(SD)	M(SD)	M(SD)	M(SD)	M(SD)
Computer Skills					
Com1	1.00(.00)	1.24(.54)	1.90(1.05)	2.81(1.06)	3.00(.00)
Com2	1.00(.00)	1.14(.48)	1.55(.78)	2.41(1.21)	4.33(.58)
Com3	1.00(00)	1.14(.48)	1.86(.95)	2.89(1.37)	4.33(.58)
Com4	1.00(.00)	1.14(.48)	1.59(.87)	2.45(1.37)	3.00(1.73)
Com5	1.00(.00)	1.05(.22)	1.55(.99)	2.14(1.23)	1.00(.00)
Com6	1.00(.00)	1.00(.00)	1.48(.78)	1.77(1.25)	1.00(.00)
Education in Prison					
Edu1	1.00(.00)	1.95(1.39)	2.14(1.53)	1.82(1.59)	1.00(.00)
Edu2	1.00(.00)	1.14(.65)	2.49(1.53)	2.07(1.72)	1.00(.00)
Edu3	1.00(.00)	1.00(.00)	1.79(1.35)	3.68(.88)	1.00(.00)
Edu4	1.00(.00)	1.00(.00)	1.17(.76)	1.00(.00)	1.00(.00)
Training in Prison					
Tra1	1.00(.00)	1.00(.00)	1.49(1.06)	1.63(.94)	1.00(.00)
Tra2	1.33(.58)	1.57(1.07)	1.38(.49)	1.16(.43)	3.00(.00)
Tra3	1.00(.00)	1.43(.75)	1.89(1.14)	1.25(.87)	1.00(.00)
Probable Cases					
Pro1	4.33(.58)	4.05(.80)	3.86(.64)	3.93(.62)	5.00(.00)
Pro2	4.00(.00)	3.86(.79)	4.41(.95)	4.02(1.00)	3.67(.58)
Pro3	3.33(2.08)	3.95(.80)	3.72(1.07)	3.77(.77)	4.33(1.15)
Pro4	4.00(.00)	3.71(.46)	4.03(.63)	3.81(.90)	4.00(.00)
Pro5	3.66(.58)	4.09(.62)	3.76(.91)	3.66(.83)	3.33(.58)
Advantages					
Adv1	4.33(.58)	3.57(.92)	3.82(1.23)	4.07(.87)	4.00(.00)
Adv2	3.33(1.15)	4.05(.50)	3.66(.71)	3.98(.85)	3.00(.00)
Adv3	4.00(1.00)	3.90(.70)	4.34(.67)	3.98(1.07)	3.67(.58)
Adv4	4.67(.58)	3.90(.77)	3.76(.83)	3.87(.72)	4.00(.00)
Adv5	3.00(1.00)	4.10(.62)	3.69(1.17)	4.00(.86)	5.00(.00)
Adv6	4.00(1.00)	3.76(.54)	4.03(.63)	3.91(.74)	4.00(1.73)

Disadvantages					
Dis1	3.00(1.00)	3.90(.77)	3.59(1.27)	3.56(.90)	4.00(.00)
Dis2	3.33(1.15)	3.23(.77)	4.14(.69)	3.82(.84)	4.00(.00)
Dis3	3.33(1.52)	3.62(.92)	3.90(.77)	3.72(1.00)	4.00(.00)
Dis4	3.33(1.52)	3.71(1.10)	3.76(1.15)	4.02(1.02)	3.33(.58)
Dis5	3.00(1.00)	3.86(.85)	3.31(1.04)	3.54(.93)	3.67(.58)
Dis6	2.33(.58)	3.71(.85)	3.83(.71)	3.75(.89)	4.67(.58)

Note. 1= strongly disagree. 2= disagree. 3= neutral. 4= agree. 5= strongly agree.

Notations

Com1:general skills in computer use.
Com2: general skills in computer use.
Com3:home availability of internet.
Com4: home availability of internet.
Com5: prison availability of computer.
Com6: prison availability of internet.

Edu1:primary education in prison.
Edu2: intermediate education in prison.
Edu3: secondary education in prison.
Edu4: high education in prison.

Tra1: Training sessions in computer.
Tra2: Training sessions in computer, plumbing and tailoring.
Tra3: other training sessions.

Pro1: Quality evaluation of distance education versus regular education.
Pro2: self evaluation for distance education skills.
Pro3: assessment of self ability to complete own education via distance education.
Pro4: assessment of self ability to benefit from distance education.
Pro5: assessment of self ability to benefit from distance education after release from prison.

Adv1: that distance learning will eliminate educational isolation barrier in prison.
Adv2: that an inmate can study under distance education as effectively as regular education.
Adv3: that distance education affords inmates an educational opportunity analogous to opportunities outside prison.
Adv4: that an inmate could be successful in distance education barring the presence of study distractions.
Adv5: that distance learning affords freedom and flexibility in choosing appropriate time for studying and solving homework problems.
Adv6: that distance learning ushers individual freedom of inmates.

Dis1: that it is difficult to study through distance learning for the lack of assistance and encouragement and the presence of distractions.

Dis2: that regular education is superior to distance education in prison.

Dis3: that distance education deprives inmates of other educational activities and additional lessons usually available in prison.

Dis4: that interaction with instructors is less under distance education.

Dis5: that it as more difficult to communicate with the instructor under distance education.

Dis6: that educational attainment is inferior under distance education than under regular education.

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