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The Effects of Blended Learning Methods on Educational Achievement and the Development of Online Material in a Curriculum Information Document Online System (CIDOS) for Computer Application Courses

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Abstract

Measuring the effects of educational methods on learning achievement is a vital aspect of tertiary education. These effects can be measured by summative evaluation whether conventional, virtual or hybrid teaching and learning methods are used. As learning technology adjusts to a new era, so do the techniques for generating feasible and effective learning outcomes. Hybrid learning, or blended learning, combines online learning components with conventional face-to-face (FtF) instruction. The objectives of the present study were to (1) determine students' learning achievement without the hybrid method, (2) determine students' learning achievement with the hybrid method, (3) identify differences between cases that do and do not use hybrid learning and (4) determine the appropriate characteristics of online material to be implemented in the Curriculum Information Document Online System (CIDOS). Hybrid learning with the contextualised method is a proven concept that incorporates cognitive science, behaviourism and multiple intelligence theories in a single learning environment. The present study used a statistical t-test to analyse 66 respondents' test results in non-hybrid and hybrid learning environments and to assess the differences between them. The study comprised 33 students of Diploma in Manufacturing Technology (DTP 1) course and 33 students of Diploma in Electronic Engineering (DEP 1A) course, who were interviewed over the course of 5 months starting from July 2010. In the hybrid environment, CIDOS is used as a tool for online learning in a Computer Application (BC101) course that helps first semester students discover meaningful learning objectives in the context of the real world. The findings of this study indicate the existence of a significant difference in learning achievement with the application of a combined method using Learning Management System (LMS) exploration, assessment using CIDOS, teamwork projects, and time management and instructional technology skills. Based on the findings of this study, Malaysian Polytechnics, a technical institution, would benefit from supporting e-learning policy, technology-enabled classrooms and enhanced LMS deployment among its staff and students.

Keywords: hybrid or blended learning, contextualised method, learning achievement, CIDOS online material.

Introduction

As the technology of learning develops over time, it frequently requires a new paradigm to remain relevant to the educational system. One example of a new type of instruction involves the mixing of synchronous instruction and asynchronous instruction using emerging educational electronic media (Mitchell and Forer, 2010). This blended learning approach can combine face-to-face instruction with computer-mediated instruction in the fields of science, engineering and information technology.

Students and educators work together to improve the quality of learning and teaching. The ultimate aim of blended learning is to provide realistic and practical opportunities for students to make learning as independent, useful, sustainable and expansive as possible (Buzzetto-More and Sweat-Guy, 2006). Hybrid learning increases the possibility for greater quality and quantity of human interaction in a learning environment. It offers learners the opportunity "to be both together and apart" (Wu, Tennyson and Hsia, 2010). A community of learners can interact anytime and anywhere because of the benefits provided by computer-mediated educational tools. In addition, hybrid learning provides a beneficial mixture of technology and face-to-face interaction, resulting in a socially supported and constructive learning experience.

A typical example of blended learning methodology is the combination of technology-based materials and face-to-face sessions to present content (Cowie and Nichols, 2010). An instructor can begin a course with a well-structured introductory lesson in the classroom and then proceed with follow-up materials online. Hybrid learning can also be applied by integrating e-learning through a Learning Management System (LMS), using computers in a physical classroom with face-to-face instruction (Mitchell and Forer, 2010). An example of an LMS application is Curriculum Information Document Online System (CIDOS) e-learning, which has been used by Merlimau Polytechnic since July 2010. Guidance and instruction are provided earlier in the process and will be used more sparingly as learners gain expertise in applying the system in the courses offered (Ministry of Education Malaysia, 2008).

Education in a contextualised environment encourages students to learn in the way that provides them with the best results, retain valuable knowledge and apply it to their own lives (Advance Technology Environment and Energy Center [ATEEC], 2000). Contextualised learning typically focuses on a basic lesson pertaining to an overarching problem in the students' community. Once the basic lesson is grasped by the students, a contextualised approach draws on students' diverse skills, interests, experiences and cultures to further their education. Ultimately, the students are prepared to be self-regulated learners who stimulate self-interdependence among their peers. Finally, it is beneficial to examine students' learning outcomes by incorporating authentic assessment strategies. The method of Contextual Teaching and Learning (CTL) has been implemented by ATEEC since 1999. ATEEC is one of the regional cluster teams involved in a University of Wisconsin-Madison research project called TeachNET and funded by the United States Department of Education. Moreover, ATEEC emphasises self-directed learning, collaborative learning, and experiential-based learning and encourages the active participation of learners. Educational approaches have also been influenced by applied technology in recent decades, such as motion pictures, radio, television, computers and other emerging information and communication technologies (ICT) (Frank, 2010).

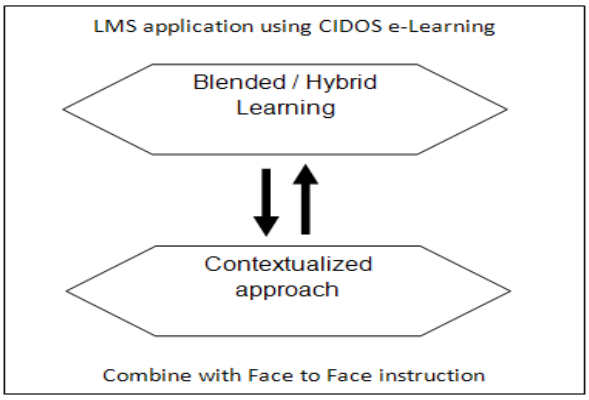

Figure 1: The environment of LMS and Face to Face Instruction
Source: Illustration of the writer based on Emergence of Learning Management System, (Frank, 2010)

Problem Statement

The changes in teaching methods in polytechnic education from traditional to online and, more recently, through the adoption of hybrid methods have been enhanced significantly by technology. This development has also increased interest among potential technical students who are attracted by blended learning. Considerations in the decision to offer online learning include the need to balance work and education and the flexibility offered by polytechnic institutions. Because there are transformative initiatives in polytechnic education planned by the year 2020, the option of conducting programmes partially online and the implementation of hybrid methods must be taken into account. As Rungtusanatham et al. (2004) state, the most important consideration is the effectiveness and efficiency of the various methods for delivering material online. Blended learning combines online learning components with conventional face-to-face (FtF) instruction. LMS exploration requires knowledge and skill in managing CIDOS. Rivera, McAlister and Rice (2002), who surveyed student satisfaction with the three modes of learning (face-to-face, fully online, and hybrid), found that students were most satisfied with the hybrid learning model. The hybrid teaching method may eventually become the norm in higher education. Young (2002) concluded that the hybrid model offered the most substantive benefits for teaching and learning. The level of learning achievement for those using the hybrid method remains an open question. After several decades of using non-hybrid methods in education, studies on learning achievement can offer proof that the blended method provides a new, effective paradigm for learning. Accordingly, the online material used in blended learning must be designed as a reference for the students.

Research Questions

1. What is the degree of learning achievement for students who experience hybrid learning?
2. What is the degree of learning achievement for students who do not experience hybrid learning?
3. What are the differences in the levels of learning achievement between hybrid learning and non-hybrid learning students?
4. What are the appropriate characteristics of online material in CIDOS for students to use as guidelines and notes?

Objectives

1. To identify the levels of learning achievement among students who experience hybrid learning.
2. To identify learning achievement among students who do not experience hybrid learning.
3. To determine the differences in learning achievement between hybrid learning and non-hybrid learning students.
4. To develop the appropriate characteristics of online material in CIDOS for students to use as guidelines and notes.

Essential Features of Contextual Learning that are Related to the Implementation of Blended Learning in Polytechnic Education

Polytechnic institutions in Malaysia provide hands-on courses to create competent graduates in fields such as Civil, Mechanical and Electrical Engineering; a polytechnic education also includes courses in non-Engineering training fields, such as Hospitality and Commerce. Computer Application (BC101) is offered as a compulsory course during the students' first semester at polytechnic institutions. The teaching method of the course blends online and face-to-face interaction. A substantial proportion (20%) of its content and assessment is delivered online. Approximately 30% to 70% of the course is based on hybrid learning. The hybrid portion of the course relies on conventional and CIDOS e-learning to distribute the digital content and facilitate online learning matters. LMS consists of a set of learning and communication tools to plan, prepare, develop, deliver, communicate and manage the online course.

The essential features of contextualised learning focus on active participation, which is beneficial to the student (Fahad, 2010). Moreover, contextualised learning emphasises problem-solving, encouraging students to become active and self-motivated learners. These characteristics facilitate the implementation of blended learning implementation, as contextual learning fosters in-depth learning and engagement with the material in both digital and conventional methods. These learning techniques support each other; they enrich knowledge and teach the skills necessary to support the use of technology in the classroom.

Learning and references are closely related to the students. As a means to obtain input on the course from students, the references are produced and suggested by Ministry of Education under the Division of Curriculum Development and Evaluation. The references are consistently updated based on changes to the course syllabus. The most important factor influencing learning is the active engagement of the learner with the course material.

In facilitating the implementation of blended learning, contextualised learning must apply the knowledge and content of teaching and learning to various situations. Another essential aspect of contextualised learning is the use of group activities to encourage students to become involved and learn from each other. Contextual examples should be interesting and familiar to students to stimulate student participation in the learning activity and perform analysis and exploration with the assistance of digital information. Furthermore, contextualised learning can increase knowledge and nurture certain learning habits that will have life-long benefits for students.

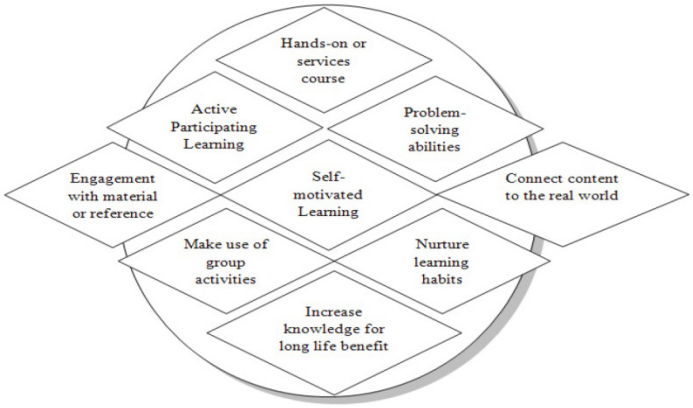

Figure 2: The vital features of contextualised learning by Fahad (2010)

Key Features and Contexts of Hybrid Learning

In this research, hybrid or blended learning refers to the following key features:

1. Experience of using the Learning Management System (LMS) environment.

2. Implementation of the online quiz.
3. Application of netiquette in electronic mail.
4. Instructional technology skills including scanning, audio and video file creation, web design and using a digital camera.
5. Implementation of case studies or projects.
6. Presentation skills.
7. Implementation of practical tasks in a computer laboratory.
8. Time management skills and commitment to participation in an online system.

Table 1: Differences between hybrid and non-hybrid learning in the computer application course

Number	Hybrid	Non-hybrid
1.	LMS exploration	Without LMS exploration
2.	Assessment using CIDOS	Assessment using manual
3.	Implemented project in teamwork	Implemented practical individually
4.	Time management in CIDOS	Time management in class
5.	Instructional technology skill (Practical)	Instructional technology skill (Theory)

As indicated in Table 1, using LMS to administer online quizzes and facilitate the submission of practical exercises is an example of the application of blended or hybrid learning. The Computer Application course requires students to become involved in the use of LMS. In addition to the quizzes administered online, a course assessment is completed in a teamwork environment. The duration of quizzes is managed in LMS with the time setting determined by instructors. In this mode of learning, students are able to gain experience and practise using instructional technology skills, such as photography with digital cameras.

In contrast, a non-hybrid/non-blended method involves teaching without a Learning Management System (LMS); face-to-face interaction is the sole teaching method. Learning activities are completed on paper, and assessments and practical exercises are conducted individually rather than through discussion or collaboration. Time management on assessments, such as quizzes, is managed by educators in the classroom. Instructional technology and design skills are dealt with in theoretical terms only. Educators do not demonstrate technological devices or the basics of

multimedia in practical terms. Instead, the functions of these devices are explained theoretically.

Table 2: The proportion of content delivered through each teaching method

Number	Proportion of content delivered	Category of course	Typical description
1.	0%	Traditional	Course with no online technology used-content is delivered in writing or orally.
2.	1% to 29%	Web facilitated	Course which uses web-based technology to facilitate essentially a face-to-face (FtF). Use Course Management System (CMS) or web pages to post syllabus and assignments.
3.	30% to 79%	Blended / hybrid	Course that blends online and face-to-face (FtF) delivery. Substantial proportion of the content is delivered online, typically uses online discussions and FtF meetings.
4.	80+%	Online	A course where most or all of the content is delivered online. Typically have to FtF meetings.

Source: Boettcher and Conrad (2010)

Boettcher and Conrad (2010) created an online teaching survival guide indicating the proportion of content delivered through each teaching method. As depicted in Table 2, the courses included traditional, web-facilitated, blended and online teaching methods. The percentage of online content utilised by educators in a traditional classroom setting is 0%, with no online engagement, exclusive face-to-face (FtF) interaction and manual assessment. The understanding of key concepts is acquired through reading, writing or oral instruction. The proportion of online content in a web-facilitated course ranged from 1% to 29%. Instructors used CMSs or web pages to share the course syllabus, make announcements and communicate assignments. Technology, in this instance, is used only to facilitate FtF. In hybrid or blended learning, a mixture of online and FtF methods is used, resulting in the majority (30%–79%) of content appearing online. In this method, online discussions supplement FtF meetings. Meanwhile, courses in which the vast majority of content is delivered primarily or exclusively online (80% and above) can be categorised as online only.

Technical and Vocational Institutions: The Polytechnics of Malaysia

The first polytechnic institution developed in Malaysia was the Politeknik Ungku Omar, Ipoh, Perak. The initial idea was introduced in 1969 through the Colombo Plan. Polytechnic education was upgraded and enhanced with the endorsement of the Cabinet Committee on Educational Policy Research (1979), the Cabinet Committee on Training (1991) and the National Industrial Main Plan (1985–1995). The Ministry of Education in Malaysia has responsibility for producing graduates who are semi-professionals in the fields of Engineering, Commerce, Hospitality and Information and Communication Technology (ICT). The Ministry also provides alternative paths to institutions of higher learning; these include the Malaysian Educational Certificate or Sijil Pelajaran Malaysia (SPM), polytechnic institutions and community colleges. The Division of Technical and Vocational Education, or BPTV, was introduced in 1964. However, it was subsequently restructured into the Department of Technical Education, or Jabatan Pendidikan Teknikal (JPT), in 1995. The primary function of JPT is to support the continuous education plan and the growth of technical and vocational education in Malaysia. As of 2015, there are 32 polytechnics in Malaysia.

CIDOS as a Platform for Implementing Hybrid Learning at Polytechnic Institutions

The Curriculum Information Document Online System (CIDOS) is a fully automated document management platform that manages the uploading, updating and sharing of digital information or digital content through a single integrated component. CIDOS provides a medium for interaction between users including staff of the Division of Curriculum Development, Polytechnic lecturers and students. Moreover, it also provides an interface for the storage, evaluation, authorisation and sharing of digital content and information. CIDOS is an electronic document management system, which enables users to access information stored in the database. Lecturers and students comprise the end users. CIDOS' website can be accessed at the http://www.cidos.edu.my.

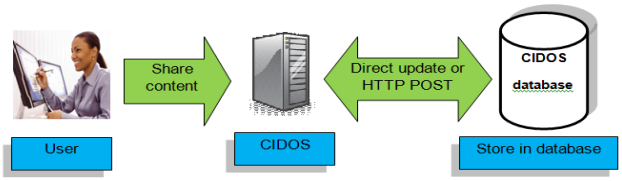

Figure 3: The flow chart provides an overview of CIDOS operations
Source: Illustration of the writer from CIDOS web site, http://www.cidos.edu.my

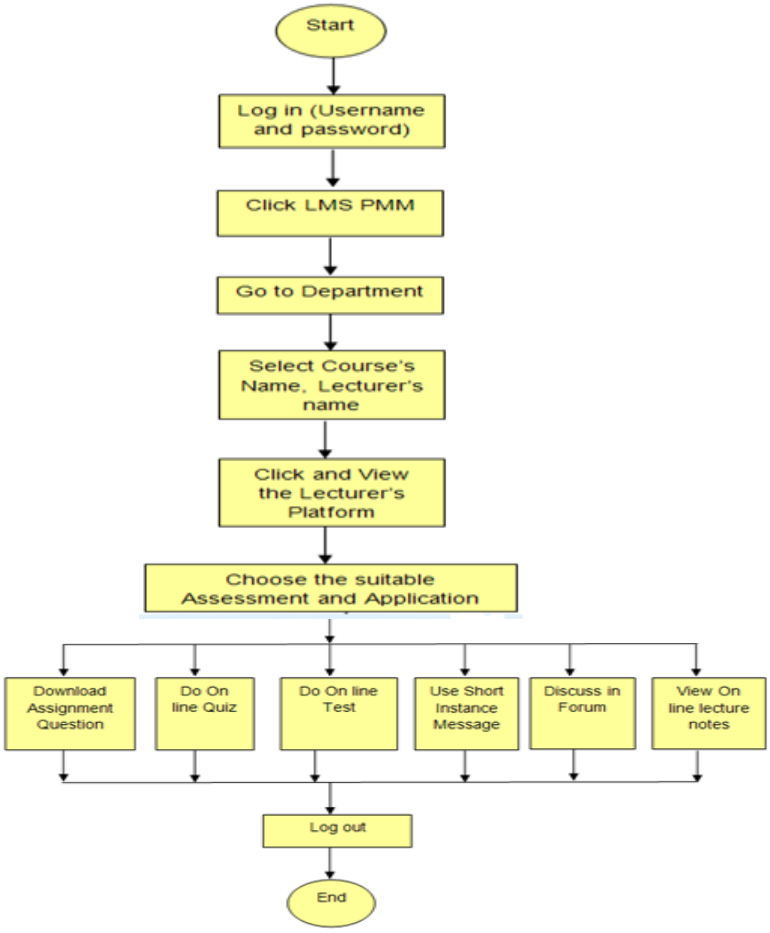

Figure 4: The flow chart shows the steps taken to enter CIDOS environment
Source: Illustration of the writer from CIDOS web site, http://www.cidos.edu.my

The minimum system requirements for using CIDOS are an Operating System such as Windows or Unix, which supports Internet Explorer 6.0

and above. Meanwhile, CIDOS requires certain client hardware requirements, including Pentium II, 64 MB RAM, 5 GB hard disk free space and a 1024 × 768 display resolution. It is compatible with a Linux server, Dual Xeon 2.4 GHz and 2 GB memory, a PHP 5 server, MySQL 5.0 and above and an Apache HTTP Server. The flow chart to enter CIDOS is shown in Figure 3.

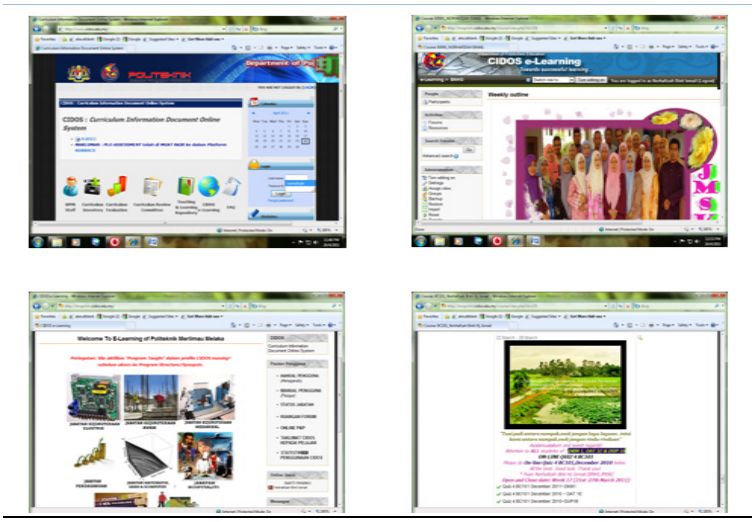

Figure 5: The basic interface shows the CIDOS environment
Source: web site of CIDOS > BC101 > platform of Norhafizah Binti Ismail > Quiz through (http://www.cidos.edu.my)

The Computer Application Course (BC101)

This course is an elementary subject that is offered to first-semester students at polytechnic institutions in Malaysia. It combines several continuous assessments, such as lab exercises, online quizzes, projects, presentations and tests. The students learn theoretical and hands-on skills. There are 5 major topics covered: Topic 1 (Computer Systems), Topic 2 (Word Processing), Topic 3 (Spreadsheets), Topic 4 (the Internet) and Topic 5 (Presentations and Basic Uses of Multimedia). The blended learning in the course manifests in the teaching and learning strategies, which include lectures, demonstrations, laboratory exercises, discussion, one-on-one conversations, games, quizzes, brainstorming, ice breakers, question and answer sessions and projects (Bonk and Graham, 2006).

Learning Achievement and Assessment in BC101

Learning achievement is an important outcome of learning that determines the effectiveness of education policies. It is driven by achievement motivation, which, according to Maehr (1974), refers to behaviour that occurs in response to a standard of excellence and thus can be evaluated in terms of success and failure. A second defining feature of achievement motivation is that the individual must, in some way, be responsible for the outcome. Third, there is some level of challenge and, therefore, some level of uncertainty involved. Computer Application is a compulsory and preliminary course for students in their first semester, whether enrolled in Engineering or non-Engineering programmes. This type of course follows a syllabus that enriches the knowledge and skills of students regarding various computer systems, word processing, spreadsheets, presentations and the Internet. Students are exposed to a combination of theoretical skills, hands-on exercises, etiquette and moral values. They also have the opportunity to manipulate and create a variety of styles to produce documents, presentations and spreadsheets (BC101 Syllabus, Version 080510_1.1_Effective: 1 Nov 2010). These features are evaluated to assess learning outcomes at the end of the first semester. To fulfil requirements for the course, several items related to the assessment must be completed. The learning outcomes assessment covers quizzes, tests, lab work, presentations and projects that are carried out in class throughout the semester. The learning outcomes evaluate affective, cognitive and psychomotor skills obtained (Gardner, 1999).

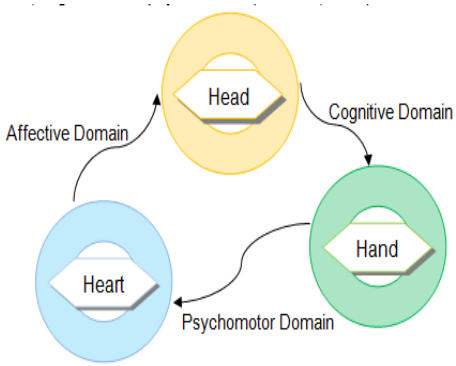

Figure 6: A schematic diagram demonstrating the relationship between learning domains

The Effects of Blended Learning on Learning Achievement

Research by Owston, York and Murtha (2013) stated that high- and low-achieving students enjoyed learning in a blended course environment because it encouraged engagement, was more convenient and taught them the key concepts more quickly than conventional teaching methods. They prefer this type of learning over an exclusively face-to-face course or an entirely online format.

Educational institutions view hybrid learning as a model that optimises the use of the classroom and provides departments an advantage in terms of flexibility in their teaching timetable. In addition, students enjoy and appreciate their achievements in a hybrid learning environment, which are higher than in an exclusively FtF or exclusively online course (Cavanagh, 2011; Dziuban et al., 2006).

Characteristics of the blended learning environment inspire students to obtain knowledge and advice from various sources, to apply the subject matter and acquire confidence in implementing the knowledge they learn in a real world context (Bliuc et al., 2011; Collopy and Arnold, 2009; Hsu, 2011; McCarthy, 2010; Smyth et al., 2012).

Previous research by Demirer and Sahin (2013) involved undergraduate pre-service teachers, who were assigned randomly a teaching method for the purposes of the experiment. The experimental group received online and classroom sessions, whereas the control group received face-to-face delivery. The research demonstrated that students in the experimental group were more successful at applying their knowledge to tasks in a blended learning environment. Thus, the blended learning method had a positive impact on students' ability to transfer knowledge compared with the FtF method.

Hence, institutions of higher education are employing a wide range of hybrid learning techniques in their programmes to enhance the learning environment. In the United States, 81% of all higher educational institutions offer a minimum of one course that is entirely online or follows a hybrid format (Allen and Seaman, 2010). The convenient middle ground of blended learning has transformed various opportunities at institutions of higher learning in Malaysia. As an exciting pedagogical

technique, blended learning has the potential to enhance education in many subjects as well as lifelong learning efforts in Malaysia (Hisham, Mohd Sobri and Hamzah, 2012).

Furthermore, several studies indicate that blended learning improves students' academic achievements, behaviours, perceptions, overall satisfaction and learning experiences when compared to FtF delivery formats (Aycock, Garnham and Kaleta, 2002; Garnham and Kaleta, 2002).

Methodology

The research strategy was quantitative, using an experimental method and a statistical t-test to analyse the mean values of Test 1 and Test 2 from results obtained in the Computer Application course for the July 2010 session.

Respondent Description

The respondents were chosen from the results of the Continuous Assessments in Test 1 and Test 2 for the first semester of the Diploma in Manufacturing Technology course (DTP 1) with 33 students and the Diploma in Electronic Engineering course (Control) (DEP 1A) with 33 students. The respondents were classified as follows:

Table 3: A description of respondents by course in the July 2010 session

Number	Program	Course / Code	Semester/Section	Quantity of students	Total (Overall)
1.	DTP 1	Computer Application / BC101	1 /July 2010	33	66
2.	DEP 1A		1/July 2010	33	

Population and Sample

The research was based on a quasi-experimental approach, which refers to a quantitative method using test results to compare the means of two groups. The research population refers to all students in academic departments. The sample of respondents included 33 first semester students from both the Departments of Mechanical Engineering and Electrical Engineering in July 2010. The total number of respondents was 66 students.

Data Analysis

Hypothesis Testing and the Matched Pairs t-Test between Means

The t-test is the most commonly used statistical data analysis procedure for hypothesis testing. In this study, the analysis relied on the matched pairs t-test, which involves two measurements that are taken from each respondent. A quasi-experimental technique with hybrid and non-hybrid methods was implemented based on students' level of achievement in their Test 1 and Test 2 results. The aim was to identify whether there was a reliable difference between means based on both test measurements.

This study measured the differences in means of a pair of dependent variables for a group of respondents. A numerical variable with data in an interval scale and ratios can be analysed using this method. Related data from this research referred to the responses from Test 2 BC101 (July 2010), which used a non-hybrid learning method, and the responses from Test 1 BC101 (July 2010), which used a hybrid learning method.

Null Hypothesis:
There is no significant difference between the means of BC101 Test 1 responses for July 2010 and BC101 Test 2 responses for July 2010.
H_o: $\mu_{\text{Test 1 (hybrid)}} = \mu_{\text{Test 2 (non-hybrid)}}$

Alternative Hypothesis:
There is a significant difference between the means of BC101 Test 1 responses for July 2010 and BC101 Test 2 responses for July 2010.
H_a: $\mu_{\text{Test 1 (hybrid)}} \neq \mu_{\text{Test 2 (non-hybrid)}}$

The value of alpha, μ, refers to the level of significance used to compute the confidence level and must be a number which is greater than 0 and less than 1. In this study, μ=0.05. The confidence norm is the confidence interval for a population mean using a normal distribution.

Results and Findings

For the purposes of data analysis, this study examined two programmes from July 2010: DTP 1 with 33 respondents and DEP 1A with 33 respondents.

Table 4: Results of BC101 Test 1, Test 2 for DTP 1 and DEP 1A, July 2010

Number of Respondents	Program	Gender	Marks of Test 1 July 2010 (Hybrid)	Marks of Test 2 July 2010 (Non-Hybrid)	Program	Gender	Marks of Test 1 July 2010 (Hybrid)	Marks of Test 2 July 2010 (Non-Hybrid)
1	DTP 1	M	49	52	DEP 1A	M	47	56
2		M	67	60		M	53	60
3		M	67	44		F	58	62
4		M	53	64		F	56	58
5		M	51	52		F	56	54
6		M	44	54		F	51	64
7		M	51	68		F	69	64
8		M	47	56		F	56	50
9		M	40	48		F	44	48
10		M	60	68		F	53	62
11		M	47	38		F	51	70
12		M	44	52		M	67	62
13		M	40	54		M	64	70
14		M	24	82		M	51	50
15		M	49	60		F	58	50
16		F	49	62		M	69	70
17		M	62	62		M	52	47
18		M	56	60		M	50	40
19		M	73	50		M	70	53
20		F	42	62		F	58	53
21		M	62	50		F	60	36
22		M	53	40		F	60	52
23		M	56	38		F	70	51
24		M	60	56		M	62	10
25		M	47	44		M	66	56
26		M	49	44		F	52	44
27		F	47	46		M	66	10
28		M	58	50		F	62	10
29		M	60	58		F	66	10
30		M	71	52		F	33	48
31		M	53	42		M	49	40
32		M	60	42		M	70	64
33		M	58	48		M	67	62
Sample			33	33	Sample		33	33
Mean			53.00	53.27	Mean		58.06	49.58
Confidence interval			3.42	3.35	Confidence interval		3.00	5.87
Standard Deviation			10.03	9.81	Standard Deviation		8.79	17.21

Table 4 provides the results of BC101 Test 1 and Test 2 for DTP 1 and DEP 1A in the July 2010 session. Using a hybrid method, DTP 1 scored 73, the highest mark, whereas DEP 1A scored 70, which represents the highest mark for Test 1. Furthermore, using a non-hybrid method, DTP 1 scored 82, the highest mark, whereas DEP 1A scored 70, the highest mark for Test 2.

The mean score for Test 1 was 55.53, and the mean score for Test 2 was 51.42. A matched pairs t-test was performed to determine whether the difference was significant. The t-test was significant at the .05 critical alpha level, $t(65) = 0.0410$, $p = .025$. Therefore, the null hypothesis was rejected, and the study concluded that the Test 1 scores were significantly higher than the Test 2 scores.

Table 5: Paired Samples Statistics for Test 1 (hybrid) and Test 2 (non-hybrid)

Program	Marks of BC101	Respondents, N	Mean Test 1 (hybrid)	Mean Test 2 (non-hybrid)	Standard Deviation Test 1	Standard Deviation Test 2	Confidence Interval	Two-Tailed Student's T Distribution
DTP 1	Marks of Test 2 July 2010	33	53.00	53.27	10.03	9.81	95%	0.9212
DEP 1	Marks of Test 1 July 2010	33	58.06	49.58	8.79	17.21	95%	0.0181

Table 6: Paired samples correlations for Test 1 (hybrid) and Test 2 (non-hybrid)

Mean / Standard Deviation/ Probability	Program	Value
Mean for Test 1 (hybrid)	DTP 1 and DEP 1A	55.53
Standard Deviation for Test 1 (hybrid)		9.41
Respondent size		66
Mean for Test 2 (non-hybrid)	DTP 1 and DEP 1A	51.43
Standard Deviation for Test 2 (non-hybrid)		13.51
Respondent size		66
Probability	0.0451	

Table 7 Paired Samples Test for Test 1 (hybrid) and Test 2 (non-hybrid)

Paired Samples Test									
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	Test1_hybrid - Test2_nonhybrid	4.106	18.152	2.234	–.356	8.568	1.838	65	.0410

The data analysis indicated that there was a significant difference between the scores for Test 1 (hybrid learning) (M = 55.53, SD = 9.699) and Test 2 (non-hybrid learning) [M = 51.42, SD = 14.025, t(65) = 1.838, p = 0.0410].

Table 8: A comparison of means, standard deviation and two-tailed t-test (DTP1 and DEP 1A, July 2010)

Program	Marks of BC101	Respondents, N	Mean Test 1 (hybrid)	Mean Test 2 (non-hybrid)	Standard Deviation Test 1	Standard Deviation Test 2	Confidence Interval	Two-Tailed Student's T Distribution
DTP 1	Marks of Test 2 July 2010	33	53.00	53.27	10.03	9.81	95%	0.9212
DEP 1A	Marks of Test 1 July 2010	33	58.06	49.58	8.79	17.21	95%	0.0181

The total mean of Test 1 (hybrid) for DTP 1 (July 2010) was 53.00 with a confidence interval = 95% and standard deviation = 10.03. The mean for Test 2 (non-hybrid) = 53.27 with standard deviation = 9.81. For DEP 1A, the mean for Test 1 (hybrid) = 58.06 and standard deviation = 8.79. Furthermore, the mean for Test 2 (non-hybrid) = 49.58 and standard deviation = 17.21 with confidence interval = 95%.

The difference between using hybrid learning and non-hybrid learning in DTP 1 was –0.27. For DEP 1A, the difference between hybrid and non-hybrid learning was 8.48. The findings indicated that there were significant differences between the means of the BC101 Test 1 marks (July 2010) and Test 2 marks (July 2010) for both DTP 1 and DEP 1A. A low value of probability p ($p < 0.05$) indicates that the null-hypothesis should be rejected. In other words, a low p indicates that there is a significant difference between the two groups being compared (Grant, 2002). In this research, $p = 0.0451$. The value of probability p is shown in Table 6. Thus, the mean for Test 1 (hybrid) = 55.53, mean for Test 2 (non-hybrid) = 51.43 and the differences between the means for hybrid and non-hybrid = (55.53–51.43 = 4.10).

Table 9: T-Test hypotheses for two groups, DTP 1 and DEP 1A, July 2010.

Mean / Standard Deviation/ Probability	Program	Value
Mean for Test 1 (hybrid)	DTP 1 and DEP 1A	55.53
Standard Deviation for Test 1 (hybrid)		9.41
Respondent size		66
Mean for Test 2 (non-hybrid)	DTP 1 and DEP 1A	51.43
Standard Deviation for Test 2 (non-hybrid)		13.51
Respondent size		66
Probability		0.0451

Discussion

The levels of learning achievement for students in a blended learning environment were higher, with a mean value of 55.53 for DTP 1 and DEP 1A in Test 1, than the mean value of 51.43 in Test 2 involving a non-blended learning environment. The value of 4.1 denotes the difference between the means in the cases of blended and non-blended learning. In the blended learning environment, students were asked to complete online quizzes, submit assignments online and perform collaborative projects in the Computer Application course.

Students with a background in Electronic Communication (DEP 1A) obtained mean = 58.06 compared to mean = 53.00 for Manufacturing Technology students (DTP) in their Test 1(hybrid). Likewise, DEP 1A students obtained mean = 49.58 in the non-hybrid environment of Test 2, whereas DTP 1, which utilised the same learning method, had mean = 53.27. The value of the two-tailed t test distribution for DEP 1A students was 0.0181.

Developing Appropriate Characteristics for Online Material in the CIDOS

Online study guide

These online notes refer to the first semester students who worked through the Computer Application (BC101). The selected topic was Topic 6: Presentation and Basics of Multimedia. The notes focused on important icons, ribbon toolbars, and exercises for designing slides in PowerPoint

2010. The students could view the notes from the lecturer platform when entering the system by inputting their registered username and password.

Content of online notes

Generally, Topic 6 provides the tools to design a professional multimedia presentation. It consists of exercises, sample quizzes and notes. The sub topics covered in the online material are as follows:

1. Introduction
2. Advantages of PowerPoint
3. Keyboard shortcuts in PowerPoint
4. New features in Microsoft PowerPoint 2010
5. Interface of PowerPoint 2010
6. Ribbon toolbar concepts
7. Display and formatting of slides
8. Principles of multimedia
9. Introduction to digital cameras
10. Uploading an image file from digital camera to computer
11. Practise the procedures of video editing

The benefits of online notes

The intention of online notes is to assist students in learning and obtaining basic theoretical knowledge before they practise exercises during Computer Application class. There are also some lab work questions to be completed individually.

Conclusion

In conclusion, the findings suggest that, in combination with traditional learning methods, the use of blended instruction can provide a significant difference in learning achievement compared with non-hybrid methods. The mean value for learning achievement in a hybrid environment was 55.53, and it was 51.43 in a non-hybrid environment. This result is promising because students in the hybrid learning environment experienced the Learning Management System CIDOS. CIDOS was used to upload and download exercises and assignments, administer online quizzes and tests, send short messages in discussion forums, and post

online lecture notes. In light of these findings, it can be concluded that there is no evidence to recommend against the use of a hybrid method as an integral part of instructional design at polytechnics institutions, specifically in the Computer Application (BC101) course. Although traditional instructional methods can fundamentally meet the needs of teaching and learning, alternative methods also can result in successful learning outcomes. Meanwhile, e-learning should be supported by good internet access and continuous commitment from the students. The hybrid method enables a mixture of face-to-face instruction and e-learning to better suit the learning needs of students. Likewise, blended learning has contributed to the outstanding quality and performance of Malaysian polytechnic institutions after the Polytechnic Transformation programme was introduced in 2010. To further promote the polytechnics' achievements in a variety of teaching and learning methods, the second phase of Polytechnic Transformation (2013–2015) promises to continue to measure excellence. This next phase will foster self-directed learning through the technology-enabled classroom and allow students to manage their own learning through a Learning Management System (LMS) or Content Management System (CMS).

Recommendations

Blended learning based on the contextual method can be expanded to variety of programmes in polytechnic institutions. The scope and dimensions of this research can be generalised to meet the needs of specific programmes, such as Diploma or Advanced Diploma (Polytechnic or Premier). To sustain the use of Learning Management Systems, such as CIDOS, the system administrator and students can equip the web browser with Really Simple Syndication (RSS) to keep them update on information contained within CIDOS. The access rate and speed required by the system should be enhanced and stabilised in the future. To encourage the use of CIDOS, the interface should be designed in a more user-friendly and easy-to-use manner to make the learning process more attractive. There is a need for further research studies in different subject areas, students' levels of achievement, and development models in hybrid learning for the next phase.

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