Blended and Innovative Teaching Strategies for a Third Year Process Instrumentation and Control Unit: An Effective Course Delivery

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Abstract

Blended learning is a student centered flexible, self-paced multi model approach to learning. The blended mode of learning has become increasingly popular in higher education. However, blended teaching requires careful scheduling to balance face-to-face and online components of the classes and also quality of blended teaching depend on teacher's ability to design and deliver the courses. Therefore, in this paper the various thoughtful design competencies has been applied on an undergraduate 3rd year large core unit, "Process instrumentation and control-328" at Curtin University, Perth WA for effective unit delivery. These competencies such as implementation of alternative group project based assessment, simulation based e-learning, problem based teaching, integration with real world as 'active learning' competency and digital full course materials, online work load, discussion, presentation, feedback to student as 'active teaching & technological' competency and finally administrative / leadership competency such as grading visible for students, application of blackboard, students behavior etc. were applied in effective course delivery. Students opinions (eVALUate results) reflects the use of a thoughtful designing of a blended teaching approach made by their lecturer in the year of 2010 in terms of well-designed units rich with resources, workload, timely feedback, visible grading, good interaction, quality of teaching, assessment tasks, motivation and high satisfaction as very high 'positive learning experience' which exceeds the target of University and faculty agreement. Survey results also revealed that integration with real world by industry visit was an important part of student's overall learning on process instrumentation and control unit 328.

1. Introduction

Blended teaching is becoming increasingly common in higher education but research has shown that it demands time, effort and innovative approaches from educators. Basically, Teaching and Learning are the two sides of a coin. The most accepted criterion for measuring good teaching is to deliver course effectively so that high positive student's learning experience occurs at the end of course. There are various methodologies are developed in effective course delivery in higher educational institutions. Blended learning practices are becoming the basis for much of today's academic teaching, research, collaborative writing, course design and professional learning. Blending is fundamentally a new paradigm in higher education that institutions are approaching with a variety of outcomes in mind including expanding access and improving the quality of learning outcomes [1].Though the term blended learning is becoming widespread in use and its alternative names are mixed learning, hybrid learning, blended e-learning. According to Garrison and Vaughan (2008)[2] blended Learning in higher education provides a vision and a roadmap for higher education faculty to understand the possibilities of organically blended face-to-face and online learning for engaging and meaningful learning experience. Garrison and Kanuka [3] indicated that blended teaching requires careful scheduling to balance face-to-face and online components of the classes. In addition, the quality of blended teaching varies based on the teacher's abilities to design and deliver the course [4]. Basically blended learning is the thoughtful fusion of face-to-face and online learning experiences. Although the concept of blended learning may be intuitively apparent and simple, the practical application is more complex. The effectiveness of blended teaching approach depends on thoughtful designing fusion or mixing. There are various thoughtful design competencies and skills which are required for effective fusion or mixing in effective course delivery. These competencies may be in active learning, administrative/leadership, LMS technology, active teaching or in technological competence. A learning management system (LMS) is a software environment that enables the management and delivery of learning content and resources to students [5]. A learning management system (LMS) provide a virtual platform for students to access teaching resources and interact with teachers, web-based flexible learning environments and media to encourage collaborative learning among students. Web-CT, blackboard are common LMS in higher education sector. Blackboard is one of the leading commercial LMS products and is the most widely-adopted learning management system. In this 21st century the increasing use of Learning Management Systems (LMS) across higher education Institutions has, in theory at least, provided

the potential for rich learning environments for all students but there was really no hard evidence that it works with very effectiveness. As for example, blended learning sounds like a nice idea-mixing a traditional class room environment with online LMS components but what are the skills and competencies necessary for the successful of blended teaching approach? The author here trying to find answer by a comparative study difference in competency modes on a large undergraduate core unit at Curtin University, Perth WA. Garrison and Kanuka [3] commented that the combination of classroom and online LMS settings has simplicity but there is also a complexity to the concept which is evident in the wide variety of settings, diversity of the student population and their background and consequent learning designs. Therefore, instructor should use a thoughtful multimedia technology in learning design through LMS that are appropriate for the learning activities. This paper will explore the effectiveness of various mixing design competencies such as implementation of alternative group project based assessment, problem based teaching, integration with real world as 'active learning' competency and digital full course materials, online work load, discussion, presentation, feedback to student as 'active teaching and technological' competency and finally administrative / leadership competency such as grading visible for students, application of blackboard, students behavior etc. These various competencies are blended with traditional face-to-face teaching in effective course delivery, unit design and in effective course management of an undergraduate large core unit, "Process instrumentation and control-328" at Curtin University, Perth WA which has been presented here as a case study. This has been measured by eVALUate survey reports as student's learning experience at the end of course. eVALUate is Curtin's online system for the gathering and reporting of feedback on teaching and learning both quantitatively and qualitatively. Research also indicates that students are the most qualified sources to report on the extent to which the learning experience was productive, informative, satisfying, or worthwhile. While opinions on these matters are not direct measures of instructor or course effectiveness, they are legitimate indicators of student satisfaction and there is substantial research linking student satisfaction to effective teaching [6]. Anwar [7] also mentioned that student's feedback based unit evaluation and teaching is an essential part for effective course delivery and effective learning experience to get effective unit outcomes. Student's feedback is used in over 90 percent of all colleges and universities in the United States and represent the most frequently used strategy for evaluating instructors and courses [8]. Overall this paper represents a constructive approach to "designing for effective learning" rather than planning for teaching.

2. Methodology and Data collection

2.1. Participants from unit Process Instrumentation and Control 328

Curtin University Perth is offering four year engineering undergraduate program and two years post graduate program. There are many core engineering units that students have to complete during their course of study. This study was conducted on undergraduate students taking 3rd year core unit "Process instrumentation and control 328 at semester 2, 2012. The students taking this unit are assumed that they have already learned the fundamentals of process principles, various unit operations in mass transfer processes, process heat transfer, reaction engineering. This unit syllabus covers the dynamics of various processes, equipment's and their control of operations, design of a control system etc. The unit is divided into lecture class, simulation based laboratory, mini-project and a site visit. Lecture class gives the solid foundation of theory. Laboratory experiments provide some small scale application of theory. Mini-project that is designed to include substantial practical application of equipment is useful in institutions. However field trips to process industries always allow the students to appreciate the relevance of the technological theory discussed in class and to experience their large scale application in real industrial situations.

Blackboard has been implemented here at Curtin University since 2009.This study was conducted on undergraduate students taking 3rd year core unit "Process Instrumentation and Control" (ChE 328) at Curtin University, Western Australia campus, WA and Curtin Miri Campus, Malaysia in the years of 2009 and 2010 respectively. The unit coordinator is from Bentley campus. All study materials are available to the students through University-wide online learning resources 'Blackboard'. There were two batches of students and followed a common course outlines. The students were both male and female with similar educational background. In the year of 2009, semester 2, followed face-to-face class teaching with poor design blended competencies in 'active learning', in 'active teaching' and in 'administration/Leadership part, whereas following year of 2010 a face-to-face class teaching with thoughtful blended with various effective competencies on same unit (Process Instrumentation and Control) in semester 2 was implemented. The full digital course material was delivered through 'Blackboard' LMS during both the study year. Blackboard provides a password-protected

environment and has administration tools that make teaching online easier [9].

2.2. Measurement & data collection

eVALUate is Curtin's online system for gathering and reporting student' perceptions of their learning experiences. Students can give feedback about their unit and their teacher-The eVALUate unit survey asks students their perceptions of what helps and hinders their achievement of unit learning outcomes, their motivation, engagement and their overall satisfaction with the unit at the end of course delivery. The eVALUate instrument is administered online through OASIS, the student portal. Students are notified by an official communications channel (OCC) message sent from the eVALUate team. The unit summary survey has eleven quantitative and two qualitative items [7, 10] prepared which had 11 questions: (1) The learning outcomes in this unit are clearly identified, (2) The learning experiences in this unit help me to achieve the learning outcomes, (3) The learning resources in this unit help me to achieve the learning outcomes, (4) The assessment tasks in this unit evaluate my achievement of the learning outcomes, (5) Feedback on my work in this unit helps me to achieve the learning outcomes, (6) The workload in this unit is appropriate to the achievement of the learning outcomes, (7) The quality of teaching in this unit helps me to achieve the learning outcomes, (8) I am motivated to achieve the learning outcomes in this unit, (9) I make best use of the learning experience in this unit, (10) I think about how I can learn more effectively in this unit and (11) Overall, I am satisfied with this unit. Responses to each item were based on scale designed by Curtin University from SA to UJ, where SA= strongly agree, A = Agree, D = Disagree, SD = strongly disagree and UJ = Unable to Judge. In addition, students are invited to make constructive comments on the qualitative items (limit of 600 characters) (item 12 to 13). Usually, more than 35% student's participation for a large unit is considered as representative in eVALUate survey. The quantitative and qualitative items are listed in Table 1.

2.3. Industry visit and data collection

Industry visit was part of learning components on this unit. Two different plant visits, namely Alcoa Kwinana Refinery WA and Coogee Chlor-Alkali Pty Ltd were organized towards end of semester period. One hundred and twenty five out of 145 students were taken part industry visit during three different afternoon sessions. As a general rule, no lectures classes are scheduled on site visit day. Students were taken by two buses for two different plants and it took one hour to reach the site from Curtin University. The plant visit took place for two hours and two guides from each plant helped students to understand various sections of the plant. Initially a group of 20 students were entered into control room of the plant and a demonstrator was showed various processes with fully control system PI diagram. After that students were divided into two groups of 10 students each and visited the different sections of plant with guide. These activities have led the students to observe closely the real application of instrumentation and control to process industry. The students are able to correlate the relevance of the technologies discussed in class and to experience their application in industry and finally their professional role in an industry. A paper based anonymous questionnaire survey on industry visit was conducted after one week of industry visit. The survey has 9 quantitative and one qualitative item. The quantitative items were asked students to put their level of agreement with statement about (i) role of process control engineer (Q1), (ii) effective unit learning through plant visit (Q2-Q5), (iii) motivation (Q6), (iv), coordination of the site visit (Q7), and (v) overall satisfaction & site visit is an integral part of their learning (Q8-Q9). The anonymous answering style was used similar to the Curtin University online evaluating system- "eVALUate". Students may indicate Strongly Agree, Agree, Disagree, Strongly Disagree or Unable to Judge for each item. In addition, students were asked to put constructive comments on the qualitative item in order to improve learning outcomes from the plant visit.

3. Results and discussion

3.1. Implementation of activities to encourage student learning and student perception based on quantitative survey

The eVALUate survey results on the unit are reported in terms of Full Unit Report (FUR) and a Unit Summary Report (USR). USRs are automatically published and anybody from Curtin can access the online report. Overall student perceptions were negative in the year of 2009 (see Table 2) whereas very high positive student's learning experience is found in the year of 2010 (see Table 3). This high positive student's learning experience is mainly due to effective and innovative teaching strategies of blended teaching approach. Student's enrolment on this unit for both the year was above 170. But student's response rate was 40% in the year of 2009, whereas response rate was 43% in the year of 2010. The industry visit survey results (see Table 4) indicated that the percentage of agreement on overall learning unit outcomes through integral plant visit was 78%. The average agreement for all the items was found as 66%. The item wise results analyses are given below:

A-1: Difference in overall student satisfaction and student engagement

Student satisfaction and student engagement are two concepts that are mutually supportive because student experience in formal and informal components of the academic system are the basis for students determining the extent of belonging and the benefit their university experience provides them [11]. Satisfaction has been widely used as one of the important parameter to evaluate learning effectiveness in academic institution [12]. Higher student satisfaction is the results of good learning and effective course delivery. It has been found from Table 3 that very high positive student's satisfaction of 90% in the year of 2010 compared to only 37% in the year of 2009 (see Table-2). Moreover in 2010 unit agreement all 11 items was much above the University or Faculty agreement. Here the instructor effectively integrated the use of technology with face-to-face class teaching that is meaningful and relevant to the student. On the other hand all 11 quantitative items were far below the University or Faculty agreement in the year of 2009. The very high positive students learning experience in the year of 2010 is due to the effective fusion of various competencies with blended teaching approach. These effective fusion components are the implementation of class problem based teaching and learning, online additional resource material, discussion, work load, feedback and visible grading which were absent in the year of 2009.

The overall satisfaction of learning process instrumentation and control 328 from industry visit was found 78% with an average agreement for all the items of 66% (see Table 4). A total of 70% agreement was found for their motivation and learning this unit through industry visit. This study clearly demonstrated that students understand their job profile as a process control engineer for which highest level of student's agreement 80% (Q1) was obtained (see Table 4). A significant number of students (78%) agreement on Q9 perceived the plant visit is an important part of their unit learning and it should be retain with the unit outcome.

A-2: The learning resources and the workload

The learning resources in blended learning settings provide the content and course materials that learners access to achieve the planned learning outcomes. In learning settings that are technology-facilitated, there are substantial amounts of course material provided for learners. Lecturer in the year of 2010 developed a range of learning resources to provide as many opportunities as possible to engage students and motivate learning. A range of learning resources, including lectures, PowerPoint presentation, I-lectures, effective reference book, feedback, critical thinking, class problems and tutorials as active teaching and technological competency were applied. In the year of 2010, new components with respect to the year of 2009 were feedback, critical thinking through class problems, online discussion, additional resource material and tutorials. The e-valuate results on item 3 (see Table 3) i.e. "the learning resources in this unit help me to achieve outcomes was 88% agreement was found compared to only 56% (see Table 2) agreement in the year of 2009. As the objective of this unit is to learn, evaluate and apply the critical thinking and problem solving skills, the teacher provided rich learning materials including taking effective lecture class and vivid examples in his critical thinking through class problem solving which were not implemented effectively in the year of 2009. In the year of 2010, the instructor encourages students to participate in class problem solving and also encourage making more interaction with instructor during lecture class period and also provides the additional resources in terms of effective reference book, uploading solutions of class problems that ultimately encourage students to go deeper into the content of the course.

The instructor also facilities learning activities that help students to find explanation/solution of various problems/tutorial problems through uploading the digital solution material in blackboard after each and every lecture class. These new learning activities were absent in the year of 2009. Moreover the instructor should take appropriate strategy to manage student workload to achieve the learning outcomes. There were 68% agreement (Table 2) on the workload in the year of 2009 and 98% agreement (Table 3) in the year of 2010. Again this is because of effective assessment tasks and effective workload strategy which were taken by the instructor in the year of 2010 compared to 2009. In 2009, there are many assessments components such as Test-1, Test-2, Final Test, Plant visit, Laboratory group project, Assignments but in 2010 only four assessments such as Mid-term Test, Final Test, Plant visit and Laboratory group project were implemented. The effectiveness of assessments was further reflected by USR results (Table 2 & Table 3), where only 54% agreement on assessment task components in 2009 (see Table 2) and 94% agreement on the same item was found in the year of 2010.

A-3 Active teaching and feedback on my work

The positive students learning experience largely depends on active teaching competency. The instructor should provide clear, detailed feedback on assignments and exams that enhance the learning experience. It is not an easy task for an instructor for large class student's environment. The instructor

should also makes grading visible to students. In the year of 2010, instructor provides clear feedback to the students by giving back of their valued test exam answer papers, valued assignments, expected student behavior, visible grading system and therefore high 84% agreement on feedback components (see Table 3) compare to only 42% agreement in the year of 2009 (see Table 2) was obtained.

A-4: Student's engagements, Learning experience and the quality of teaching

In Process Instrumentation & Control-328 unit, the curriculum is entirely problem based and project based. Each chapter of the unit starts with the theoretical background and immediately supported by analytical real life class problem solving. This will develop not only critical thinking and problem solving skills but also effectively engage students during class lecture period for large unit. There is also a group based mini project that has to be done at the end of course. Lecturer used to release mini project comprising problem statement, scope, guide line for expectation and report writing in the middle of semester period. Students used to form a team of maximum four members, distribute their work load among team members and do the project execution independently through the remaining semester period (approximately 6 weeks' time period) using various resource materials such as full lecture notes, reference book, data book, handbook, published journal articles etc. Project-based learning provides students with the opportunity to tackle real world situations that by their nature have no easy solution, or have no solution at the present time. Group based project work assessment is an alternative and effective assessment technique of outcome based education system. When effective group management processes are employed, clear assessment guidelines developed and communicated and valid and fair grading processes employed, the like hood of positive learning outcomes and student satisfaction with group activities is significantly increased. Therefore 88 % agreement on quality of teaching, 90% agreement on motivation and 93% agreement on effective positive learning experience (see Table3) are reflected in the year of 2010 which are far above level compared to 2009 year (see Table 2).

A5: Student Perception based on Industry visit

The feedback gathered from students was examined for comparative analysis and understanding of perceptions. The results revealed that, an average 66.2% of agreement were recorded from the feedbacks gathered for Question 1 to Question 9 of the survey, with the majority of responses (48%) classified under the "Agree" scale (Table 4). The teacher's role is as supporter and facilitator of the student's new learning experience. Were the students motivated and inspired to learn through plant visit? Therefore responses on motivation of Question 6 (see Table 4) received the percentage of agreement with a total rate of 70%. Industrial visit make students understand the subject to its core. It also gives idea to students about their job profile once they start working. To know the student's learning experience it was asked question 1 i.e. from the plant visit, I could understand the job of a process control engineer and the percentage agreement was total 80% (see Table 4) Responses on question 1 also received the highest rate of agreement among the respondents with a total rate of 80%. A significant number of students (78%) on Q9 of Table 4 perceived the plant visit is an important part of their unit learning and it should retain with the unit outcome. Feedback related to the bridge between classroom theory and real world on positive students learning experience has been reflected by the responses of Q 1 to Q5 with total agreement of 48% to 80%.

Table 1. Quantitative and qualitative items used for Unit Evaluation [8, 14]

Quantitative items:
1. The learning outcomes in this unit are clearly identified. *The learning outcomes are what you are expected to know, understand or to be able to do in order to be successful in this unit*
2. The learning experiences in this unit help me to achieve the learning outcomes *The learning experiences could include: face-to-face lectures, tutorials, laboratories, clinical practicum, fieldwork, directed learning tasks, and online and distance education experiences.*
3. The learning resources in this unit help me to achieve the learning outcomes. *Learning resources could include print, multimedia and online study materials and equipment available in lectures, laboratories, clinics or studios.*
4. The assessment tasks in this unit evaluate my achievement of the learning outcomes *Assessment tasks are those which are rewarded by marks, grades or feedback. Assessment tasks directly assess your achievement of the learning outcomes.*
5. Feedback on my work in this unit helps me to achieve the learning outcomes. *Feedback includes written or verbal comments on your work.*
6. The workload in this unit is appropriate to the achievement of the learning outcomes. *Workload includes class attendance, reading, researching, group activities and assessment tasks.*
7. The quality of teaching in this unit helps me to achieve the learning outcomes. *Quality teaching occurs when knowledgeable and enthusiastic teaching staff interacts positively with students in well-organized teaching and learning*

experiences.
8. I am motivated to achieve the learning outcomes in this unit. *Being motivated means having the desire or drive to learn, to complete tasks and to willingly strive for goals.*
9. I make best use of the learning experiences in this unit *I prepare for and follow up on the learning experiences offered in this unit.*
10. I think about how I can learn more effectively in this unit. *I take time to think about how I can learn more effectively.*
11. Overall, I am satisfied with this unit. *Overall, this unit provides a quality learning experience.*
Qualitative items
12. What are the most helpful aspects of this unit?
13. How do you think this unit might be improved?

Table 2. Unit survey results for Process Instrumentation and Control 328 in the year 2009 [13]. Total enrolment = 171; Responses = 69, Response rate = 40% [13]

eVALUate quantitative items	**% agreement**	**% disagree -ment**	**% unable to judge**
1.The learning outcomes in this unit are clearly identified	49	51	**0**
2. The learning experiences in this unit help me to achieve the learning outcomes	51	48	1
3.The learning resources in this unit help me to achieve the learning outcomes	56	41	3
4.The assessment tasks in this unit evaluate my achievement of the learning outcomes	54	45	1
5.Feedback on my work in this unit helps me to achieve the learning outcomes.	42	57	1
6The workload in this unit is appropriate to the achievement of the learning outcomes	68	30	2
7. The quality of teaching in this unit helps me to achieve the learning outcomes	36	61	3
8. I am motivated to achieve the learning outcomes in this unit	52	45	3
9.I make best use of the learning experiences in this unit	64	32	4
10.I think about how I can learn more effectively in this unit.	71	26	3
11.Overall, I am satisfied with this unit	37	61	2

Table 3. Unit survey results for Process Instrumentation and Control 328 in the year 2010 [13]. Total enrolment = 191; Responses = 82, Response rate = 43% [13]

eVALUate quantitative items	**% agreement**	**% disagree -ment**	**% unable to judge**
1.The learning outcomes in this unit are clearly identified	91	9	**0**
2. The learning experiences in this unit help me to achieve the learning outcomes	87	12	1
3.The learning resources in this unit help me to achieve the learning outcomes	88	10	2
4.The assessment tasks in this unit evaluate my achievement of the learning outcomes	94	6	0
5.Feedback on my work in this unit helps me to achieve the learning outcomes.	84	15	1
6.The workload in this unit is appropriate to the achievement of the learning outcomes	98	2	0
7. The quality of teaching in this unit helps me to achieve the learning outcomes	88	12	0
8. I am motivated to achieve the	90	9	1

learning outcomes in this unit			
9.I make best use of the learning experiences in this unit	93	6	1
10.I think about how I can learn more effectively in this unit.	86	14	0
11.Overall, I am satisfied with this unit	90	10	0

Table 4. Survey results on Industry visit. Total Responses (35%) on each question from industry visit survey

Questationaries	Scale	Cumulative, %
Q1 (From plant visit I understand the job of a process control engineer	Strongly agree Agree Disagree Strongly disagree Unable to judge	14 80 90 94 100
Q2 (I understand the practical application of theories that I learned in lecture class)	Strongly agree Agree Disagree Strongly disagree Unable to judge	12 58 86 90 100
Q3 (The lecture materials on PI&C are sufficient to understand the different aspects of a plant)	Strongly agree Agree Disagree Strongly disagree Unable to judge	10 58 82 86 100
Q4 (I could learn PI &C more effectively through this plant visit)	Strongly agree Agree Disagree Strongly disagree Unable to judge	16 48 78 88 100
Q5 (Plant visit helps me to achieve the overall learning outcomes of this part of the unit)	Strongly agree Agree Disagree Strongly disagree Unable to judge	10 56 90 92 100
Q6 (I am motivated to take part of this plant visit)	Strongly agree Agree Disagree Strongly disagree Unable to judge	30 70 88 94 100
Q7 (Coordination of the plant visit was appropriate)	Strongly agree Agree Disagree Strongly disagree Unable to judge	16 72 84 90 100
Q8 (Overall I am happy with this plant visit)	Strongly agree Agree Disagree Strongly disagree Unable to judge	18 76 84 92 100
Q9 (Plant visit is an important part of this unit and it should retained with the unit outcomes	Strongly agree Agree Disagree Strongly disagree Unable to judge	36 78 84 90 100

B: Qualitative Survey

Students put their qualitative evaluation in two evaluation criteria as given in Table 1 which is available in unit wise Full Unit Report (FUR) which is not published online for students/staff access. Only unit coordinator can access the eVALUate FUR report for his/her own unit so that he or she can reflect for effective unit delivery. The qualitative data of 2009 was utilized for selection of thoughtful fusion components in effective teaching and course delivery in the year of 2010. These new fusion competencies of 2010 were in the area of 'active learning', active teaching and in the area of 'administrative/leadership competency. Students qualitative reflections (FUR-2010) was indication of their strong satisfaction on each and every competency through their positive qualitative statements and few statements are presented below: The source of these statement is FUR-2010 of Curtin University on ChE 328 (Process Instrumentation & Control).

- *The problem based learning style gives a good idea of what is expected*
- *Class problems which was good for us on understanding of the units*
- *Class problems essentially give me an idea on how to apply whatever are thought in lecture*
- *Class problems were the most effective means of learning the content after going through these in the lectures the content become more clear*
- *A lot of class problems in class for each section which really helps to learn what is expected*
- *Lectures & tutorials help to a better understanding of the unit.*
- *The many examples in the lectures and tutorials were helpful in achieving the outcomes for the unit.*
- *Site visit which is a real eye opener that shows how instrumentation and control system are widely used in the industries*
- *The project expose students with the knowledge of process control in the industry*

- *Field trip, labs are more helpful to open the minds and widen the views of the student*
- *While I am happy with the plant visit, it is only giving me some overall look of what PIC real life applications one. Some of the explanations given onsite are just too complex to understand*
- *Learn how they control the process in real life*
- *Help me learn about process control*
- *General understanding of what a process engineer working environment*
- *The learning resources are plentiful for this unit*
- *The project help student to think critically and apply the theory to the practical work.*

4. Conclusion

Today one of the most challenging tasks for modern higher education is to deliver course material and teach effectively so that learning outcomes can be achieved. These challenges include a large population of learners from varied backgrounds, needs, motivations, abilities, learning preferences and course content etc. According to Garrison and Vaughan [2] blended Learning in higher education provides a vision and a roadmap for higher education faculty to understand the possibilities of organically blended face-to-face and online learning for engaging and meaningful learning experience. Basically blended learning is the thoughtful fusion of face-to-face and online learning experiences. This research demonstrated the importance of this thoughtful design of fusion competencies through student perceptions from a batch of students completed the undergraduate large unit "Process Instrumentation and Control-328" in a blended environment. Student opinions reflect the use of various effective fusion components made by their instructor in terms of well-designed units rich with learning resources, assessment tasks, timely feedback, and workload, quality of teaching, motivation, good interaction and overall satisfaction as "positive learning experiences".

5. References

[1] T. K. Sen, "Application of blended and traditional class teaching approach in higher education and the student learning experience, J. Innovation, Management Technol. Vol2, No. 2, April, 107-109, 2011.

[2] D. R. Garrison, and N. D. Vaughan, "Blended learning in higher education: Framework, principles and guidelines", The Jossey-Bass higher and adult education services. San Francisco: Jossey-Boss, 2008.

[3] R. Garrison and H. Kanuka, "Blended learning: uncovering its transformative potential in higher education", *Internet and Higher Education*, vol. 7, pp. 95-105, 2004.

[4] M. A. Ocak, "Blend or not to blend: a study investigating faculty members perceptions of blended teaching, World J. Educational Technology, vol. 2, no. 3, pp. 196-210, 2010.

[5] F. Martin, "Blackboard as the learning management system of a computer literacy course", *MERLOT J. online Learning and Teaching*, vol. 4, no. 2, pp. 138-145, 2008.

[6] M. Theall, M. and J. Franklin, "Looking for bias in all the wrong places- a search for truth or a witch hunt in student ratings of instruction? In The Student Rating Debate: Are they Valid? How can we best use them?" Theall, P., Abrami, L. and Lisa Mets (Eds). New directions in educational research, No. 109. San Francisco: Jossey-Bass, 2001.

[7] A. H. M., Anwar, "Student's feedback based blended teaching approach for effective learning", Int. J. Innovation, Management Technol. Vol2, No. 1, Feb, 9-12, 2011

[8] J. Cuseo (n.d.), "The case for student evaluation of college courses. Policy Center on the First Year of College", http://www.brevard.edu/fyc/fya/CuseoLink.htm, 2002.

[9] C. Lowe, "Open source weblog CMS's: An alternative to blackboard" Retrieved Aug 26, 2006 from http://cyberdash.com/node/view/83, 2003

[10] B. Oliver, Tucker, B., R. Gupta and S. Yeo, "eVALUate: an evaluation instrument for measuring student's perceptions of their engagement and learning outcomes, Assessment & Evaluation in Higher Education", vol. 33, No. 66, 619-630, 2008.

[11] F. Padro and A. Frederiks, "Evaluating the impact of the learning centre on student learning and satisfaction. In Design, develop, evaluate: The core of the learning environment", Proceeding of the 22nd Annual Teaching Learning Forum, 7-8 February 2013. Perth: Murdoch University, Australia (http://otl.curtin.edu.au/professional_development/conferences/tlf2013/referred/padro.html)

[12]J. Lu, C-S, Yu and C. Lu, "Learning style, learning patterns and learning performance in a WebCT-based MIS course", *Information and Management*, vol. 40, pp., 497-507, 2003.

[13] eVALUate survey data, http://evaluate.curtin.edu.au/

