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Relationship between Learning Environment and Learning Approaches among Engineering Students

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ABSTRACT

The purpose of this study is to explore the relationship between learning environment and learning approaches among engineering students at Malaysian Polytechnics. The learning environment plays important roles in the cognitive, effective and social domains of the students because it could improve students' learning outcomes. Learning approaches refer to the ways students deal with academic tasks that are related to learning outcomes. In this study, Course Experience Questionnaire (CEQ) and Revised Two-Factor Study Process Questionnaire (RSPQ-2F) were used to collect the research data. The data were analyzed using AMOS Version 18. Multiple regressions was used to predict learning environment factors that influenced the level of students learning approaches. The main result of the study shows that good teaching is a major factor affecting the students' deep approach followed by the assessment, learning resources and clear objectives.

Keywords: *Learning approaches, learning environment, learning outcomes, Polytechnics, Malaysia*

INTRODUCTION

Barrie and Prosser (2003) states that learning is a function of current and past experiences. Thus, to enhance the learning outcomes, learning institution should be concerned with the context and experiences of the students. The aim of this study is determine whether the students' personal factors (ability, motivation, prior knowledge, gender, race) and the learning contexts (program goals, evaluation, task load, good teaching, teaching approach) affect the students' learning outcomes. Aspects of learning environment studied by previous researchers such as work load (Karagiannopoulou & Christodoulides, 2005; Kember & Leung, 1998, Lizzio *et al*., 2002;), assessment (Gijbels & Dochy, 2006; Karagiannopoulou & Christodoulides, 2005; Kember, Leung & Ma, 2007; Kim, 2002), teaching approach (Cabrera, Colbeck & Terenzini, 2001; Karagiannopoulou & Christodoulides, 2005; Kember & Kam, 2000; Ramsden, Prosser, Trigwell & Martin, 2007), learning resources and learning community (McInnis, Griffin, James & Coates, 2001; Smith & Bath, 2006). Table 1 shows the aspects of learning environment studied by previous researchers.

Table 1: Learning Environment Factors

	Factor	Researchers
1.	Assessment	Ramsden (1991); Kember & Leung (2005); Gijbels & Dochy (2006)
2.	Work Load	Ramsden (1991); Kember & Leung (1998); Biggs (1999); Karagiannopoulou & Christodoulides (2005)
3.	Learning Community	Pascarella (1985); Fraser (1998); Smith & Bath (2006); Norlia (2006); Kamaruddin (2010)
4.	Learning Resources	Norlia (2006); Smith & Bath (2006); Kamaruddin (2010)
5	Teaching Approach	Ramsden (1979, 1991); Biggs (1999); Kember & Leung (2005)

6	Clear Objectives	Ramsden (1991); Biggs (1999); Lizzio et al. (2002); Kember & Leung (2005)

A series of important studies conducted by Marton and Saljo (1976) and then through their highly influential book , *The Experience of Learning*, they examined surface and deep approaches to learning. Marton and Saljo's study which took place at the University of Gothenburg, Sweden in the 1970's where they asked students to read an article written by a professor of education on some proposed university reforms in Sweden. They told students that they would ask them some questions about the text once they finished reading it. Marton and Saljo met with the students and asked them open-ended questions to assess their approach to reading and their understanding of the text. Marton and Saljo (1976) reported that while reading the text, some students simply identified some isolated facts mentioned in the text, which they believed the researchers would ask them about during the interview, and then memorized those facts. These students could not make any connections between these facts and failed to see any connection to their realities. Another group of students tried to understand what the author was saying, focused on the underlying meaning of the text, and sought to integrate the different facts mentioned in the text. The first group of students focused on the surface level of the text while the second one adopted a deeper approach. These findings are consistent with earlier work of Ausubel in 1961 where he differentiated between meaningful learning and rote learning. Marton and Saljo (1976) identified two different levels of processing, which was then called deep and surface learning approaches.

METHODOLOGY

This survey research was conducted at Malaysian Polytechnics involving 527 final year engineering students. In order to collect the research data, a questionnaire was developed. The questionnaire contains 3 parts − Part A, B, and C. Part A consists of items related to student demographics. Part B of the questionnaire is about learning environment consisting of six constructs adapted from Moos (1974), Ramsden (1991), Fraser (1998), and McInnis *et al*. (2001). Part C contained 20 items of the learning approaches adopted from the Revised Two-Factor Study Process Questionnaire [R-SPQ-2F] (Biggs *et al*., 2001). This part is designed to measure the extent to which the customary approach to learning by individuals could fulfill the task of learning in a learning environment. Table 2 shows the learning Environment factors based on the Moos scheme.

Table 2: Learning Environment Factors based on the Moos Scheme

	Factors	Description	Moos Scheme
1.	Teaching Approaches	Good teaching − relates to the quality of the teaching approach.	Relationship
2.	Clear Objectives	Clear objectives − shows whether the students were given clarification about how and what knowledge and skills that are being developed in their program.	System Maintenance and Change
3.	Assessment	Assessment − shows the extent of quantity and quality of students' assessment's role.	Personal Development
4.	Work Load	Work Load – reflects the burden and quantity of assignments in students' learning.	Personal Development
5	Learning Resources	Learning Resources − shows the learning resources provided for the students.	System Maintenance and Change
6	Learning Community • Peer Interaction • Cooperation • Equality	Learning Community – shows the influence of peers on the learning.	Relationship and Personal Development

Reliability of the Instrument

The questionnaire was validated by measuring the internal consistency of the items. Table 3 shows the values of the reliability index (Cronbach Alpha). The values of Cronbach alpha for all the sub-constructs for the questionnaire in this study are between 0.77 and 0.86. According to Babbie (1992), Cronbach Alpha values are classified based on the classification in which the reliability index of 0.90-1.00 is very high, 0.70-0.89 is high, 0.30-0.69 is moderate, and 0.00 to 0.30 is low. The result shows that the Cronbach Alpha for this instrument is relatively high. According to Sekaran (2003), Cronbach Alpha value must be greater than 0.5. While Mohd Najib (1999), suggests a minimum value equal to 0.6. We can conclude that this instrument has high reliability since Cronbach Alpha value for this questionnaire is more than 0.5 (Table 3).

Table 3. Values of Cronbach Alpha for Learning Approach

Sub-constructs	Number of Items	Number of Items Excluded	Cronbach Alpha
Assessment	5		0.77
Good Teaching Approach	7		0.79
Work Load	5		0.86
Teaching Objectives	5	1	0.79
Learning Community	5		0.86
Learning Resources	6		0.78

RESULTS and DISCUSSION

Factor analysis was performed on the six sub-constructs, ie., instructional objectives (O), assessment (P), work load (T), learning communities (KP), learning approaches (PP), and learning resources (SP) using the varimax rotation (Table 4). Results show that the six factor with Eigen values above 1.0. The value of Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.868 which is adequate for inter-correlation while Barlett Test was significant (Chi Square = 5962.485, $p < 0.05$). The anti-image correlation matrix by the Measure of Sampling Adequacy (MSA) was more than the value of 0.5. Items O2, PP6, PP7, P1, SP3 and SP4 were dropped based on the criteria by Hair et al. (2006), where each item should exceed the value of 0.50. Total variance explained for this loading was 61.5%. This value is sufficient as according to Sekaran (2003), the total variance explained must be more than 50%.

Table 4: Factor Analysis

Items	Objectives	Assessment	Work Load	Learning Community	Learning Approach	Learning Resources	Extraction
O1	0.673						0.540
O3	0.829						0.668
O4	0.799						0.655
O5	0.757						0.610
P2		0.735					0.598
P3		0.785					0.685
P4		0.772					0.609
P5		0.714					0.608
T1			0.717				0.517
T2			0.837				0.720
T3			0.796				0.684
T4			0.815				0.676
T5			0.781				0.652
KP1				0.800			0.688
KP2				0.751			0.672

KP3	0.775			0.651
KP4	0.846			0.726
KP5	0.701			0.591
KP6	0.800			0.557
PP1		0.751		0.485
PP2		0.645		0.589
PP3		0.760		0.544
PP4		0.690		0.516
PP5		0.577		0.430
SP1			0.569	0.568
SP2			0.715	0.681
SP5			0.804	0.689
SP6			0.810	0.540
Total variances explained				61.51%

Table 5 shows the reliability of the items in the two-domain approach to learning. The Cronbach Alpha for items measuring the deep approach is 0.73 and the surface approach is 0.85, respectively. Factor analysis (Table 6) was performed using varimax rotation to confirm the two constructs studying the deep approach (DS) and surface approach (SS). Result of the analysis has shown that two factors have Eigen values exceeding 1.0. The value of Kaiser-Meyer-Olkin measure of Sampling Adequacy was 0.851which is adequate for intercorrelation while Barlett test was significant (Chi Square = 1577.558, $p < 0.05$). The Measure of Sampling Adequacy MSA for anti-image correlation matrix was more than the value of 0.5. Item DS1, DS2, DS3, DS4, DS10, SS1, SS7, SS9 and SS10 were dropped based on the criteria by Hair *et al*. (2006) since the items do not exceed 0.50. Total variance explained for this loading was 53.16 %.

Table 5: Cronbach Alpha value for learning approaches scales

Variables	Item	Cronbach Alpha in this study	Cronbach Alpha published in 2001 (Biggs et al)
Surface	10	0.85	0.64
Deep	10	0.73	0.73

Table 6: Factor Analysis

Item	Deep	Surface	Extraction
DS5		0.600	0.370
DS6		0.589	0.389
DS7		0.700	0.490
DS8		0.653	0.426
DS9		0.706	0.501
SS2	0.771		0.603
SS3	0.826		0.688
SS4	0.828		0.690
SS5	0.786		0.620

SS6	0.724		0.542
SS8	0.718		0.529
Total varians explained %	33.42	19.74	53.16
Eigen values	3.9	1.9	5.8

Table 7 shows the correlation between criterion variable (DS) and predictor variable of good teaching was 0.360 and the correlation between criterion variable and a combination of good teaching and assessment is 0.418. While the correlation of criterion variable (DS) and linear combinations of three predictor variables of learning resources, assessment, good teaching is 0.452. While the correlation of criterion variable and linear combinations of the four predictor variables of learning resources, assessment, good teaching and a clear objective is 0.469. The R^2 of 0.130 shows that 13% change in the criterion variable (DS) is due to change in the good teaching. The combination of good teaching and assessment contribute 17.5%. The combination of good teaching, assessment, learning resources accounted for 20.4%. The linear combination of the four predictor variables accounted for 22% of the variance in the criterion variable (DS).

Table7: Regression Model

Model	R	R^2	Adjusted R Square	Std. Error of the Estimate
1	0.360[a]	0.130	0.128	0.42373
2	0.418[b]	0.175	0.172	0.41294
3	0.452[c]	0.204	0.200	0.40596
4	0.469[d]	0.220	0.214	0.40239

Results of F (4, 510) = 35,884, ($p < .05$) indicates that the relationship between the four predictor variables and the criterion variable is significant. This value shows the 22% contribution of the four constructs (instruction, assessment, learning resources, clear objectives) of the criterion variable (DS) is significant. This situation clearly shows that good teaching is a major factor affecting the increase in students' deep approach followed by the assessment, learning resources and clear objectives. Table 8 shows the regression coefficient b for the four predictor variables in linear combinations.

Table 8: Multiple Regression Analysis (Stepwise) for predicting deep learning approaches

Model	B	Beta (β)	t	Sig.
(Constant)	1.400		6.944	.000
Teaching	.179	.186	4.103	.000
Assessment	.173	.188	4.339	.000
Learning Resources	.101	.157	3.722	.000
Clear Objectives	.144	.143	3.178	.002

a Dependent Variable: deep

The value of regression coefficient β represents the standard for four predictor variables in the form of linear combinations. While the value of t indicates significant results at $p < .05$. Thus, the multiple linear regression is:

ZPM =(0.186) Zgood teaching + (0.188) Zasessment + (0.157) Zobjective + (0.143) Zresources

Table 9 shows the correlation between criterion variable (SS) (Surface Approach) and predictor variable workloads is 0.340 and the correlation between criterion variables and a combination of workload and assessment is 0.447. The correlation between criterion variable and linear combinations of the three predictor variables workload, learning community and assessment is 0.468 while the correlation of criterion variable (SS) and linear combinations of the four predictor variables workload, assessments, learning resources, learning community is 0.485. The R^2 of 0.115 shows that 11.5% change in the criterion variable is due to changes in workload. Combination of workload and assessment contributed 20%. The combination of work load,

assessment, learning community contributes 21.9%. The linear combination of the four predictor variables accounted for 23.5% of variance changed in the criterion variable (SS).

Table 9: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	0.340[a]	0.115	0.114	0.71809	
2	0.447[b]	0.200	0.197	0.68353	
3	0.468[c]	0.219	0.215	0.67589	
4	0.485[d]	0.235	0.229	0.66950	1.864

Results of F (4, 510) = 39,272 ($p < .05$) indicates that the relationship among the four predictor variables and the criterion variable is significant. The value shows the 23.5% variance is attributed to the four sub-constructs (work load, assessment, learning communities, learning resources). This situation clearly shows that the work load is a major factor influencing the increase in the surface approach followed by the assessment, learning communities and learning resources. Table 10 shows the regression coefficient b for the four predictor variables in linear combinations.

Table 10 : Multiple Regression Analysis (Stepwise) for predicting surface learning approaches

Model	B	Beta (β)	t	Sig.
(Constant)	3.115		9.175	0.000
Workload	0.349	0.330	8.398	0.000
Assessment	-0.373	-0.242	-5.861	0.000
Learning communities	-0.261	-0.192	-4.403	0.000
Learning resources	0.147	0.136	3.285	0.001

a. Dependent Variable: surface

The value of regression coefficient β represents the standard for four predictor variables in the form of linear combinations. While the value of t indicates significant results ($p < .05$), thus, the multiple linear regression is:

ZPP =(0.330) Zworkload + (-0.242) Zassessment + (-0.192) Zcomunities + (0.136) Zresources

In addition, a path analysis was conducted using AMOS 18 to test the relationship between learning approaches and learning environment (Figure 1). Various goodness of fit indices were used to evaluate the proposed model based on the data in the study. Literature reported that some measure of the index matching is often used as a benchmark in determining goodness of fit indices matching a model such as chi-square ($\chi 2$), root mean-square error of approximation (RMSEA) (Bollen, 1989; Browne & Cudeck, 1993; Hu & Bentler, 1999; Hair *et al*., 2006), Tucker-Lewis index (TLI), normed fit index (NFI) (Hu & Bentler, 1999; Hair *et al*., 2006), comparative fit index (CFI) and normed chi-square ($\chi 2$/df) (Hair *et al*., 2006). Table 11 shows the values of the RMSEA, CFI and NFI that could be assumed that the model has a nearly perfect fit. Further, the findings of the standardized regression weight indicated that there was a direct effect of the learning environment and learning approaches.

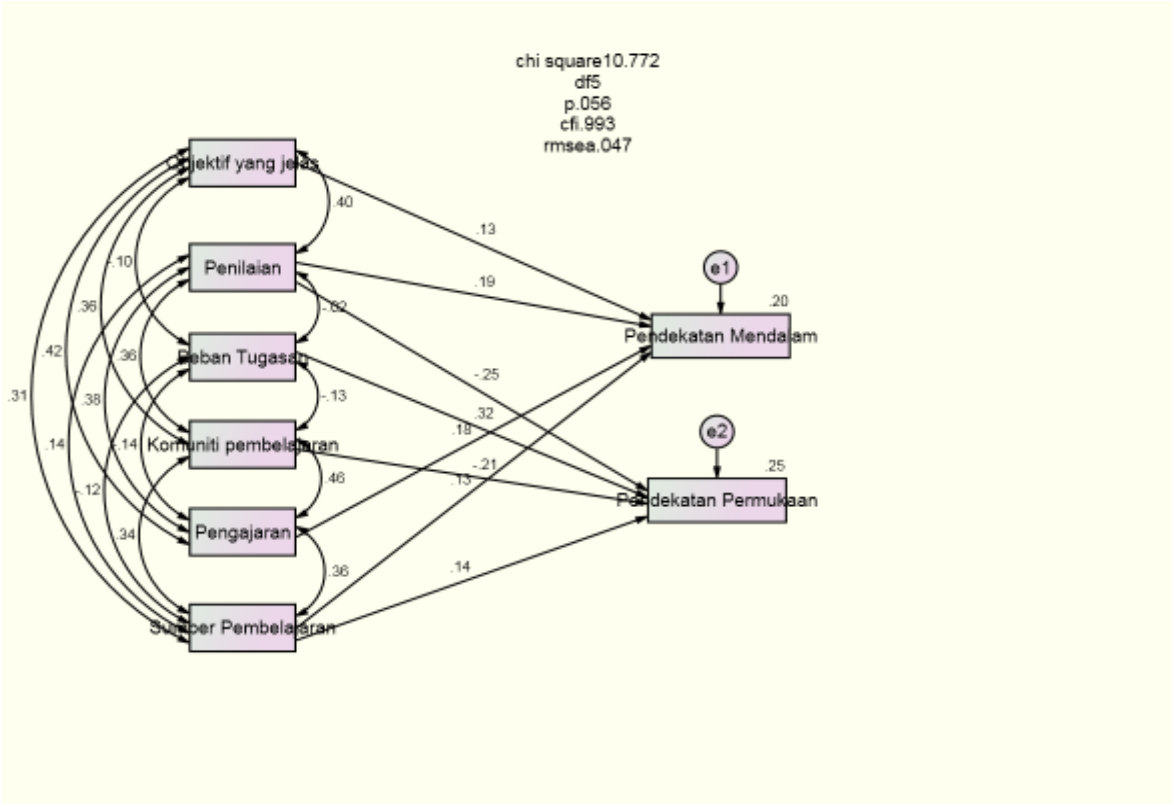

Figure 1: Relationship model between learning environment and learning approaches

Table 11: Fit Indices

Fit Indices	Model	Value suggested	Sources
df	5		
χ^2	10.772		
χ^2/df	2.15	≤ 5.00	Hair et al (2006)
CFI	0.993	≥ 0.90	Bagozzi & Yi (1988); Hair et al (2006)
RMSEA	0.047	≤ 0.08	Browne and Cudeck (1993); Hair et al (2006)

CONCLUSION

Result of this study clearly shows that good teaching is a major factor affecting the increase in students' deep approach followed by the assessment, learning resources and clear objectives. The study also shows that the work load is a major factor influencing the increase in the surface approach followed by the assessment, learning communities and learning resources. A student who adopts a deep approach is interested in academic work and enjoys the process of doing, finding the meaning in the work; makes work that means to own experiences and the actual situation; integrates parts or aspects of a task (e.g., linking evidence to conclusions); relates the findings to previous knowledge; tries to build a theory of the task or to form hypotheses. However, a student who adopts surface approaches, sees the work as a condition to be fulfilled; views part or aspect of work as something separate and not connected to each other or with other tasks; takes concerned about the time taken to do the task; avoids other meanings carried by the task; and tries to produce work that only have surface meaning.

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