Establishing Pre-Requisite Employability Traits of Electrical Engineering Students by Item Characteristic Curve Analysis

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Abstract

There is a growing emphasis on generic skills as a determinant for a graduate employability. Generic skills include among others; analytical reasoning, problem solving, intellectual curiousity and teamwork skills. These latent traits, or referred to as attributes, shall be embedded in the course development to ensure the expected learning outcomes is achieved. Thus, it enhances the employability of graduates who possessed such traits. SEE 3512- Electromagnetic Field Theory (EMT-1) utilized active learning, a type of outcome based education method (OBE), in their course delivery. OBE offers a new perspective to improve students' learning process as compared to the traditional teaching and learning method. It shifts the learning responsibility to the students; hence more active participation from the students in the attempt to develop the required generic skills. This called for a method of measurement to gauge the expected learning outcomes from the students. A Table of Test Specification is developed to meet the objectivity and specificity of the required generic skills conducted through the course assessment to achieve the set quality assurance (QA). Item Characteristic Curve Analysis in the form of difficulty index and discrimination index are used to provide a better measure of students' qualitative achievements. The analysis can serve as a model to establish the students' pre-requisite employability traits to be developed and the construct validity of an examination paper in assessing the said aspects.

Keywords: Generic skills; Employability; Item Characteristic Curve; Discrimination index; Difficulty index; Latent traits.

1. Introduction

A range of reasons was put forward when the number of undergraduates in the country getting unemployed grows exponentially annually. Despite efforts taken by various authorities, these are more of reactive in nature, which will remain a burden to the government in the long run. The root cause of the issue lies in our education system which needs to be seriously reviewed to produce graduates having the required capabilities and qualities. A good education system should generate graduates that are able to think creatively, take calculated risks and adopt exploratory attitudes; collectively termed as generic skills. A graduate is deemed to be of competence when they possess good interpersonal skills, oral and written communication, leadership skills, teamwork, problem solving, creativity and sound computer literacy as illustrated in Figure 1. [7]

In the effort to improve the quality of graduates particularly those from local public higher learning institutions, the Ministry of Higher Learning has developed a guideline named *Jaminan Kualiti – Institusi Pengajian Tinggi Awam, Mei 2002* (JK-IPTA). Generally the guideline is based on the American Accreditation Board of Engineering and Technology (ABET) which promotes the outcome based education (OBE) learning process. OBE introduces prudent methods such as problem based learning, collaborative and active learning to inculcate the necessary attributes viz; attitudes, values and skill components that constitutes the generic skills. Many leading authorities in engineering education have vouched on the effectiveness of such practices. Therefore, the Faculty of Electrical Engineering (FKE), UTM Skudai, has embarked on the program as recommended by the

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Board of Engineers, Malaysia to embed OBE in their curriculum.

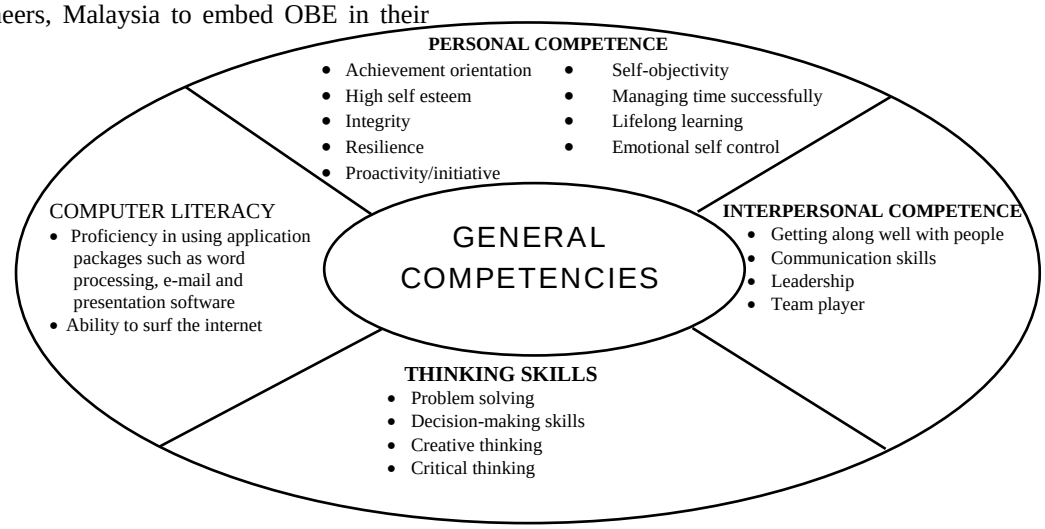


Figure 1. Generic Competencies as defined by industry. Source: *Ranjit and Normah, 2005 [7]*

This requires a method of measurement to gauge the achievement of the expected learning outcomes from the students. A series of assessment in the form of tests, quizzes and final examination were designed to validate such learning outcomes. This paper presents an aspect of a case study recently conducted on a third year undergraduate engineering course, *SEE 3512 Electromagnetic Field Theory 1 (EMT- 1)*, to verify the construct validity of the said assessment. Data there from is used to evaluate and establish the graduate achievements in developing the relevant generic skills at every pre-determined level.

2. Generic Skills and Employability

Generic skills are of utmost importance for a graduate to be able to compete effectively in the increasingly demanding job market. A graduate equipped with the required generic skills has a greater opportunity for mobility hence higher income prospect. However, these desirable characteristics needed for greater employability and perceived as of value to employers remain difficult to find and is getting rather rare. [17]

It is worthy noting that a typical three (3) to five (5) year traditional educational system does not readily accommodate to the rapid changes in skills required by the business and corporate world. Academia needs to develop a curriculum that is sensitive to such future changes to make their graduates relevant; hence employable upon graduation. This is a challenging demand upon educational providers which requires new teaching and learning approaches; both in style and methodologies to be deployed accordingly. Teaching professionals are equally responsible to acquire and develop the salient knowledge; locating, managing and disseminating it effectively to the students, which is undeniably the important factor in educational process.

Ironically, graduates are often prematurely judged by the potential employers simply by looking at job applications or over short interviews. Industries must realize that universities to provide sound foundation of knowledge for lifelong learning. The industries should have the wisdom to nurture or to tap into these graduates' strengths and transform them productively. It can be agreed on the perception that the graduates' written and communication skills can be quickly identified during interviews. However, cognitive capabilities concerned; creative thinking, critical thinking and decision making; termed as latent traits, requires further scrutiny and should be delved in the right perspective.

Since these are truly the latent traits that need to be grafted, it is vital for the academia to make strategic moves promptly to map out a student's account of the expected generic skills to make them employable. Such accountability remains in the higher learning institutions to incorporate smartly such assessment into the educational framework.

3. Item Response Theory Methodology in Performance Assessment

A primary goal of assessment is the determination of how much of such latent traits a student possessed. Teaching students how to learn as well as assessing how well students learn is an integral part of this new paradigm in engineering education [16]. The

measurement of cognitive levels achieved for SEE 3512 Electromagnetic Theory-1 (EMT-1) for the first semester of year 2004/05 was carried out by using Item Response Theory (IRT). This assessment model is a classroom-based measurement on which holistic judgments regarding competence is done. The key dimensions of the generic skills acquired are evaluated.

The IRT analysis is based on difficulty index and discrimination index. Difficulty index indicates the percentage of students who correctly answered each test item[1]. Whereas discrimination index refers to the ability of the item to distinguish between more and less knowledgeable students; the students are grouped into upper 1/4 and lower 1/4 of scorers[1]. This gives an indication of the student's ability to answer a given task. The generic term "ability" is used within IRT to refer to such latent traits previously mentioned.

The learning outcomes for SEE 3512 EMT-1 have been identified in the course outline according to Bloom's Taxonomy criteria. Criterion-referencing measurement is used to describe each examinee's test performance in terms of specific behaviours.

The domain of knowledge and behaviours concerned for SEE 3512 EMT-1 are; *determine*, *perform*, *evaluate*, *apply*, *compute*, *solve* and *gain*. It can be deduced that the generic skills that are addressed or assessed include Communication Skills, Teamworking, Problem Solving, Adaptability and Lifelong Learning. The final paper contributes 50% of the total assessment with the other 35% each from series of Test 1 & 2 and 15% for quizzes / assignment. The final exam paper for SEE 3512 EMT-1 Semester 1 2004/05 was duly analyzed and results are tabulated in Table 1. It should be noted that the generic competency acquired by assessing the Bloom Taxonomy criteria in the final examination paper is in the thinking skills category as defined by Figure 1.

Nevertheless, all the other dimensions such as computer literacy, interpersonal and personal competencies were also inculcated throughout the course via tutorials and assignment. However, their contribution is less towards the course evaluation since bigger emphasis is given on thinking skills assessment. Each attributes therein; problem solving, creativity and critical thinking as well as decision making process carries a higher score apportionment.

Fundamentally, the IRT employs the discrimination and difficulty indices; denoted as '***a***' and **'*b*'** respectively**,** being a set of parameters whose numerical values gives a particular item characteristic curve. The properties of the item characteristic curve were defined in terms of verbal descriptors such as; easy or hard, high or low. While this is useful to obtain an intuitive understanding of item characteristic curves, it lacks the precision and rigour needed.

Rasch Model is a mathematical model for the item characteristic curve showing the relation of the probability of correct response to ability. The equation for the Rasch model is given by the following [2]:

$$P(\theta) = \frac{1}{1 + e^{-a(\theta - b)}}$$

where $P(\theta)$ is the probability of correct response for a given ability which identifies the loci on the *S* - curve indicating the student's ability for a specific task. This will determine the type and degree of generic skills improvement needed henceforth.

4. Findings and Discussion

Table 2 below shows the outcome of the teaching and learning process. It displays the level of cognitive skills acquired and the construct validity of a given topic. The overall discrimination index of a=0.41 indicates the students' achievement in attempting the final paper can be categorized as very good by Rasch Model discrimination index. It is noteworthy to mention that the students examined have been subjected to active and collaborative types of learning [9], [10]. Initial investigations have shown that the classes conducted using active learning method performed better than that using conventional lectures [3],[4]. An evaluation of Table 2 yields a number of findings to be delved further.

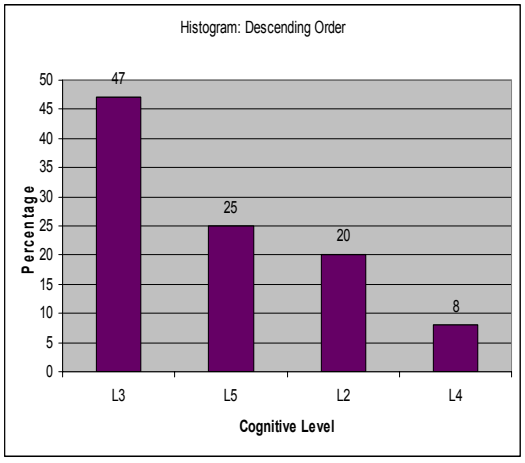
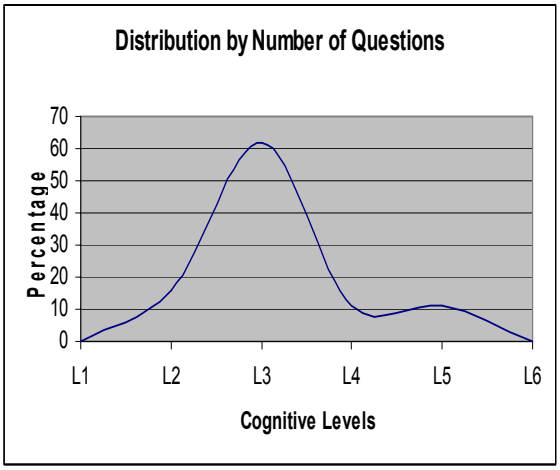


Figure 2. Cognitive level assessed in descending order

Most students attempted Q1 and Q3 which encompassed primarily cognitive development area L2: -*Comprehension* and L3: -*Application* and equal



number chose to answer Q2 and Q4. Thus, it gives a fair reflection of the students' assessment with a fairly even spread from L3: - *Application*, L4: - *Analysis* to L5: - *Synthesis* irrespective whether the student answered Q2 or Q4 for the due evaluation of cognitive level acquired. The assessment gave focus on L3: -*Application*; which carries 35 marks equivalent to 47% of the whole assessment followed by L5: -*Synthesis*; 25 %, L2: -*Comprehension*; 20% and L4: -*Analysis* as the balance of the assessment as shown in Figure 2.

The histogram sorted in descending order shows the degree of coverage for each of the generic skills assessed in the final examination paper. Figure 3 displays the spread of cognitive levels examined.

Figure 3. Spread of question by cognitive levels

By virtue this is a third year subject of a five-year program, the spread can be further improved to encompass L1 and perhaps L6 to some extend. It is important to recognize the need to develop other areas of generic skills at this level of study. Emphasis on upper end generic skills is definitely prudent and can contribute significantly to a student at this level. The distribution by number of questions as shown in Figure 3 conspicuously shows the present leptokurtic spread needs to be further evened out to appear more platykurtic; hence a better coverage of generic skills to be developed. The Test Specification of EMT-1 need to be reviewed to ensure the sufficiency of such coverage as stated in the learning outcomes statement.

It was generally found that female students attain a better level of cognitive achievement in all domain areas as shown in Table 3. A significant difference is found in their ability in analyzing (L4) a given problem. Male students faired worst in the said cognitive skill. However, in applying (L3) the knowledge acquired, their results did not show any significant difference. Upon scrutiny of the answer scripts, male students revealed that they tend to shun away prematurely in approaching a problem which demands an analysis whereas their female counterparts took a good concerted effort to their level best attempt to answer the question. Generically the students has developed a good understanding and are able to apply their knowledge with L2 and L3 achieved at a commendable b=0.86 and 0.64 respectively. The discrimination index obtained gave an indication on the degree of separation; hence the differences in the students' ability in acquiring the required cognitive skill. The larger the discrimination index, the bigger the gap in the students' ability within the cohort to develop the required generic skill. Table 4 shows that Bumiputra male students exhibit large discrepancies in almost all aspects with $a > 0.5$ except in L4: - *Analysis*, as compared to the others. Overall, Bumiputra females showed a more consistent acquisition of generic skill. This information is vital in giving pointers to education providers to plan the proper corrective action in arresting an identified problem.

The IRT Analysis serves as a barometer for learning ability. Therefore it can be used to measure the effectiveness of the learning process. Table 5 exhibits the overall learning accomplishment where the male students obtained only 60.3% whilst their female counterpart achieved 64.3%. This data provides an insight on the sufficiency and level of generic skills acquired thus far. The overall achieved level of learning becomes the benchmark to ascertain the preparation needed in assisting the students to proceed to the next level of generic skill.

Table 6 exhibits the overall learning accomplishment by Bumiputra male students who obtain a commendable 54.6% despite the large disparities in difficulty index. Their Bumiputra female counterpart instead achieved a mere 59.0% though more consistent in the acquisition of the generic skills. Bumiputra females' achievements are still not outstanding enough to top the cohort performance. Nevertheless, Bumiputra males' dismal performance in their analytical thinking (L4) ability; b=0.19, certainly need a closer look particularly which they faired poorest. Their ability to acquire this attribute with only a minute magnitude; being only half of the cohorts' capability, is surely a grave concern which call for prudent measures forthwith. The evaluation thus far, however is very limited to the performance of

students to be discussed on a group basis only. Discussion by simple tabulation of mean average of discrimination and difficulty indices do not have the rigour to extract detailed information to an adequate depth. This calls for IRT characteristic curve analysis to be utilized.

Figure 4 contains three (3) item characteristic curves having the same difficulty level but differing discrimination indices. The IRT characteristic curves is a function of '*a*', the discrimination index. For a given value of difficulty index, the slope of the curve gets steeper as the value of discrimination index becomes higher.

In this case, the middle curve (represents the male students) shows a steeper slope compared to the upper curve (the female students). This justifies that the development of generic skills of the female students is easier and better throughout. Furthermore, Q.4a is of L5-*Synthesis* type which is a higher end of cognitive skill. Hence, a near perfect discrimination between lowest-ability and highest-ability of male examinees. The upper low curve which refers to Q.2b(i), indicates female examinees displays a fairly even acquisition of L3-*Application* type of thinking skills.

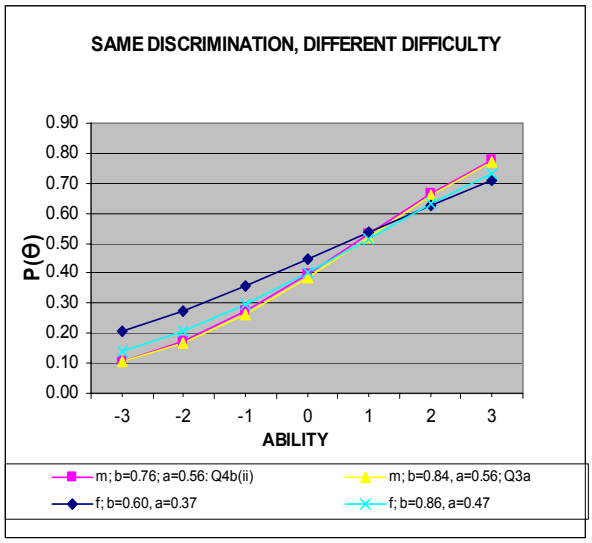
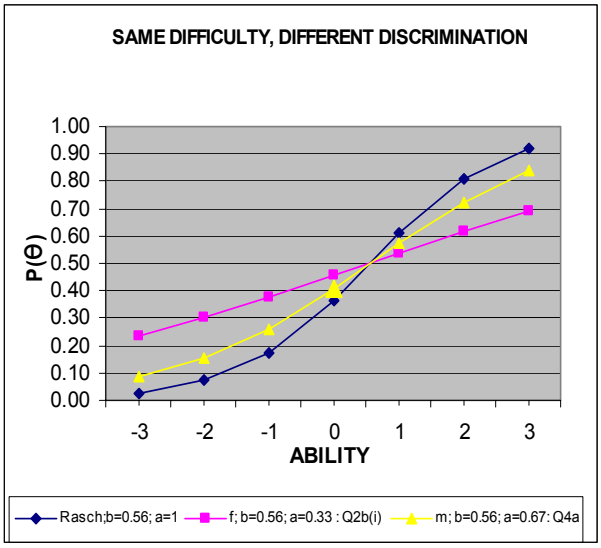


Figure 4. Item Characteristic Curve 1 - Same difficulty, different discrimination

Item characteristic curves with similar level of discrimination but differing difficulty indices is illustrated in Figure 5.

Both Q.3a and Q.4b(ii) represent items with moderate difficulty. As mentioned before, the students examined have been subjected to active and cooperative types of learning. Questions Q.3a and Q.4b(ii) are of L2-*Comprehension* and L3-*Application* cognitive skills, respectively. The female students were found to have less difficulty in developing these thinking generic skills as compared to their male cohort. Thus, it can be concluded that female examinees have a better acquisition of L2-*Comprehension* and L3-*Application* skills.



L1: Knowledge; L2: Comprehension; L3: Application; L4: Analysis; L5: Synthesis; L6: Evaluate

Figure 5. Item Characteristic Curve 2 - Same discrimination, different difficulty

This paper is an attempt to give a scale of assessment for the generic skill developed based on Rasch Model Characteristic Curve as exhibited in Figures 6 and 7. By giving a certain discrete value using a common measurable unit, it is then possible to establish the Pre-Requisite Employability Traits. Education providers are now equipped with a measurement tool that is able to assist them to evaluate each students ability by stipulated generic skills. The students can now be identified whether they truly have achieved the minimum required ability for each generic skill required at each level of study.

Figure 6 shows $P(\theta)$, of L4-*Analysis* cognitive skill, is first established from the students' raw score by each item. A horizontal line is then pulled across until it crosses the Rasch Model Characteristic Curve. The ability value θ_n; where n is the notation for the respective required cognitive skill, shall be a value between -3 being the lowest, through 0 and +3, the highest on the x-axis. As an illustration, if $P(\theta)$=0.64 then by interpolation, $\theta_n = +0.80$. It cannot be taken at $\theta_n = +1.40$ because the horizontal line that crossed the raw score curve is not calibrated to the Rasch Model Characteristic Curve. Thus, after calibration, the score

for analytical thinking skill of this particular student is taken at θ_n = +0.80; and so forth.

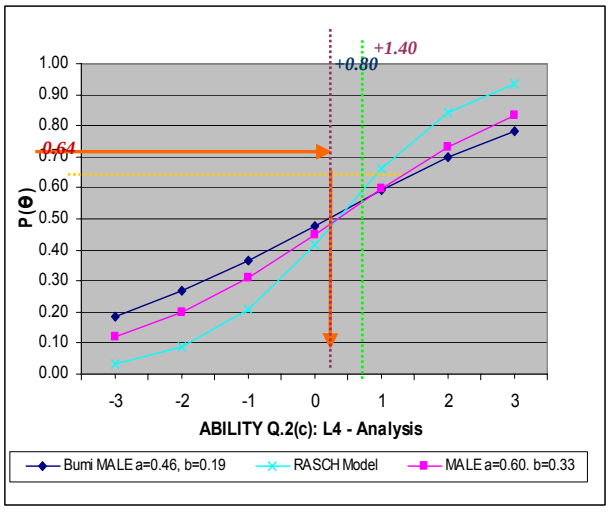


Figure 6. Item Characteristic Curve 3 - Assessing individual's generic achievement

Figure 7 shows the method to establish a student's position. For this purpose θ_n=*+0.00* is taken as the benchmark, where the student is thought not to have acquired the requisite generic skill sufficiently. Similarly $P(\theta)$ cannot be taken at 0.36 from the Rasch Model Characteristic Curve but by extrapolating the line until it passes through the raw score curve.

Then a horizontal line is drawn to establish the correct $P(\theta)$; in this case interpolated at $P(\theta)$ = 0.44. The true raw score can be computed by proper substitution and those students having lower than the identified score can be categorized as not possessing the pre-requisite traits.

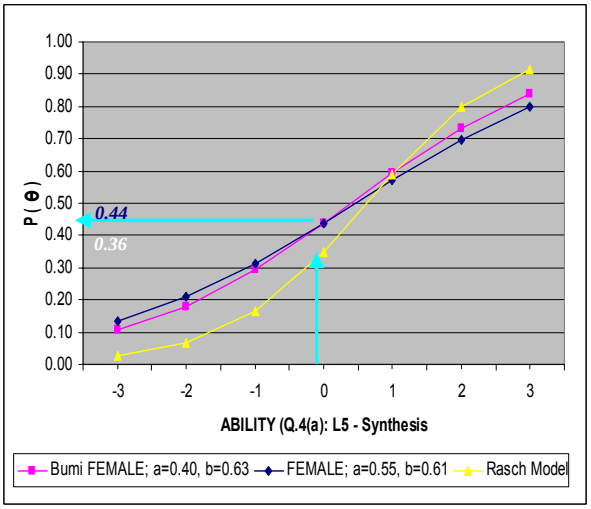


Figure 7. Item Characteristic Curve 4 Evaluating individual's position

5. Conclusion and Recommendations

Upon evaluation of the final EMT1 examination paper, it was found to be deficient in some areas stipulated in the course outline learning outcomes. It should be improved to encompass the requisite generic skills to be developed and enhance the quality of teaching and learning in FKE. The final exam paper *pro-forma* Table of Test Specification is proposed as per Table 7. This will serve as a benchmark in drawing out EMT-1: Table of Test Specifications to construct the content of the tests or final examination papers i.e. construct validity which establishes whether a test matches the capabilities or psychological construct that is to be measured, i.e. latent traits specified in the course outline. However, it should be noted that this is subject to further study.

The findings established that FKE students have developed some of the pre-requisite employability skills to a sufficient satisfactory depth. This is evident when most of the graduates have been grabbed by reputable multi nationals prior to the students' graduation. This perception can be further enhanced after taking into account all the findings made in this study.

The Rasch Model Characteristic Curve can serve as a measurement tool to measure the expected learning outcomes hence the required generic skill. It can be observed from the graphs that regardless of the level of discrimination, item difficulty locates the student's performance along the ability scale. This can be used conclusively as a discrete measurement of the student accomplishment for each latent trait. Hence, it reflects the effectiveness of the learning process as measured by the generic skills acquired for a particular course. This can be a basis for future improvement of students' assessment method; i.e. tests and final exam papers and learning outcomes. This evaluation is more holistic in nature and specific in resolving the problem.

Table 8 shows a recommended evaluation form of acquired generic skills known as the GSSC-*Generic Skill Score Card* by program year and subject. In the event the students show symptoms of weakness in certain trait, this can be traced more effectively very early. This method of measurement will help guide education providers to response more definitely on the nature of corrective action to be done. On the other hand, a more balanced reporting is developed where

their accomplishment is equally recognized. Since the discrete value of score uses Rasch Model ability scale, this reporting method can be used widely across the board.

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Table 1. Item Classification by question and spread of cognitive levels derived from Final Exam Paper Sem.1-2004/05

Item		Marks	%	Cognitive Levels					
No. Q	No. Sub-Items			**L1**	**L2**	**L3**	**L4**	**L5**	**L6**
1	a	7	9.3		√				
	b	3	4.0		√				
	c	15	20			√			
2	a	9	12					√	
	b(i)	7	9.3			√			
	b(ii)	2	2.7			√			
	c(i)	4	5.3				√		
	c(ii)	3	4.0				√		
3	a	5	6.7		√				
	b(i)	4	5.3			√			
	b(ii)	4	5.3			√			
	b(iii)	7	9.3			√			
	b(iv)	5	6.7			√			
4	a	10	13.3					√	
	b(i)	4	5.3			√			
	b(ii)	3	4.0			√			
	b(iii)	4	5.3			√			
	b(iv)	4	5.3			√			
Total	**18**	**100**			**3**	**11**	**2**	**2**	
%			***100***		***16***	***62***	***11***	***11***	

Table 2. OVERALL STUDENT'S PERFORMANCE : Cognitive level achievement by Topics

Item		Marks	Cognitive Levels											
Topic	No. Sub-Item		**L1**	**L2**		**L3**		**L4**		**L5**		**L6**	Topic $\overline{X}$	
				b	***a***	***b***	***a***	***b***	***a***	***b***	***a***		***b***	***a***
1.Coulomb's Law	1(a)	7		0.80	*0.58*								**0.78**	***0.46***
	1(b)	3		0.92	*0.27*									
	1(c)	15				0.62	*0.52*							
2. Gauss's Law	2b(i)	7				0.54	*0.41*						**0.65**	***0.47***
	4b(ii)	3				0.76	*0.52*							
3. Potential & Energy	2c(i)	4						0.38	*0.48*				**0.51**	***0.49***
	2c(ii)	3						0.38	*0.48*					
	4b(iii)	4				0.76	*0.52*							
4. Current, Materials & Capacitance	2a	9								0.65	*0.59*		**0.65**	***0.61***
	2b(ii)	2				0.54	*0.41*							
	3a	5		0.86	*0.55*									
	3b	20				0.57	*0.71*							
	4a	10								0.61	0.67			
	4b(i)	4				0.76	*0.52*							
	4b(iv)	4				0.76	*0.52*							
5. Poisson & Laplace Equations*														
Cognitive $\overline{X}$				**0.86**	***0.47***	**0.64**	***0.57***	**0.38**	***0.48***	**0.63**	***0.63***		**0.64**	***0.41***

L1: Knowledge L2: Comprehension L3: Application L4: Analysis L5: Synthesis L6: Evaluation

'*a*': Very good = .40 and above Good = .30 to .39 Marginal = .20 to .29 Review = .00 to .19 Discard = Below .00

Table 3. Difficulty index 'b'; by Bloom`s Taxonomy, level of cognitive skill

Cognitive Level	**L2**	**L3**	**L4**	**L5**	***OVERALL***
OVERALL	0.86	0.64	0.38	0.63	0.64
MALES	0.74	0.58	0.33	0.59	0.63
BUMI MALES	*0.79*	*0.50*	*0.19*	*0.52*	*0.54*
% ∂ M	6.75%	(13.79%)	(42.42%)	(11.86%)	(14.28%)
FEMALES	0.86	0.60	0.46	0.67	0.67
BUMI FEMALES	*0.63*	*0.44*	*0.29*	*0.60*	*0.53*
% ∂ F	(26.74%)	(26.67%)	(36.96%)	(10.44%)	(20.89%)

L1: Knowledge; L2: Comprehension; L3: Application; L4: Analysis; L5: Synthesis; L6: Evaluate

Table 4. Discrimination index 'a' by Cognitive levels; Students' learning ability spread

Cognitive Level	**L2**	**L3**	**L4**	**L5**	***OVERALL***
OVERALL	0.47	0.57	0.48	0.63	0.41
MALES	0.37	0.44	0.47	0.52	0.42
BUMI MALES	*0.68*	*0.75*	*0.46*	*0.60*	*0.47*
% ∂ M	83.78 %	70.45%	(0.02%)	17.65%	11.90%
FEMALES	0.41	0.27	0.54	0.55	0.36
BUMI FEMALES	*0.65*	*0.27*	*0.34*	*0.48*	*0.29*
% ∂ F	58.53 %	0.0%	(37.03%)	(12.72%)	(19.44%)

L1: Knowledge L2: Comprehension L3: Application L4: Analysis L5: Synthesis L6: Evaluate

Table 5. Overall Learning Barometer: Weighted Score

Cognitive Level	**L2**	**L3**	**L4**	**L5**	***OVERALL***
No. of Questions	3	2	3	10	***18***
% Weightage	***16***	***11***	***16***	***57***	***100 %***
b $\overline{X}$ MALES	0.66	0.64	0.47	0.62	
Weighted Score	0.105	0.070	0.075	0.353	
Cumulative MALES *ws*	**0.105**	**0.175**	**0.250**	**0.540**	**60.3 %**
b $\overline{X}$ FEMALES	0.79	0.58	0.51	0.65	
Weighted Score	0.126	0.064	0.082	0.371	
Cumulative FEMALES *ws*	**0.126**	**0.190**	**0.272**	**0.643**	**64.3 %**
b $\overline{X}$ OVERALL	0.78	0.65	0.51	0.65	
Weighted Score	0.125	0.071	0.082	0.371	
Cumulative OVERALL *ws*	**0.125**	**0.196**	**0.278**	**0.649**	**64.9 %**

L1: Knowledge L2: Comprehension L3: Application L4: Analysis L5: Synthesis L6: Evaluate

Table 6. Bumi Students' Learning Barometer: Weighted Score

Cognitive Level	L2	L3	L4	L5	*OVERALL*
No. of Questions	3	2	3	10	***18***
% Weightage	***16***	***11***	***16***	***57***	***100 %***
b $\overline{X}$ BUMI MALES	0.86	0.53	0.19	0.56	
Weighted Score	0.137	0.058	0.032	0.319	
Cumulative BUMIMALES *ws*	**0.137**	**0.195**	**0.227**	**0.546**	**54.6 %**
b $\overline{X}$ BUMI FEMALES	0.69	0.48	0.32	0.66	
Weighted Score	0.110	0.053	0.051	0.376	
Cumulative BUMI FEMALES *ws*	**0.110**	**0.163**	**0.214**	**0.590**	**59.0 %**
b $\overline{X}$ OVERALL	0.82	0.53	0.27	0.64	
Weighted Score	0.131	0.058	0.043	0.364	
Cumulative OVERALL *ws*	**0.131**	**0.189**	**0.232**	**0.596**	**59.6 %**

L1: Knowledge L2: Comprehension L3: Application L4: Analysis L5: Synthesis L6: Evaluate

Table 7. Pro-forma EMT-1: Table of Test Specification

Item	Cognitive Level						
TOPIC	**L1**	**L2**	**L3**	**L4**	**L5**	**L6**	***%***
1. Coulomb's Law	1	1	2				20
2. Gauss's Law	1	1	2				17
3. Potential & Energy		1	2	1	1		17
4. Current, Materials & Capacitance		1	2	2	1	1	30
5. Poisson & Laplace Equations	1	1	2				16
Total	**3**	**5**	**10**	**3**	**2**	**1**	***100***
%	***12.5***	***21***	***42***	***12.5***	***8***	***4***	

L1: Knowledge L2: Comprehension L3: Application L4: Analysis L5: Synthesis L6: Evaluate