Meaningful Hybrid e-Training Model via POPEYE Orientation

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Abstract— This present study is aimed at developing a meaningful hybrid e-training model for ICT trainers by distinguishing the usefulness of its' content, delivery, service, outcome and infrastructure. In doing so, the study sought to establish the content validity, test reliability and construct validate factors affecting usefulness of the hybrid e-training approach. Overall reliability coefficients of the instrument examined when analyzed with SPSS 15.0 using Cronbach Alpha reliability test were .986 while reliability at the scale levels were also acceptable ranging from .886 to .971. Subsequently external construct validity was conducted by employing structural equation modeling using confirmatory factor analysis (CFA) with AMOS 7.0. Overall analyses suggested that the instrument is valid and reliable to measure the usefulness of a hybrid e-Training module or program. Internal consistency was still maintained after CFA with overall reliability coefficient of .959 and at the scale level ranging from .814 to .909. A revised model was developed from the hypothesized measurement model with findings showing evidences for construct validity. Goodness-of-fit measures of comparative fit index (CFI) and non-normed fix index (NNFI also known TLI) were above suggested threshold > .90 (CFI=.943; TLI=.930). The paper will also showcase some of the instructional media and method used in the study to promote good practice of the problem oriented project based hybrid e-training (POPEYE) orientation.

Keywords— E-training model, reliability, structural equation modeling, validity, problem oriented project based learning.

I. INTRODUCTION

It is evident that in order to progress further into the area of e-Learning, particularly e-Training for ICT trainers, an appropriate measurement scale is required. This scale would ideally, distinguish the usefulness of a program in terms of its' content, delivery, service, outcome and infrastructure. This is in line with the rapid change in information & communication technology (ICT) and businesses practices & innovations that warrant for realignment of the IT curriculum to suit the needs for business strategies [1][2].

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II. AIM OF THE STUDY

The aim of this study is to examine the reliability and validity of the **H**ybri**d** e-**T**raining In**s**trument (HiTs) used to measure usefulness of a Hybrid e-training (HiT) module and eventually develop a model by comparing the measurement model against reality as represented by the sample data. The HiT module was designed to adopt the problem oriented project based hybrid e-training (POPEYE) orientation to deliver computer and technology courses via various instructional media. The module's aim is to provide a meaningful e-Training experience by integrating online learning strategy into the regular face-to-face and self-learning method.

Constructs of this instrument were adapted from the Demand Driven Learning Model (DDLM) inventory which is a web-based learning model [3] and evaluation tool developed by MacDonald et al. [4]. DDLM was defined by five key constructs: Structure, Content, Delivery, Service and Outcomes. The 59-item DDLM inventory were then modified and adapted for HiTs to fit the Asian and local university's culture. Adaptation was mainly guided by result of interaction and document analysis done during feasibility phase of the study. The first version of the adapted instrument yielded 61 items regarding e-Training for adult learners in a hybrid environment on a Likert-type scale.

A. Research Objectives

Specifically, the objectives of the study were to (i) establish face and content validity, and then to (ii) determine the reliability and internal consistency of HiTs and finally to (iii) investigate its constructs validity by developing a revised model of Hybrid e-Training using confirmatory factor analysis.

B. Research Question

Upon establishing the first and second objective of the study as discussed in the following methodology section in Section VI, the study was then guided by the following research question to achieve the third objective, "Is trainee's perspective towards usefulness of the Hybrid e-Training module influenced by the module's content, delivery, service, structure and outcome?"

III. Operational Definition

Terminology associated with the use of structural equation modeling and major terms for this study are operationally defined as follows. More elaborated terminology however, will be discussed in the subsequent section. This includes discussions about structural equation modeling and confirmatory factor analysis.

A. Hybrid

The term hybrid refers to a combination of learning and instructional strategy comprising of face-to-face, online and self learning.

B. E-Training

E-Training in this study refers to a course, module or program delivered in a hybrid environment as a process of developing knowledge, skills, and abilities in ICT trainers for the achievement of organizational goals.

C. ICT trainers

ICT trainers in this study refers to university staff appointed by the university's ICT Center, whose role is to support and direct staff in the area of ICT and Computer Science; (ii) educational developers and learning technologists attached to the university's Computer Center, whose role is to work with or alongside practitioners to enable and enhance e-learning researchers into learning and e-learning, including academic researchers, action researchers and research-project staffs and assistants; (iii) appointed ICT trainers, teachers and teacher trainees and (iv) ICT educators in the country or Asia in general.

D. Observed variables

Observed variables in this study also termed as measured, indicator or manifest variables. Researchers traditionally use a square or rectangle to designate them graphically. Response to the likert-scaled item in this study is an example of an observed variable.

E. Unobserved variables

Unobserved variables in this study are termed latent factors. Factors or constructs are depicted graphically with circles or ovals. Common factor is another term used because the effects of unobserved variables are shared in common with one or more observed variables [5]. In Fig. 1, the large circle labeled with a prefix unobserved is an unobserved or latent variable.

F. Unique factor

In reference to Fig. 1, the small circles labeled with the prefix letter "e" are the unique factors or measurement errors in the variables. The unique factors are different from the latent factors because their effect is associated with only one observed variable.

G. Causal effect

In reference to Figure 1, the straight line pointing from a latent variable to the observed variable indicates the causal effect of the latent variable on the observed variables.

H. Correlation

In reference to Fig. 1, the curved arrow between latent variables indicates that they are correlated. If the curve were changed to a straight one-headed arrow, a hypothesized direct relationship between the two latent variables would be indicated. In addition, the directional path would be considered a structural component of the model [5], [6] and [7].

I. Face Validity

Face validity is the extent to which the content of the items is consistent with the construct definition, base solely on the researcher's judgment [8]. In this study, after face validity was done, judgment by fellow researchers and English as a second language expert was sought to ensure the sentences constructed are of the technical and language level understandable by targeted respondents.

J. Content Validity

Content validity is the assessment of the degree of correspondence between the items selected to constitute a summated scale and its conceptual definition [8]. In this study expert judgment from the field of education and training, measurement and evaluation, educational technology, general studies, information system, ICT and computer education were used to assess whether the hybrid e-training instrument measures what it is proposed to measure.

K. Construct Reliability

Measure of reliability and internal consistency of the measured variables representing a latent construct. It must be established before construct *validity* can be assessed [8].

L. Construct Validity

Construct validity is the extent to which a set of measured variables are actually representing the theoretical latent construct they are designed to measure [8].

M. Confirmatory Factor Analysis

The use of factor analysis to test hypotheses about the latent traits that underlie a set of measured variables [8].

IV. Structural Equation Modeling

Structural equation modeling (SEM) is more of a confirmatory technique but it can also be used for exploratory purposes [5], [6] and [7]. SEM encompasses two components, (i) a measurement model, essentially the confirmatory factor analysis (CFA) and (ii) a structural model. The measurement model of SEM is CFA as in Fig. 1. It depicts the pattern of observed variables for those latent constructs in the hypothesized model.

A major component of a CFA, which is to test the reliability of observed variables were conducted in this study. As part of the process, factor loadings, unique variances, and modification indexes (should a variable be dropped or a path added) are estimated to derive the best indicators of latent variables prior to testing a structural model. However,

discussion about the testing of the structural model which is the larger part of this study is beyond discussion of this paper.

V. CONFIRMATORY FACTOR ANALYSIS

Confirmatory factor analysis (CFA) is a confirmatory technique that is theory driven and therefore the planning of the analysis is driven by the theoretical relationships among observed and unobserved variables. In this research, when CFA was conducted, the researchers hoped to minimize the difference between estimated and observed matrices. In reference to the example in Figure 1, each of the two latent variables is measured with five observed variables. The ten observed variables are responses from statements from two Likert-based scales. The numbers "1" in the diagram indicate that the regression coefficient has been fixed to 1. Coefficients are fixed to a number to minimize the number of parameters estimated in the model. In Figure 1, the curved arrow between latent variables indicates that they are correlated. If the curve were changed to a straight one-headed arrow, a hypothesized direct relationship between the two latent variables would be indicated. In addition, the directional path would be considered a structural component of the model [5]-[7].

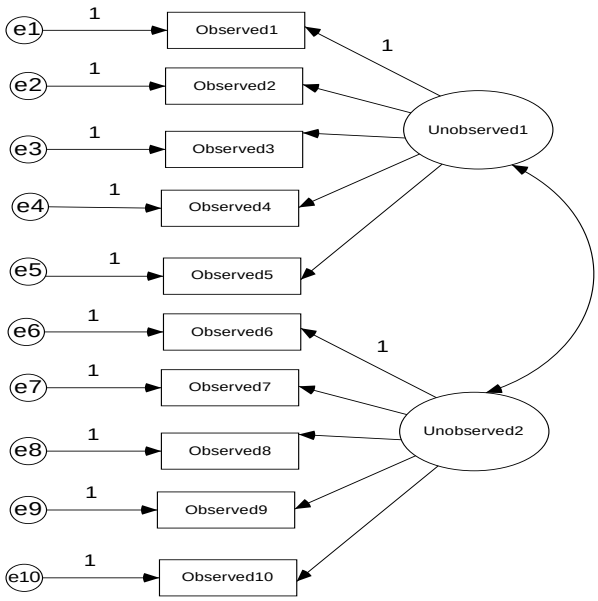

Fig.1 Generic example of structural equation modeling application to test for factorial validity of a theoretical construct using the confirmatory factor analysis. e = error

VI. RESEARCH METHOD

A. Feasibility & Early Study

A preliminary model was constructed based on literature review and DDLM, the Demand Driven Learning Model [3]. The model was then further reconstructed based on new themes emerged from the data collected during training sessions, interview and content analysis of interactions and feedbacks (616 postings) from ICT trainers who attended the hybrid training courses in UKM, the national university of Malaysia in the year 2003-2005. Task analysis was then conducted to identify what is significant to be worth included in the new, updated curriculum and to identify the learner needs. Fig. 2 shows the preliminary model while Table 1 and Table 2 shows result of task analysis conducted to determine appropriate and demand driven content as well as instructional media and method to be used for the hybrid course. Consequently, based on findings of this early study, a handbook for instruction of computer training delivery course was developed as shown in Fig. 3. Table 3 shows the learning matrix embedded into the course handbook. The learning matrix specifies all the learning outcomes expected from the course with the associated learning process and assessment. This section will also show some captured screens of learning resources developed using the university learning management system (Fig. 4) and the course blog (Fig.5-6).

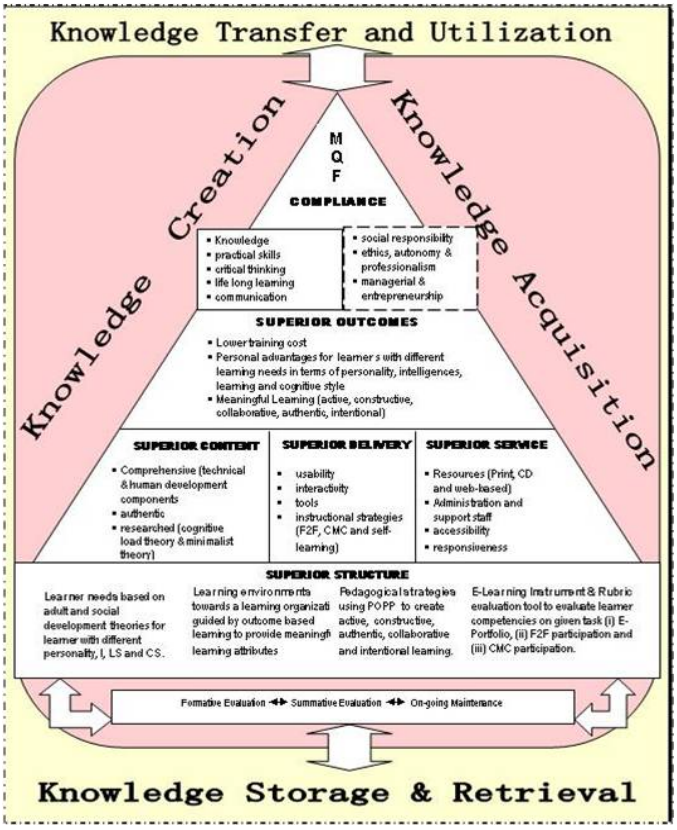

Fig.2 A reconstructed preliminary model based on literature review and the Demand Driven Learning Model [3] in combination with the new themes that emerged based on data collected during training sessions.

B. Sample

A number of different communities of users are referred to in this study. Broadly speaking they are ICT trainers as defined in the terminology section. Despite their internal complexities, these communities will be referred to in this paper, simply as ICT trainers. The pilot sample was 42 ICT trainers from the same institution. The subsequent sample

originally encompasses 213 participants, 172 females and 37 males, studying at a public university in Malaysia. The trainees were enrolled in credit-bearing education and computer education courses. The age of trainees range from 20 to 48 years old. Highest frequency is in the range of 21-25 years old; that is 62% (132) of the whole sample. The trainees represented four origin, (31.9% (68) from East Malaysia, 51.6% (110) from West Malaysia, 1.4% (3) from Brunei and 14.6 (31) from main land China. They make up four main races with 71.4% (152) Malays, 23.9% Chinese, 2.8% (6) Indians and 1.4% (3) other from other races. All but 28.2% (60) of the participants had none or less than one year teaching experience.

Table 1 Task analysis for computer education content

Content	Time (minutes)	Probability of use	Consequences of incompetence	Importance
Foundation of Computer Education:				
11. Computer in Education**	30 (OL)	100.0% (24)	Significant	Important
12. Computer Integration in Teaching & Learning**	30 (OL)	100.0% (24)	Significant	Important
13. Computer Applications in the Teaching of Science and Mathematics in English**	30 (OL)	25.0% (6)	Significant	Important
14. Computer Mediated Communication**	30 (OL)	95.8%(23)	Significant	Important
15. Integrated Learning in Computer Education**	30 (OL)	95.8%(23)	Significant	Important
16. Learning Organization*	60 (Hyb)	75.0%(18)	Significant	Critical
17. Teaching Methods and Strategies**	60 (Hyb)	100.0%(24)	Significant	Critical
18. Facilitator Skill*	30 (OL)	100.0%(24)	Significant	Critical
19. Effective Computer Training Delivery**	60 (Hyb)	100.0%(24)	Significant	Critical
20. Instructional Design **	50 (F2F)	100.0%(24)	Disastrous	Critical
Learning Theories:				
13. Behaviorism**	30 (OL)	100.0%(24)	Serious	Important
14. Constructivism**	90 (Hyb)	95.8%(23)	Significant	Critical
15. Cognitivism**	30 (OL)	58.0%(14)	Significant	Important
16. Adult Learning*	25 (F2F)	92.0%(22)	Significant	Critical
17. Situated Learning**	30 (OL)	58.0%(14)	Significant	Important
18. Contextual**	30 (OL)	58.0%(14)	Significant	Important
19. Anchored Instruction**	30 (OL)	58.0%(14)	Significant	Important
20. Human-Computer Interaction**	30 (OL)	92.0%(22)	Significant	Important
21. Minimalist**	25 (F2F)	100.0%(24)	Significant	Critical
22. Experiential Learning**	30 (OL)	92.0%(22)	Significant	Critical
23. Cognitive Load**	25 (F2F)	92.0%(22)	Significant	Critical
24. Cognitive Flexibility**	30 (OL)	58.0%(14)	Significant	Critical
Learner Differences:				
5. Multiple Intelligences**	50 (F2F)	92.0%(22)	Significant	Critical
6. Personality**	50 (F2F)	100.0%(24)	Serious	Critical
7. Learning Style**	50 (F2F)	100.0%(24)	Significant	Critical
8. Cognitive Style*	60 (OL)	100.0%(24)	Significant	Critical
Computer Skills:				
6. Internet & e-Learning**	60 (Hyb)	100.0%(24)	Serious	Important
7. Blogging*	60 (Hyb)	100.0%(24)	Significant	Critical
8. Web Construction**	60 (Hyb)	100.0%(24)	Significant	Critical
9. Hard Disk Maintenance**	30 (OL)	100.0%(24)	Significant	Important
10. Multimedia Applications**	180(OL)	100.0%(24)	Significant	Critical

* suggested for inclusion into new curriculum by past course participants/education expert
** covered in current curriculum
FTF= Face to face interaction
OL = Online Learning
Hyb= A combination of F2F and online learning

Adapted from Pratt (1980)

C. Instrument

The first version of the adapted instrument yielded 61 items to measure usefulness of a hybrid e-Training course on a Likert-type scale. Likert scale has five points from strongly agree to strongly disagree; those with 6, 7 or 8, etc. are Likert-type scales [9]. Likert actually scaled the category labels he used. Although the instrument for this study uses a scale of 1-5, no scaling has been done to determine the anchors. In addition, a response category for "Not Applicable" was added for each Likert item [10]. As such we refer them as a "Likert-type" scale.

First phase of the study was to establish face and content validity and to test reliability and internal consistency of HiTS. The instrument were reviewed in various aspects; technical, language and instructional design in terms of (i) pedagogical/learning strategy, (ii) theories in practice, (iii) cosmetic design of instructional media and (iv) course functionality. The 61-item instrument still contains 5 constructs at this point namely Content (9-item), Delivery (9-item), Service (7-item), Outcome (12-item) and Structure (24-item). Respondents rated aspects of the course on a 1 to 5 scale where 1 equals "strongly disagree" and 5 equals "strongly agree"; 1 represents the lowest and most negative impression on the scale, 3 represents an adequate impression, and 5 represents the highest and most positive impression. They chose N/A if the item is not appropriate or not applicable to the course. Table 4 shows the contents of HiTs after face and content validation.

Table 2 Task analysis for instructional media and method

Instructional Media	Time (minutes)	Probability of use	Consequences of incompetence	Importance
Computer Mediated Communication:				
1. Computer in Education**	30 (OL)	100.0% (24)	Significant	Important
2. Computer Integration in Teaching & Learning**	30 (OL)	100.0% (24)	Significant	Important
3. Computer Applications in the Teaching of Science and Mathematics in English**	30 (OL)	25.0% (6)	Significant	Important
4. Computer Mediated Communication**	30 (OL)	95.8%(23)	Significant	Important
5. Integrated Learning in Computer Education**	30 (OL)	95.8%(23)	Significant	Important
6. Learning Organization*	60 (Hyb)	75.0%(18)	Significant	Critical
7. Teaching Methods and Strategies**	60 (Hyb)	100.0%(24)	Significant	Critical
8. Facilitator Skill*	30 (OL)	100.0%(24)	Significant	Critical
9. Effective Computer Training Delivery**	60 (Hyb)	100.0%(24)	Significant	Critical
10. Instructional Design **	50 (F2F)	100.0%(24)	Disastrous	Critical
Self Learning:				
1. Behaviorism**	30 (OL)	100.0%(24)	Serious	Important
2. Constructivism**	90 (Hyb)	95.8%(23)	Significant	Critical
3. Cognitivism**	30 (OL)	58.0%(14)	Significant	Important
4. Adult Learning*	25 (F2F)	92.0%(22)	Significant	Critical
5. Situated Learning**	30 (OL)	58.0%(14)	Significant	Important
6. Contextual**	30 (OL)	58.0%(14)	Significant	Important
7. Anchored Instruction**	30 (OL)	58.0%(14)	Significant	Important
8. Human-Computer Interaction**	30 (OL)	92.0%(22)	Significant	Important
9. Minimalist**	25 (F2F)	100.0%(24)	Significant	Critical
10. Experiential Learning**	30 (OL)	92.0%(22)	Significant	Critical
11. Cognitive Load**	25 (F2F)	92.0%(22)	Significant	Critical
12. Cognitive Flexibility**	30 (OL)	58.0%(14)	Significant	Critical
Face to face Meetings:				
1. Multiple Intelligences**	50 (F2F)	92.0%(22)	Significant	Critical
2. Personality**	50 (F2F)	100.0%(24)	Serious	Critical
3. Learning Style**	50 (F2F)	100.0%(24)	Significant	Critical
4. Cognitive Style*	60 (OL)	100.0%(24)	Significant	Critical
Computer Skills:				
1. Internet & e-Learning**	60 (Hyb)	100.0%(24)	Serious	Important
2. Blogging*	60 (Hyb)	100.0%(24)	Significant	Critical
3. Web Construction**	60 (Hyb)	100.0%(24)	Significant	Critical
4. Hard Disk Maintenance**	30 (OL)	100.0%(24)	Significant	Important
5. Multimedia Applications**	180(OL)	100.0%(24)	Significant	Critical

* suggested for inclusion into new curriculum by past course participants/education expert
** covered in current curriculum
FTF= Face to face interaction
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Adapted from Pratt (1980)

D. Face and Content Validation

In order to achieve face and content validity, we thoroughly reviewed related literature and conduct interaction analysis as well as document analysis. Following discussions with language and technical experts a judgment process by a jury of ten experts from the field of educational technology, measurement and evaluation, general studies, information system, computer training and education was carried out. Similar method was employed by Mohamad Sahari et al. [13] in their studies. A pre-test involving 42 students who fits the description of computer trainers at an institution of higher learning in Malaysia was completed. As a result, we came up with a 61-item HiT instrument. Although the scales were previously established scales, expert judgment was still seek out to ensure adaptations, deletions and additions were justified. When two items have virtually identical content, one was dropped. Items, upon which judges cannot agree, were also dropped. Summated scales were created from the pre-test and items with item-total correlation of less than 0.5 were deleted [8]. Factor analysis was not done at this time since the sample size was less than 50.

Fig.3 A Course Handbook for the updated curriculum of the course Instruction for Computer Training Delivery

E. Reliability and Internal Consistency

For the assessment of reliability, this 61-item instrument was administered to 42 computer trainees in a pre-test then to another 213 respondents at a higher learning institution. The cronbach alpha reliability analysis was conducted to ensure the internal consistency was at least maintained if not improved from the pre-test reliability. In the pre-test with 42 respondents, the result indicates overall cronbach's alpha of 0.957. Reliability test using data from the 213 respondents reveal an overall cronbach's alpha of .986 as shown in Table 2. After deleting five cases for missing data and outliers, the cronbach's alpha came out to **.987**. As seen in Table 5, the alphas of the hybrid e-training measures were high in each of the five constructs. They range from 0.886 to 0.971. Overall analyses suggested that the instrument is reliable to measure usefulness of the hybrid e-training module.

Table 3 Learning Matrix

Learning Outcomes	Learning Process	Assessment
Participants should be able to demonstrate the ability to apply fundamental theories and principles of instructional design and meaningful computer training delivery.	Guided student presentation	• Lesson plan • Teaching media • Teaching method • Teaching strategy • Teaching Approach • Pedagogical content knowledge
Participants should be able to apply knowledge and skills in information and communication technology articulately and develop critical thinking, inter-personal and communication skills through working in large and small multi-discipline and/or multi-cultural group.	• Identify, explore and select knowledge from various databases and resources and integrates them with prior knowledge and experience to create and organize new knowledge that can be assessed by peer and moderators. • Participants will work individually or cooperatively within their small group to design and develop a weblog and collaborate with other groups to achieve a shared goal	• Reflective journal • Online forum • Individual/group blogs
Participants as an autonomous learner and trainer are responsible: • to promote, protect and enhance social values, cultural diversity and beliefs • to adhere to the global netiquette for their benefit as well as for the participants, institution and society at large.	• Presentation and workshops • Practical Training/micro teaching/macro teaching • Blogging activities • Online discussion	• Class participation • Field work • Field report • Reflective journal • Weekly forums
• Participants are to maintain records of activities for critical reflections and improvement.	• Critical reflection	• Reflective journal
• Able to do feasibility and need analysis study to identify real world problems in media development and come up with a project to solve the problem.	• SWOT analysis • Identification and application of an instructional design model • Problem oriented project pedagogy	• An instructional media for computer training
• Able to identify global trends and suggest a short term curriculum for a computer integrated course at a competitive price yet able to break-even. • Able to create creative and innovative brochure to market the course.	• Workshop • Cooperative and collaborative group work	• An eye-catching brochure

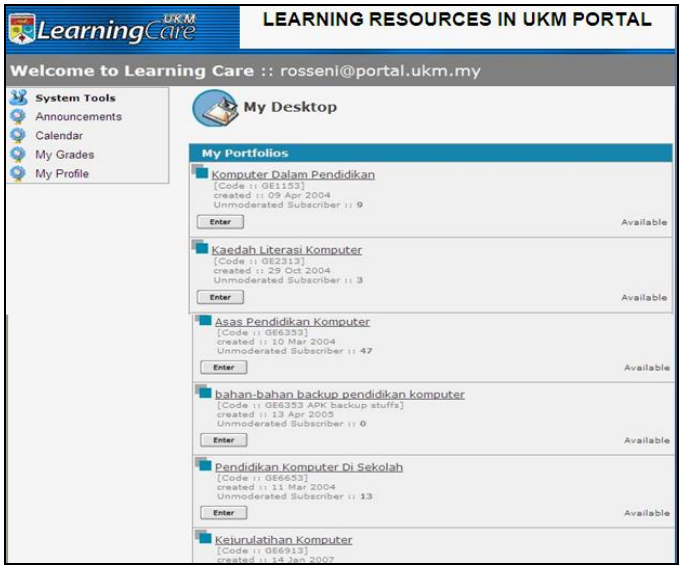

Fig.4 Some of the resources for computer education available in the university's LMS

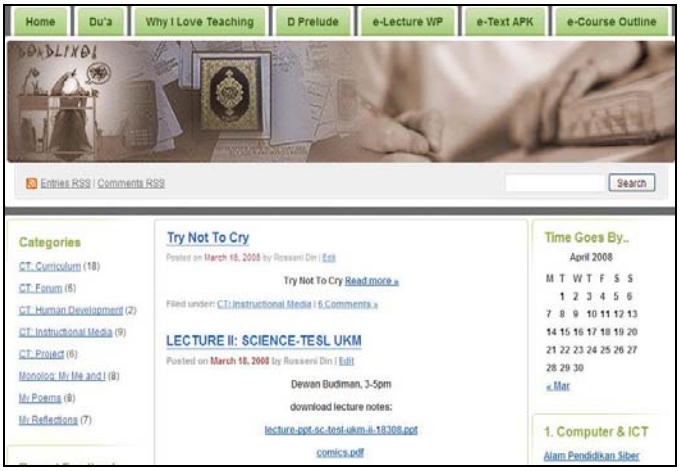

Fig.5 The front page of the computer education blog which is the official course blog at http://rosseni.wordpress.com

Fig.6. An example reflection of the course instructor in the Malay version of the official course blog

Table 4 Contents of HiTs

Factors	Item ID	Total Item
Content	C01 - C09	9
Delivery	C10 - C18	9
Service	C19 - C25	7
Outcome	C26 - C37	12
Structure	C38 - C61	24

*Total items = 61 (before extraction during principal component analysis)

F. Preparation for Confirmatory Factor Analysis

The last step taken after achieving research objective one and two is to achieve research objective number three in preparation for confirmatory factor analysis which is necessary to answer the research question. This preparation

was done using principal component analysis with varimax rotation. Varimax rotation method has proved successful as an analytic approach to obtaining an orthogonal rotation of factors which is the most widely used rotation method for data reduction [8][11] meant for subsequent use in other multivariate techniques [8]. According to Kaiser (1958) as in [11], varimax orthogonal rotation attempts to maximize the variance on factors by minimizing the number of variables loading highly on the separate factors. This process is the default in SPSS. The method normalizes the loadings on pairs of factors prior to rotation and tends to promote finding simple structures in which loadings are high on one factor and near zero on others.

A preliminary examination of the factor matrix in terms of the factor loading was made based on theory and practical significance. Factors in the range of .30 to .40 which are considered the minimal level for interpretation of structure were kept. However, research has shown that factor loadings have substantially larger standard errors than typical correlations [8]. Thus, to obtain a power level of 80 percent with the use of .05 significance level by a sample size of 208, a factor loading of at least .40 is required for significance [8]. Table 6 shows the contents of HiTS after principal component analysis.

Table 5 Reliability Analysis With Overall Reliability Coefficient Equals 0.986.

Cronbach's Alpha for construct measure	Item	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
0.933 for CONTENT measures of the hybrid e-Training system N of items = 9	I am aware of the course prerequisites	.747	.925
	I had the course prerequisite knowledge and skills	.750	.925
	I was well informed about the course objectives.	.787	.923
	Course lived up to my expectations.	.761	.924
	course relevant to my job	.700	.928
	Reading materials are relevant to the course.	.699	.928
	Strong links between theory and practice.	.755	.925
	Content includes knowledge applicable in life.	.765	.924
	Content covers current technology use.	.786	.923
0.921 for DELIVERY measures of the hybrid e-Training system N of items = 9	Is concise and uncluttered.	.703	.913
	Uses appropriate style for display.	.796	.908
	features aesthetically pleasing graphics	.768	.910
	Provides descriptions to all links.	.724	.912
	Provides materials that stimulate curiosity.	.687	.914
	Have useful functions.	.780	.908
	support face to face lecture	.732	.912
	uses appropriate technology	.735	.912
	features reasonably fast download of files	.628	.921
0.886 for SERVICE measures of the hybrid e-Training system N of items = 7	Instructor was well prepared.	.719	.864
	Face to face instruction was helpful.	.760	.860
	Online resources are useful.	.741	.862
	Online support from peers was helpful.	.789	.856
	Sufficient time was given to complete the project.	. 620	.876
	Comments are responded to within reasonable time.	.501	.898
	Suggestions are quickly responded to.	.696	.867
0.948 for OUTCOME measures of the hybrid e-Training system N of items = 12	Online support from peers was helpful.	.678	.946
	Course project is in line with my expectations.	.795	.942
	I gained more knowledge about technology	.727	.945
	I have acquired proficiency in blogging with wordpress.	.781	.943
	I have developed new skill	.783	.943
	My attitude has changed.	.767	.943
	I can use the new skill throughout my career	.746	.944
	I have applied the new knowledge in my life.	.813	.942
	I initiated new ideas from the new knowledge	.718	.945
	Interactive blogging was essential in the course.	.787	.943
	Assessment criteria were fair.	.749	.944
	I completed the required tasks for the project	.734	.944
0.971 for STRUCTURE measures of the hybrid e-Training system N of items = 24	Free wireless connection is important for learning	.757	.970
	The university provides free wireless connection.	.499	.972
	The course content meets my need.	.381	.976
	The course uses interactive technology.	.651	.971
	The course engages me in the learning experience.	.780	.970
	The course builds my confidence in problem solving.	.855	.969
	The course builds my confidence in planning.	.791	.970
	The course is interactive	.766	.970
	The instructor act as a partner in learning	.840	.970
	My opinions are considered in the course	.774	.970
	The instructor was empathetic to my needs	.748	.970

	The course creates a positive learning environment	.747	.970
	The course activities support learning goals	.829	.970
	The instructor facilitates self-directed learning	.746	.970
	The instructor makes his/her expectations clear	.798	.970
	The instructor embeds learning in realistic contexts	.823	.970
	The course allow me to make choices	.800	.970
	The course provides sufficient practice opportunity	.840	.970
	The course provides opportunities for self-reflection	.856	.970
	The course provides opportunities for self-evaluation	.881	.969
	The course supports exploratory learning	.837	.970
	The course enhanced my learning	.845	.970
	The course provides -steps/ links to further my learning	.856	.969
	Free wireless connection is important for learning	.757	.970

Table 6 Contents of HiTs After PCA

Factors	Item ID	Total Item
Content	C03, C04, C05, C06	4
Delivery	C10, C11, C12, C17, C18	5
Service	C19, C20, C21, C23	4
Outcome	C28, C31, C35, C33, C37	5
Structure	C38, C42, C46, C48, C54, C56, C58, C60, C61	9

*Total items = 27

I. FINDINGS

This section presents the results of the study by answering the research question - Are trainees perspective towards usefulness of the Hybrid e-Training module influenced by the module's content, delivery, service, structure and outcome? This is done by reporting the results of structural equation model process using confirmatory factor analysis to achieve external construct validation.

A. CFA and Construct Validity

This section will illustrate the first four-stage procedure of performing CFA [8] to confirm the hypothesized hybrid model. Having completed Stage 1: Defining Individual Constructs, as explained previously in the methods section, Stage 2: Developing the Overall Measurement Model was constructed. A visual diagram depicting the first hypothesized measurement model consisting of 27 measured indicator variables and five latent constructs is shown in Figure 7.

As prescribed in the CFA stages procedure [8], all constructs are allowed to correlate with all other constructs and all measured items are allowed to load on only one construct each but the error terms are not allowed to relate to any other measured variable. Two constructs (Content and Service) are indicated by four measured indicators, another two (Delivery and Outcome) are indicated by five measured indicators and one is indicated by nine indicators. Every individual construct is identified.

The overall model has more degrees of freedom than paths to be estimated. Therefore, abiding with the rule of thumb [8] recommending a minimum of three indicators per construct but encouraging at least four, the order condition is satisfied which means the model is over identified. Given the number of indicators and sufficient sample size of 208, no problem with the rank condition are expected either.

Stage 3 requires that the study be designed and executed to collect data for testing the measurement model constructed in Stage 2. Having done that, AMOS 7.0 was selected to estimate parameters in the measurement model drawn using the graphical interface earlier as depicted in Fig. 7. The model was estimated using the default maximum likelihood estimation. Result of estimation is shown as in Fig. 8.

The next stage is Stage 4: Assessing Measurement Model Validity. This is done by comparing the theoretical measurement model against reality as represented by the sample. Key fit statistics and the parameter estimates from Figure 8 and subsequent iterations were reviewed.

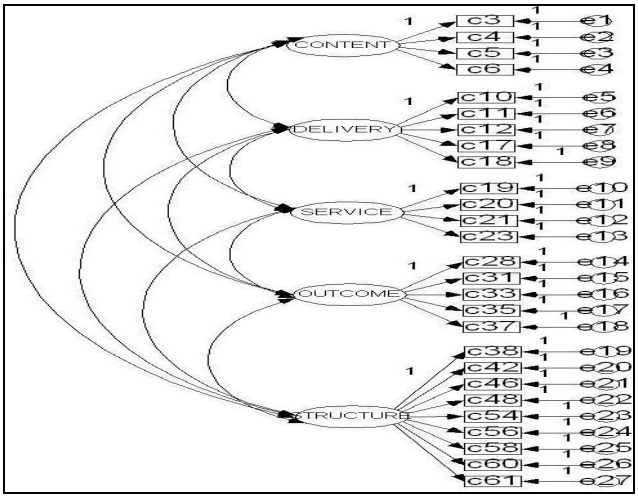

Fig. 7 The first hypothesized measurement model

B. Data Analysis

To arrive at the conclusion, a confirmatory factor analysis was conducted on the hypothesized five-factor structure model using AMOS [5] model-fitting program. The program adopted maximum likelihood estimation to generate estimates in the full-fledged measurement model. To assess the fit of the measurement model, the analysis relied on a number of descriptive fit indices, which included the (1) relative chi-square (χ^2/df), (2) comparative fit index (CFI), (3) Tucker-Lewis coefficient (TLI), and (4) root mean square error approximation (RMSEA). Wheaton et al. in Hair et al. [3] suggest the use of relative chi-square (chi-square/df) as a fit measure. They suggest a ratio of approximately five or less as beginning to be reasonable. Carmines and McIver in [8]

however stated from their experience, chi-square/df in the range of two to three are indicative of an acceptable fit between the hypothetical model and the sample data. The possible values of CFI and TLI range from zero to one, with values close to one demonstrate a good fit [5]. Finally a value of approximately .08 or less for RMSEA shows a reasonable error of estimation.

C. Hypothesized Model

Fig. 8 presents the estimated five-factor model for the hybrid module using the data drawn out from the test sample (N=208). Items from each scale are assumed to load only on their respective latent variables and some of the overall fit indicators and parameter values are shown in the figure. The results indicated that the parameters were free from offending estimates, ranging from .56 to .87. Both fit indicators (CFI & TLI) exceeded threshold of .90, the standard deemed important for model fit. However, the root-mean square error of .088 approximation reflect a possible fit problem.

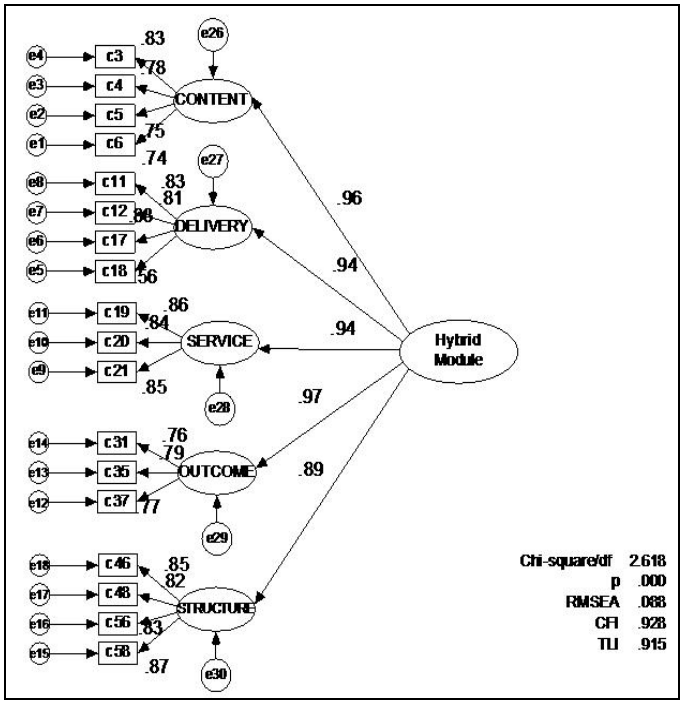

Fig. 8 The revised hypothesized e-Training: C3-C58 represents observed variables; e4-e19 represents error variances; single headed arrows from factors depict factor loadings.

D. Revised Model

A closer examination of the results revealed one possible reason for the model's lack of fit in the term of the RMSEA. Evidently, the residuals associated with observed indicators C6 (e1=.32) and C18 (e5=.76) may have created some problem. Typically residuals of less than |2.5| do not suggest a problem; conversely residuals greater than |4| raise a red flag and suggest a potentially unacceptable degree of error. To deal with the "noises", the hypothesized model was revised, with the two problematic indicators being excluded in the subsequent analysis [8].

To validate the likelihood of the revised five-factor model, another confirmatory factor analysis was applied on the same sample. Fig. 8 shows the revised hypothesized measurement model for the hybrid e-training module while Fig. 9 shows the final revised model. Note that in the revised model, there are only 18 indicators left. Three constructs (Content, Service and Structure) are indicated by four measured indicators and two other constructs (Delivery and Outcome) are indicated by three measured indicators. Based on the modification indeces, 9 items were deleted after 9 iterations to bring down the RMSEA to approach the required threshold of 0.08 for an adequately fit model in the revised model as shown in Fig. 8. The overall fit of the final 16-item revised measurement model is summarized in Fig.9. The magnitude of the factor loadings were substantially significant with CFI=.943 & TLI=.930 while RMSEA has slightly improved at 0.086. Since not much improvement on RMSEA were made and all loadings and residuals are acceptable, we stop the iteration with what is shown in Figure 9 as the final revised model.

The model is free from offending estimates, ranging from .75 to .87. The internal consistency estimates satisfied the standard deemed necessary in scale construction. The cronbach alphas for the five sub-constructs after CFA are range from .814 to .909 (content=.831, delivery=.865, service= .885, outcome=.814 and structure=.909) while cronbach alpha for the whole section measures = **.959.**

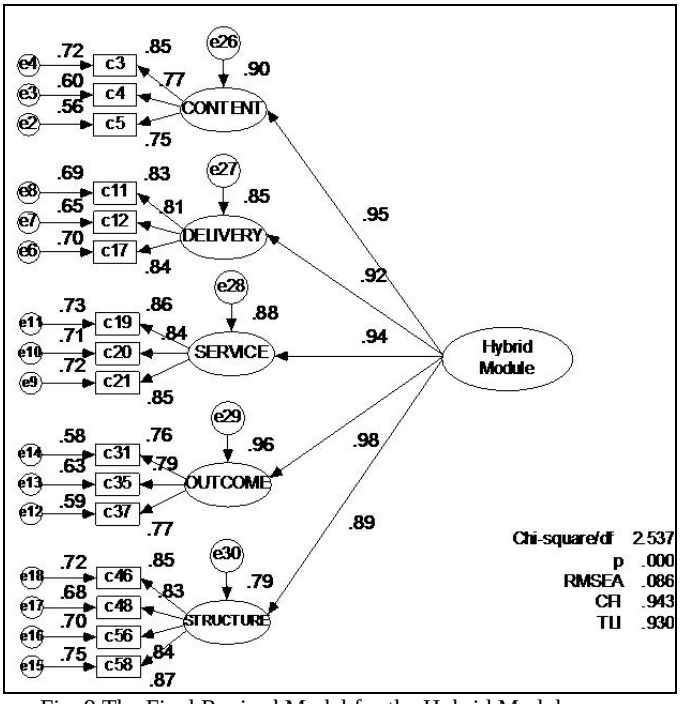

Fig. 9 The Final Revised Model for the Hybrid Module

E. Descriptive Findings

In this study at three phases, the overall Cronbach's Alpha for the instrument succeeded the standard. In addition, the principle component analysis results indicated that there were five dimensions emerged for the Hybrid scales, namely content (c3, c4 and c5); delivery (c11, c12 and c17); service (c19,c20 and c21); outcome (c31, c35 and c37) and structure

(c46, c48, c56 and c58). In order to confirm which items belong to what constructs, i.e., to test the construct validity of the Hybrid Module, confirmatory factor analysis was conducted. Findings showed evidences for construct validity. As such, the answer to research question as to whether the trainee's perspective towards usefulness of the Hybrid e-Training module was influenced by the module's content, delivery, service, structure and outcome are valid as portrayed in the descriptive result for this particular group of trainers in Table 7. The result in Table 7 shows the mean score of all items measuring the usefulness of the hybrid e-training module. Considering a mean score of 1 is very low, 2 is low, 3 is average, 4 is high and 5 is very high, it is save to round up the average mean to 4.0 to consider it as high or leave it at 3.97 and consider it as on the high side of average approaching the high side.

Table 7. Average mean score of items measuring usefulness of HiT

	Item Description	N	Minimum	Maximum	Mean	Std. Deviation
c3	I was well informed about the course objectives	213	.00	5.00	3.9484	.82540
c4	The course lived up to my expectations	213	.00	5.00	3.6995	.86540
c5	The course is relevant to my job	213	.00	5.00	4.0282	.78857
c11	The course blog uses appropriate style for display	213	.00	5.00	3.8685	.77191
c12	The course blog features aesthetically pleasing graphics	213	.00	5.00	3.8779	.71647
c17	The course uses appropriate technology	213	.00	5.00	4.0094	.73965
c19	The instructor was well prepared	213	.00	5.00	4.1221	.81503
c20	Face to face instruction was helpful	213	.00	5.00	4.1878	.77243
c21	The online resources are useful	213	.00	5.00	4.1878	.81983
c31	My attitude has changed	213	.00	5.00	4.1737	.76038
c35	Interactive blogging was essential in the course	213	.00	5.00	3.9155	.81402
c37	I completed the course project by satisfying all required tasks	213	.00	5.00	3.7840	.86892
c46	The instructor act as a partner in the learning experience	213	.00	5.00	3.8357	.84465
c48	The instructor was empathetic to my needs	213	.00	5.00	3.8498	.87737
c56	The course provides opportunities for support and self- reflection	213	.00	5.00	3.9624	.81755
c58	The course supports exploratory learning	213	.00	5.00	3.9906	.84111
Average mean score of all items measuring usefulness of the Hybrid e-Training module is **3.97**						

I. DISCUSSION

In summary, a psychometrically sound instrument is evidence by a high reliability and validity. Therefore, a rigorous effort has been invested in developing the Hybrid E-Training Instrument. According to Hair [8] and Thorndike [12], the generally agreed upon lower limit for Cronbach's alpha is .70. As mentioned in the previous section, at three phases of the study, the overall Cronbach's Alpha for the instrument succeeded the standard. The results indicated that the instrument is a highly reliable instrument.

Goodness-of-fit measures of comparative fit index (CFI) and non-normed fix index (NNFI also known TLI) were above suggested threshold > .90 (CFI=.943; TLI=.930). In reference to model fit, researchers use numerous goodness-of-fit indicators to assess a model but in general, for one time analysis TLI, CFI and RMSEA are preferred [5]. According to Browne and Cudeck in [6], a value of 0.08 or less for the RMSEA would indicate a reasonable error approximation and would not want to employ a model with a RMSEA greater than 0.1. As such we consider the RMSEA for the final revised model of 0.86 as acceptable although generally the general accepted threshold would be RMSEA < .08.

In this study, SEM estimates the degree to which a hypothesized model fits the data. In the CFA test, goodness-of-fit indexes are estimated for the latent variable Hybrid Module
as a distinct structural model. Although it is wise and appropriate for one to measure items found in other studies such as the items to make up the DDLM from [3] and [4] to form a certain construct, it is not appropriate to assume that a certain group of items found to form a valid and reliable construct in another study will form an equally valid and reliable construct when measured in a different set of data. Similarly, constructs tested on a national data set are valid in a new study only in the rare instance when the new study uses the identical observations analysis in the same data with the same theoretical underpinning. Divergent choices addressing the problem of missing data will normally change construct validity results such that a new confirmatory analysis is appropriate [5].

II. CONCLUSION

As a national and research university UKM is among the most established universities in Malaysia. Building on its past and present successes, the university will continue to move ahead and carve a name internationally along with other reputable universities. This can be achieved by exploring new opportunities such as implementing the hybrid method which has been empirically tested as a verified local model. Implementing the hybrid model will guide the university particularly the academicians and trainers in optimising on existing resources and by leveraging the university's strengths to make the global impact.

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