

**A MEANINGFUL HYBRID E-TRAINING MEASURE AND MODEL
FOR TECHNOLOGY IN EDUCATION**

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Abstract

A close examination of new hybrid e-training programmes, for determining programme quality, exposed a critical disparity between rapid technological advancements and established pedagogical models. The objective of this study was, therefore, to develop, generate, test, and validate a two-stage model for a meaningful hybrid e-training programme. An early framework of the model helped develop a questionnaire to measure the meaningfulness of a hybrid e-training programme. Confirmatory factor analysis was performed using AMOS 7.0 on data collected from 213 trainees to obtain three best-fit measurement models from three latent variables. Overall reliability analyses, using Cronbach's Alpha and the Rasch Model, in addition to content validation by experts, suggested that the questionnaire was reliable and valid for measuring a meaningful hybrid e-training programme. Subsequently, structural equation modelling was applied to test the hypotheses. The results showed a strong positive relationship between hybrid e-training and meaningful e-training, a weak positive relationship between learning style preference and hybrid e-training, and a negative relationship between learning style preference and meaningful learning. In brief, the study proved that hybrid e-training contributed significantly towards achieving meaningful learning. Consequently, future training, with respect to the use of hybrid e-training, should include all the five components of meaningful hybrid e-training instead of focusing on the content alone. With the results showing a weak positive relationship between learning style and hybrid e-training, and a negative relationship between learning style and meaningful e-training, instructional media designers and developers should now focus on integrating all the five components of e-training to ensure meaningful learning. It would be interesting to further investigate whether or not learning style is a mediating or a moderating factor in achieving meaningful learning through the use of hybrid e-training programmes, as was modelled in the final results.

Keywords: validation, structural equation modelling, hybrid e-training, meaningful learning

INTRODUCTION

A meaningful hybrid e-training experience provides a logical purpose for strategic educational change through lifetime education and creation of a knowledge society. This has encouraged many institutions of higher learning to endorse, fund, and even design or deliver alternative educational and professional development programmes. The most popular among these programmes is the Web-based training programme through which learners can empower themselves by acquiring both explicit and tacit knowledge. The introduction of e-training in Malaysia, though a major undertaking, signifies a valuable investment in the future productivity of its workforce. However, a close examination of new hybrid e-training programmes, for the purpose of determining programme quality, indicated a critical gap between rapidly developing technology and existing pedagogical models.

With the advent of knowledge-based economy, it has become necessary to adopt the concept of knowledge management (KM) for lifelong learning (LLL) as the foundation of a learning society. This is because people need to update their knowledge and skills continuously to maintain a competitive edge in the global economy (Sharifah Hapsah, 2003). The Malaysian Qualification Framework (MQF) provided the structure for actualizing LLL by facilitating individuals to select a learning pathway that was most appropriate for them (Sharifah Hapsah, 2003, 2004). Thus, a response was generated to create an academic culture capable of producing learners who not only possessed typical technical and professional skills but also displayed competency in soft skills, and intellectual and affective attributes (Committee of Deputy Vice-Chancellors and Rectors of Malaysian Higher Learning Institutes, 2006). The committee developed four strategies to successfully create the much desired academic culture. This study focuses on the third strategy that deals with the implementation of an updated, relevant curriculum delivered through relevant methods. Thus, the study seeks to contribute to the achievement of the shared vision of the university, that is, to create an academic culture comparable to international standards and to nurture holistic development of the learner at the same time.

It is widely accepted that the infrastructure for Information and Communication Technology (ICT) can enable e-Training. The technology may bring down costs for the university administrators and add a measure of convenience for learners; however, educators may reason that if the e-training programmes do not produce workers capable of a higher-order thinking and reasoning for solving intricate and authentic problems in the workplace, then the programmes lose their significance (Govindasamy, 2002; Jonassen, Peck, and Wilson, 1999). Therefore, in a strategic planning process for the implementation of new e-training programmes, or for the enhancement of existing ones, the focus should not only be on how technology can be used to achieve educational goals, but also on the human aspects of teaching and learning (Rosseni et al., 2011, 2010, 2009, 2008). It is for this reason that the study aims to develop a model for a meaningful e-training programme that makes use of the hybrid method to cater to learners with different learning style preferences.

MEANINGFUL HYBRID E-TRAINING

The hybrid e-training (HiT) framework developed in this study was derived from the Demand-Driven Learning Model (DDLDM), which was developed by MacDonald et al. (2001, 2002). In the DDLDM framework (Breithaupt and MacDonald, 2003), high-quality *content* is considered to be comprehensive, authentic or industry-driven, and well-researched. In relation to

content, high-quality *delivery* is defined as one that places a strong emphasis on usability, interactivity, and tools. Moreover, the DDLM defines high-quality *service* as that which provides the essential resources for learning as well as administrative and technical support. Such a service is supported by a skilled and emphatic staff that is accessible and responsive.

High-quality programmes provide *outcomes*, such as personal advantages for learners, with a lower cost to employers, while achieving learning objectives. The publication and dissemination of findings on DDLM-based programmes have contributed to its theoretical and practical evolution. Such ongoing evaluations ensure the longevity and validity of the proposed standards for *structure*. The evolution of the operational definition of the components in the DDLM has resulted in the need to adapt and improve the model, and all evaluation efforts should include a measurement of learning objectives which are specific to the programme being evaluated (MacDonald et al., 2001). The objective of this study was, therefore, to develop, generate, test, and validate a two-stage model for a new meaningful hybrid e-training programme. The early framework of the model guided the development of the questionnaire to measure the meaningfulness of a hybrid e-training programme.

Operationally, the definition of hybrid e-training for this study can be visually described as given in Figure 1. Alternatively, hybrid e-training or HiTs can be defined as a combination of various instructional media (face-to-face, computer-mediated communication, and self-learning) delivered through a combination of different educational technologies (both new and old technologies, including printed material, CD-ROM-based e-books, and the Web 2.0 technology).

All instructional media and technology employed in the study were selected on the basis of the theories of andragogy and social learning, and guided by the outcome-based education principles provided by the Malaysian Qualification Framework (Sharifah Hapsah, 2003, 2004). The main components of the HiT system are the learners, the facilitators, and the knowledge management system set up to achieve meaningful learning through activities involving different skills, including the ICT skill, the information-seeking skill, and the creative- and critical-thinking skills. Although not all of these components were tested in the study, all of them were used in designing the system. The terms *e-training* and *e-learning* have been used interchangeably in this article.

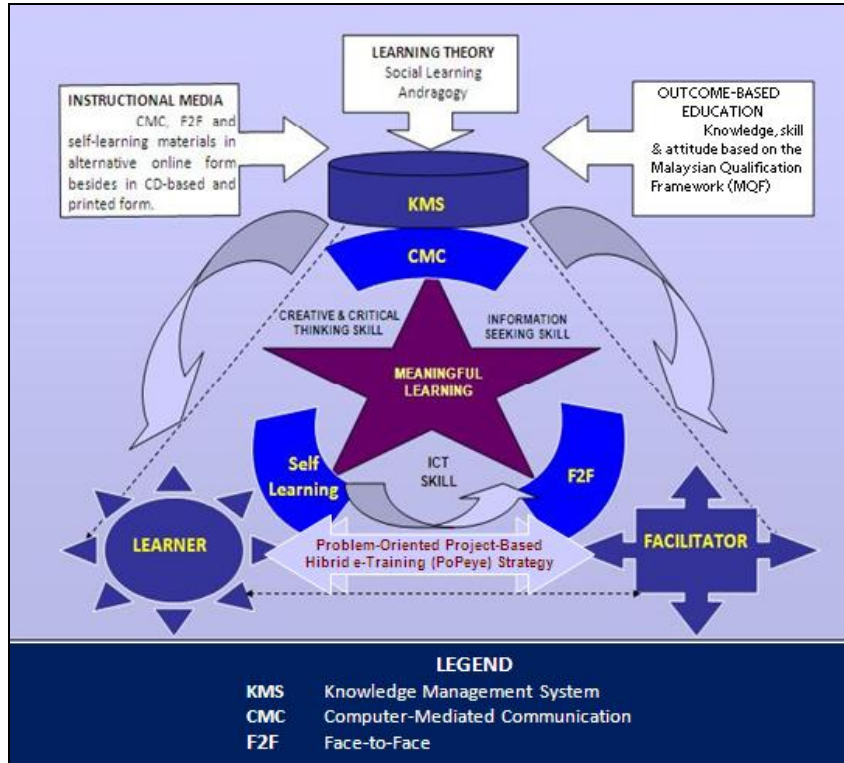


Figure 1 Operational definition of hybrid e-training as constructed for the study

METHOD

The study sought to gather empirical evidence to illustrate the adequacy of the meaningful hybrid e-training instrument in measuring the effectiveness of a hybrid e-training programme. Accordingly, measurement theory was utilized to resolve pertinent assessment and measurement issues. Specifically, the objective of the research was to identify if a relationship exists among learning style preference (LSP), hybrid e-training system (HiTs) and meaningful e-training (MeT). The research hypotheses were as follows:

- H₁: Hybrid e-Training (HiT) influences Meaningful e-Training (MeT)
- H₂: Learning Style Preference (LSP) influences Hybrid e-Training (HiT)
- H₃: Learning Style Preference (LSP) influences Meaningful e-Training (MeT)

The early framework of the model guided the development of a questionnaire to measure the meaningfulness of hybrid e-training. The questionnaire consisted of three sections which assessed meaningful learning (MeT) with $\alpha = .88$, hybrid e-training (HiT) with $\alpha = .93$ and learning style preference (LSP) with $\alpha = .89$. Overall reliability analyses, using Cronbach's alpha and the Rasch Model (Table 1), in addition to content validation by experts suggested that the questionnaire was reliable and valid for measuring a meaningful hybrid e-training programme. Data collected from 213 trainees in the technology in education programme, consisting of graduating seniors and post-graduate students of the university, was tested with confirmatory factor analysis using AMOS 7.0 to obtain three best-fit measurement models from the three latent variables. Subsequently, Structural Equation Modelling (SEM) was applied to test the hypotheses.

Table 1 Person and Item reliability of the MeT, HiT, and LSP Measures

Statistical Info	MeT Measure	HiT Measure	LSP Measure
a. Person reliability	.86	.97	.85
b. Item reliability	.87 ($\alpha = .88$)*	.97 ($\alpha = .93$)*	.94 ($\alpha = .89$)*

*Reliability coefficient using Cronbach's alpha

INSTRUMENT AND DATA

In this study, a survey questionnaire, called the **Integrated Meaningful Hybrid e-Training Instrument (I-MINT)** version 5.2, was employed as the major instrument to empirically test the three hypothesized relationships. The I-MINT questionnaire consisted of four sections (Section A to Section D). Section A comprised demographic items, including academic qualification, gender, ethnicity, age, teaching experience, country of origin, and study programme. Section B consisted of items to measure meaningful e-training (MeT), Section C contained items for measuring hybrid e-training (HiT), and section D included items to measure learning style preference (LSP).

The items in section B, used to measure meaningful e-training (MeT), were developed on the basis of the meaningful learning rubric template constructed by Jonassen, Peck, and Wilson (1999). The first version of the adapted MeT measure consisted of 21 items to measure the meaningfulness of hybrid e-training experienced by the respondents in this study. The rubric was constructed on the basis of the five meaningful learning attributes (Jonassen, Peck, and Wilson, 1999), co-operation, activity, authenticity, construction, and intentionality. Table 2 shows the contents of the MeT measure. The content validation for the instrument was conducted by four experts and was reviewed by four more experts.

Table 2 Contents of the MeT measure

Factors	Item ID	Total Items
Co-operation	B01–B04	4
Activity	B05–B09	5
Authenticity	B10–B13	4
Construction	B14–B15	2
Intentionality	B16–B21	6

*Total items = 21

Section C was designed to measure hybrid e-training. The HiT measure was adopted from the Demand-Driven Learning Model measurement tool (Mac Donald et al., 2001, 2002). The first version of the adapted HiT measure consisted of 61 items to measure the usefulness of a hybrid e-training course on a Likert-type scale. (The original Likert scale has five points, from strongly agree to strongly disagree; one with 6 or more points is classified as a Likert-type scale (Likert, 1932).

The next step was to establish the content validity of the instrument and to test the reliability and internal consistencies of the HiT measure (section C of the I-MINT instrument). The instrument was reviewed on various aspects, including 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 HiT measure consisted of 61 items that constituted 5 constructs, namely *Content* (9-item), *Delivery* (9-item), *Service* (7-item), *Outcome* (12-item), and *Structure* (24-item). The respondents rated different aspects of the course on a scale of 1 to 5, where '1' equalled 'strongly disagree' and '5' equalled 'strongly agree'. While '1' represented the lowest and most negative impression on the scale, '3' represented an adequate impression, and '5' represented the highest and most positive impression. The respondents chose 'N/A' if the item was not appropriate or if it was not applicable to the course. Table 3 shows the contents of the HiT measure after content validation for this study in comparison to two other studies conducted previously by other researchers.

Table 3 Contents of the HiT measure

Factors	Item ID	α	α	α
		(Total Items for This Study)	(*Total Items for Previous Study 1)	(*Total Items for Previous Study 2)
Content	C01–C09	.93 (9 items)	.88 (9 items)	.88 (8 items)
Delivery	C10–C18	.92 (9 items)	.91 (10 items)	.92 (9 items)
Service	C19–C25	.89 (7 items)	.92 (12 items)	.93 (8 items)
Outcome	C26–C37	.95 (12 items)	.94 (15 items)	.88 (9 items)
Structure	C38–C61	.97 (24 items)	.96 (23 items)	.96 (23 items)
Total Items		61 items	69 items	57 items

*MacDonald et al. (2002)

The third measure of the I-MINT instrument, the measure of learning style preferences (LSP), is contained in Section D. The LSP measure was adapted from Perceptual Learning-Style Preference Questionnaire by Reid (1984). The first version of the adapted LSP measure consisted of 30 items to measure six learning style preferences on a Likert-type scale. The questionnaire instructed the respondents to read the statements quickly, without spending too much time on them, and asked them not to change their responses once they had made their choice. The respondents had to decide whether they agreed or disagreed with each statement and had to rate the degree of their agreement on a scale of 1 to 5, where '1' equalled 'strongly disagree' and '5' equalled 'strongly agree'. While '1' represented the lowest and most negative impression on the scale, '3' signified an undecided impression, and '5' represented the highest and most positive impression. The respondents chose '3' if they were unable to decide. Table 4 shows the contents of the LSP measure after content validation for this study and for a previous study that employed the same instrument (Rosmidah, 2006).

Table 4 Contents of the LSP measure

Factors	Item ID	A (Total Items for This Study)	α (*Total Items Previous Study 1)
Visual	D06, D10, D12, D24, D29	.49 (5 items)	.89 (5 items)
Auditory	D06, D10, D12, D24, D29	.62 (5 items)	.86 (5 items)
Kinesthetic	D06, D10, D12, D24, D29	.88 (5 items)	.87 (5 items)
Tactile	D06, D10, D12, D24, D29	.81 (5 items)	.83 (5 items)
Group	D06, D10, D12, D24, D29	.82 (5 items)	.88 (5 items)
Individual	D06, D10, D12, D24, D29	.84 (5 items)	.89 (5 items)
Total Items		30 items	30 items

*Rosmidah (2006)

RESULTS & DISCUSSION

The distribution of the major learning styles among the respondents, as indicated by the results, is as follows: (i) visual - 37.7% (n = 80), (ii) group - 25.8% (n = 55), (iii) individual - 13.6% (n = 29), (iv) auditory - 12.2% (n = 26), (v) kinesthetic - 8% (n = 16), and (vi) tactile - 2.8% (n = 6). This shows that the majority of learners in this study preferred visual and group learning styles to other styles. Figure 2 displays the results of structural relationships among hybrid e-training (HiTs), meaningful e-training (MeT), and learning style preferences (LSP). The study was able to validate the meaningfulness of the hybrid e-training components (content, delivery, service, outcome, and structure) as proposed in the original model (MacDonald et al., 2001) and various studies. The study also showed that the five-dimension measurement model for HiTs generated valid results for data collected from trainees from different Asian countries. Consequently, it was established that the HiT model performs accurately, even when used in a different cultural setting and among culturally diverse learners.

The study was also able to validate the meaningful e-training attributes (co-operation, intentionality, construction, activity, and authenticity) as proposed by Jonassen, Peck, and Wilson (1999). As shown in Figure 2, it offered evidence (Hair et al., 2006) that the five-dimension measurement model generated favourable results for data collected from computer trainees belonging to different Asian countries. As in the case of HiT, the validity test results for MeT did not establish any doubts to suggest that the MeT model was incorrect, even when applied in a different cultural setting (Hair et al., 2006).

In the case of the third latent factor, the study was able to validate five out of the six learning styles (visual, auditory, kinesthetic, tactile, group, individual) as proposed by Reid (1984) and in various studies on learning styles (Kappe et al., 2009; Isemonger, 2008; Rosmidah, 2008; Dunn and Dunn, 1993, 1979, 1978; Reid 1987, 1984). It provided evidence that the new five-

dimension measurement (five out of the six dimensions mentioned earlier, excluding the individual dimension) model generated valid results for the data collected from computer trainees from various Asian countries. As with the results for HiT and MeT, the validity test results for LSP did not establish any doubts to suggest that the new LSP model was incorrect, even when used in a different cultural setting (Hair et al., 2006).

This section deals with the empirical results of the structural equation modelling analysis for the purpose of testing the hypotheses, proposing models for testing the underpinning theories, and validating those models. It also concludes the overall Structural Equation Modelling (SEM) findings and reports how SEM was used in the study to test the three hypotheses. It also reports the results of the investigations on the structural relationships among hybrid e-training system (HiTs), meaningful e-training (MeT), and learning style preference (LSP). To support the investigation, the following hypotheses were tested:

- H₁: Hybrid e-Training (HiTs) influences Meaningful e-Training (MeT)
- H₂: Learning Style Preference (LSP) influences Hybrid e-Training (HiTs)
- H₃: Learning Style Preference (LSP) influences Meaningful e-Training (MeT)

A hypothesized structural model was constructed in the second stage of the SEM analysis. A diagrammatic representation of the first hypothesized structural model for this relationship with the tested parameters is shown in Figure 2. To validate the accuracy of the revised three-construct model, several rounds of SEM analysis were applied on the same sample. The tested hypothesized model and the final revised model are shown in Figures 2 and 3, respectively. The overall fit of the final revised model is summarized in Figure 3.

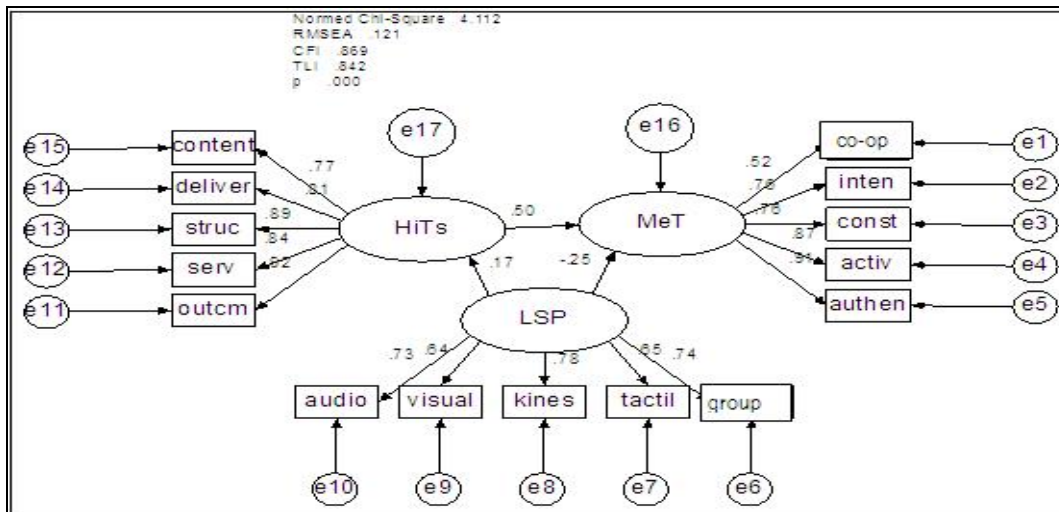


Figure 2 Results of hypothesized structural relationships among HiTs, MeT, and LSP

The results of the hypotheses tests are concluded as follows:

- H₁: Hybrid e-Training (HiTs) influences Meaningful e-Training (MeT)
Fail to reject.
- H₂: Learning Style Preference (LSP) influences Hybrid e-Training (HiTs)
Fail to reject.

H₃: Learning Style Preference (LSP) influences Meaningful e-Training (MeT)
Fail to reject.

The factor loadings in the final revised model were substantially significant with CFI = .945, TLI = .929, and RMSEA = .081. The statistics indicate that the parameters, ranging from .52 to .95, were free from offending estimates. The CFI (.945) and TLI (.929) fit indicators exceeded the threshold of .90, indicating an extremely good fit. The root-mean square error of approximation (RMSEA = .081) met the cut-off point requirement for a reasonable error of approximation (Hair et al., 2006). The normed chi-square (χ^2) of 2.471 for a good fit was also met. The final fit index indicates that the test failed to reject the hypothesized model. Consequently, the model in Figure 3 was concluded to be the validated structural equation model. Since the hypotheses tests failed to reject the three statements (Hybrid e-Training influences Meaningful e-Training; Learning Style Preference influences Hybrid e-Training; Learning Style Preference influences Meaningful e-Training), the research objective was achieved.

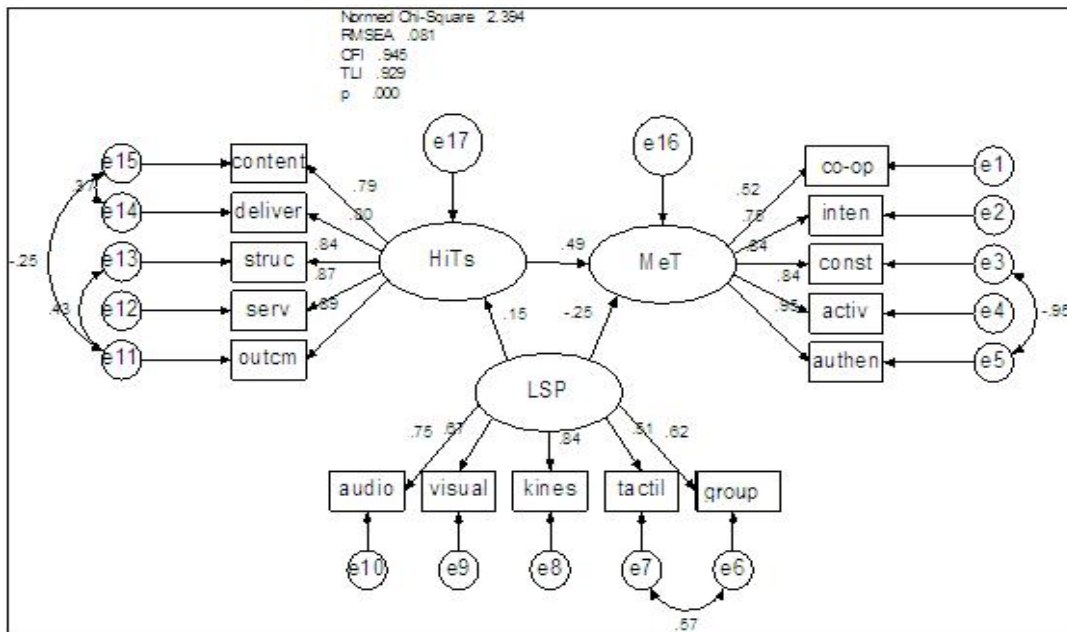


Figure 3 Results of revised structural relationships among HiTs, MeT, and LSP

IMPLICATION OF THE STUDY

In reference to Figure 3, the study showed that there was a strong positive relationship between hybrid e-training and meaningful e-training, with a path coefficient of .49. To put it briefly, as HiT increases, meaningful learning also increases. In other words, whenever all the five components (content, delivery, service, structure, and outcome) of hybrid e-training are at the highest level of utilization, meaningful learning will be highly achieved.

The results also indicated a weak positive relationship between learning style preferences and hybrid e-training, with a path coefficient of .15. In other words, as a specific learning style dominates an individual's style of learning, a hybrid e-training environment improves the effectiveness of the training experience to some extent. For example, a learner who possesses a dominant visual learning style is able to achieve meaningful learning through

hybrid e-training because the platform provides visual cues and objects that support his/her preferred learning style. This is true for all other learning styles as well, including auditory, tactile, kinesthetic, group, and individual.

The study, however, indicated a negative relationship between learning style preferences and meaningful learning, with a path coefficient of $-.25$. This implies that the e-training experience becomes more meaningful when the learner is less influenced by a single learning style. In other words, when a learner is less dependent on one particular learning style, the probability of achieving meaningful learning is higher. Since learning is affected by learning style preferences, students who are able to employ multiple learning styles have a higher learning outcome (Felder, 1995; Reid, 1987).

CONCLUSION

The successful application of hybrid e-training at the tertiary level depends on many factors, especially on the policy governing its implementation and the issues in its application. In order to achieve its successful application, a model for appropriate infrastructure, content, delivery method, service, and outcome needs to be validated and tested. Consequently, all validated measurement models were tested again in the second stage of structural equation model to study its influence on learners' perception of what constitutes meaningful e-training and how learning style influences hybrid e-training. The results of the present study will be relevant in providing valuable insights to theorists, trainers, academic staff, and knowledge management system designers and developers and help them in their goal of achieving meaningful learning in the overall process of training or teaching, and learning. The study proves that hybrid e-training contributes significantly towards achieving meaningful learning. As a result, future training, with respect to the use of hybrid e-training, should include all the five components of meaningful hybrid e-training instead of merely focusing on content or activities, such as the upload and download of e-training materials. With the results showing a weak positive relationship between learning style and hybrid e-training, and a negative relationship between learning style and meaningful e-training, instructional media designers and developers should now focus on integrating all the five components of e-training to ensure meaningful learning. The study strongly suggests that future research be conducted to further investigate whether or not learning style is a mediating or a moderating factor in achieving meaningful learning through the use of hybrid e-training programmes, as modelled in the final results.

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