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EXAMINING THE INFLUENCE OF INTERACTIVE PERSUASIVE LEARNING AMONG ELDERLY

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ABSTRACT

In this research, we examined how interactive persuasive learning influences elderly. We have identified the relevant constructs and their measurement factors of the interactive persuasive learning that influences the elderly. Structural equation modeling was used to analyze the fit of the hypothesized model. The findings of this study corroborate the indirect effects of interactive persuasive learning influences on learning outcome, which was mediated by cognitive, motivation, experience, and emotional appeal except the direct effect of emotional appeal towards learning outcome. The findings of this study showed emotional appeal does not influence learning outcome on elderly. These findings suggest, emotional appeal of the interactive media would only persuade elderly to use the computer application but no influence would be on their learning outcomes. These findings provide suggestions on how to enhance the effectiveness of learning and ameliorate the implementation of interactive learning amongst instructional designers and software developers. Overall, this study contributed a theoretical model which can help increase the effectiveness of learning in an interactive learning environment.

Keywords: elderly, persuasive, interactive, structural equation model.

INTRODUCTION

Interactive media has begun to gain its precious output in learning since the emergence of technological apparatus and concept as the learning aids (Mayer & Moreno, 2002). The broad features of the interactive media enable researchers to fully utilize the interactive media functions as appropriate. In this study, interactive media is defined as the combinations of various types of digital media elements such as text, images, sound, animation and video as well as simulations that can persuade users to use interactive media technology for learning; and to convey information for better learning and comprehension in an interactive way. In learning, interactive media can construct knowledge and provide an active learning environment to the learners (Neo & Neo, 2004). In virtual environment interactive media can be used to enhance learners' understanding and memorization (Mayer, 2002). However, should be noted that the interactive media use in learning environment must be well designed and well developed to ensure its effectiveness to gain the desired outputs (Noor, 2012).

Nevertheless, to make elderly uses computers, particularly for learning is not a trivial. (Czaja, 2007) states the perception and physical limitation differences including inadequate skills, cognitive slowing and limited processing factor because of the increasing age make many computer tasks more difficult to the elderly. Previous research confirms that computer programs also have myriad beneficial outcomes to the elderly, even might be indirectly rehabilitation training for them who face aging vulnerability (Boulton-Lewis, Buys, Lovie-Kitchin, Barnett & David, 2007), (Yasothaa & Zamin, 2014), (Zaccarelli, Cirillo, Passuti, Annicchiarico, & Barban, 2013). According to (Lorenz & Oppermann, 2008), the generalization of all elderly difficult to use interactive media technology cannot be entirely accepted as older peoples (50 years old and above) have more abilities through their experiences than the youngest such as the aptitude, trainings and social status. Even the restrictions or impairments occurring during their lifetime can be new resurrection in their behaviour and attitude.

Thus, this study proposes a conceptual model of interactive persuasive learning for elderly. It would provide a mechanism to overcome elderly preference towards computer based learning based on their suitability while interacting with computers. The target population is elderly aged above 50 years old. A survey is conducted to construct a conceptual model of interactive persuasive learning among elderly. There is indication that elderly choose the use of computer applications as their last resort to learning.

RESEARCH MODEL

The research model for this study is related to the relevant factors of interactive persuasive learning among elderly. Previous studies have proven the positive potential of interactive media use towards the learners; such as in (Yusoff, 2012) and others. However, there is little study related to elderly learning by using the approach. The physical and psychological limitations are the major problems of the issue and make the elderly difficult to use the computer-based learning materials. Therefore, based on previous literatures and studies, this study attempts to identify not only the interactive media features but also the needed psychological factors to arouse elderly will to use computer-based learning material.

The study focuses on learning from instruction based on interactive media and persuasive technology for the elderly. According to (Shuell & Lee, 1976), learning from instruction refers to the learner's environment which has been intentionally created and structured so that the learner will achieve the expected outcomes. The model of the learning environment in this study strictly refers to the interactive media and persuasive technology where the learners' interaction with the learning materials is mediated by the interactive persuasive learning environment for the elderly. Hence, the technology-mediated learning theory is adapted in this study. Technology-mediated learning refers to an environment of learning materials (such as readings, assignments, exercises and others), peers and instructors (Alavi & Leidner, 2001).

The research framework for this study has been developed as shown in Figure-1. The model showed that learning outcome is the main variable, whereby 2 indicators were classified; PERF (performance) and SAT (satisfaction). The determinants (antecedents) include cognitive, motivation, experience and emotional appeal, which is followed by IM (interactive media) features. The IM features indicators include LAY (layout and consistency), SIM (simulation), NAV (navigation) and MIN (minimal input devices).

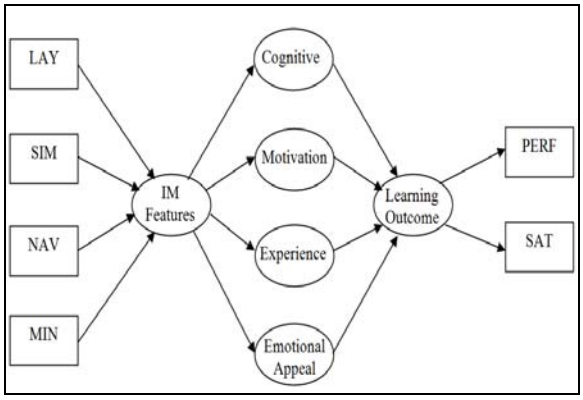

Figure-1. Research model

LAY: Layout and Consistency, SIM: Simulation, NAV: Navigation, MIN: Minimal Input Devices, IM: Interactive Media, PERF: Performance, SAT: Satisfaction

METHODOLOGY

Subjects and procedures

The target population of this study is elderly group which is in 50 years old and above as suggested by (Boulton-Lewis et al., 2007) in the area of computer technology and learning. Although the elderly age level is used differently in myriad studies such as 60 years and above (Watering, 2005), 65 years old and above (Bobeth, Schmehl, Kruijff, Deutsch & Tscheligi, 2012), 70 years and above (Giotakos, Tsirgogianni & Tarnanas, 2007), 68 years and above (Kankainen & Lehtinen, 2011) and 45 years old and above (Looije, Neerincx & Cnossen 2010); this study tend to use the age of 50 years old and above (approximately to 64 years old) as the respondent in the age level is more likely to be interested, need and want to learn new things and technology and give their effort to learn new activities (Boulton-Lewis et al., 2007). The number of the respondents for this study is approximately 300 elderly. This number satisfies the proposed minimum of 200 subjects for SEM (Gerbing & Anderson, 1985). The 300 elderly respondents are from the Kubang Pasu district in Kedah, Malaysia. The respondents were randomly selected based on their age's level. Each respondent was supplied by a laptop during the process was conducted.

Measurement

There are three sections of questionnaires that respondents needed to answer. These include a section containing respondent's demographic details, nine factors and features of the Interactive Persuasive Learning (InPeL) conceptual model (layout and consistency, simulation, navigation, minimal input devices, motivation, experience, cognitive, emotional appeal and satisfaction of the learning outcome) questionnaires, and the last section is related to another learning outcome factor, performance. The questionnaires for investigating the performance factor were isolated as the questionnaires contain the selected courseware content, V-Hajj.

In this study, four experts were involved to validate the model and the instrument. The experts were selected based on their expertise in the computer learning and interactive multimedia field for over 5 years of experience. Several amendments for model and questionnaires were corrected based on the comments by the experts in computer learning and interactive multimedia. The refinement of the model has been made after several inputs from the experts. The pilot study was carried out to validate the instrument. In the study, the Cronbach Alpha value was greater than 0.7 which is reliable because it is greater than the threshold value 0.6 (Nunnally, 1978). Table-3.1 depicts the Cronbach Alpha values for the instrument. For all items participants rated themselves on a five-point Likert scale ranging from (1) Strongly Disagree to (5) Strongly Agree.

Table-1. Interactive persuasive learning (InPeL) measurement instrument.

Construct	Elements	Items	Cronbach's Alpha
Interactive media features	Layout & consistency	9	0.886
	Simulation	7	0.831
	Navigation	4	0.833
	Minimal input device	4	0.701*
Interactive persuasive	Motivation (Attention,	18	0.931

learning elements	Relevance, Confidence, Satisfaction (ARCS))		
	Experience	4	0.744
	Cognitive	4	0.827
	Emotional appeal	4	0.600**
Learning outcome	Satisfaction	7	0.894

In this study, the evaluation was held at the participants' places. A natural setting was selected instead of a laboratory setting for conducting the evaluation since the former was more realistic (Gardner & Raj, 1983). Furthermore, the setting is particularly affecting the learning outcome and far illuminating when they are undertaken in their own context (Thangarajoo, 2008). The evaluation was conducted with each individual respondent. A laptop or computer equipped with speakers or headphones was required to run the V-Hajj courseware. The respondents were briefed on the objectives of the evaluation and the way it would be conducted. Then the respondents were given ample time to explore and learn the contents of the V-Hajj courseware prototype on their own without any interference from the researcher. Once they were done, they were asked to answer the questionnaires containing three sections. Approximately, they complete their session in one to one and half hours.

Software – The Virtual Hajj (V-Hajj Courseware)

A desktop based courseware for hajj learning procedures, V-Hajj was used to evaluate the conceptual model. V-Hajj is a courseware under the copyright of Universiti Utara Malaysia (UUM) as one of the university's research product in computer and multimedia field. It emphasizes the use of myriad multimedia elements as well as virtual environment to facilitate learners in learning Hajj procedures. Hajj procedures are complex as it contains a lot of information, rules, tasks, practical steps, doa and zikir to be learnt before performing Hajj in Mecca (Yusoff, 2012). Even though comprehensive courses are provided by the authorized organization for the pilgrims, supplementary learning materials are still required (Jamaan, 2010). For this reason, it supports the relevancy of the V-Hajj courseware development and use.

V-Hajj courseware integrates MM elements and 3D real time visualization into a computer application. The multimedia elements interactively provide information about Hajj which includes Umrah and Ziarah procedures and steps. The procedures for Hajj include Compulsory Term (Syarat Wajib), Hajj Types (Jenis Haji), Pillars of Hajj (Rukun Haji), Compulsories of Hajj (Wajib Haji), Steps in performing Hajj (Langkah mengerjakan Haji), Methods of performing Hajj (Kaedah mengerjakan Haji), Dam Payment (Dam) and Prayer (Doa). Umrah includes Compulsory Term (Syarat Wajib), Pillars of Umrah (Rukun Umrah), Compulsories of Umrah (Wajib Umrah) and Steps in performing Umrah (Langkah mengerjakan Umrah). Ziarah includes Internal Visit (Ziarah Dalam) and External Visit (Ziarah Luar). 3D real time visualization is used to enable learners to practically involve in three types of practical rituals which include Tawaf, Sa'ei and throwing of the Jamarat. Figure-2 until Figure-3 depicts the interface of V-Hajj Courseware used in this study.

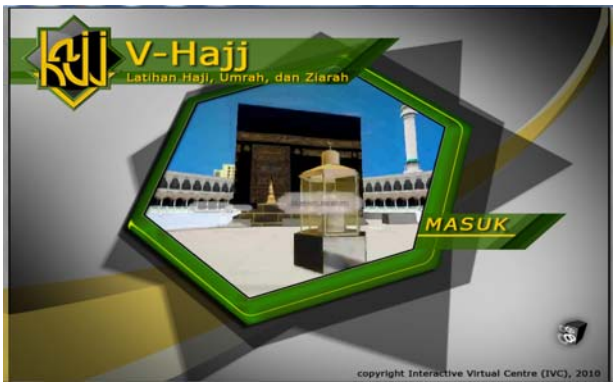

Figure-2. V-Hajj courseware main page.

Figure-3. V-Hajj courseware learning selection.

Figure-4. V-Hajj courseware contents for hajj learning procedures.

DATA ANALYSIS AND RESULT

Statistical Package for Social Sciences (SPSS) Version 16 was used to analyse the data for internal consistency reliability and descriptive statistics such as frequency and proportion. Analysis of Moment Structures (AMOS) Version 16 was used for SEM to determine the fit of the hypothesized model. SEM is an analysis technique that considers measurement error i.e. handling factors that influence the indicator (Conley, Muncey, & You, 2005), technology forecasting (Staphorst, Pretorius, & Pretorius, 2013) and identifibility of sparse for directed network (Bazerque, Baingana, & Giannakis, 2013). Some indexes are used including chi-square, i.e. a Root Mean Square Error of Approximation (RMSEA) (Browne & Cudeck, 1993), Comparative Fit Index (CFI) (Bentler, 1989), Tucker Lewis Fit Index (TLI) (Tucker & Lewis, 1973), Normed Fit Index (NFI) (Reinard, 2006) and Chi Square/Degree of Freedom (Marsh & Hocevar, 1985). The criteria for model fit assessment for both the CFA and SEM are presented in Table-2.

Table-2. Criteria for model fit assessment.

Name of category	Name of index	Index full name	Level of acceptance	Literature	Comments
Absolute fit	Chisq	Chi-square	P > 0.05	Wheaton *et al*. (1977)	Sensitive to sample size > 200
	RMSEA	Root Mean Square Error of Approximation	RMSEA<0.08	Browne and Cudeck (1993)	Range 0.05 to 1.00 acceptable.
	GFI	Goodness of Fit Index	GFI > 0.90	Joreskog and Sorbom (1984)	GFI = 0.95 is a good fit
Incremental fit	CFI	Comparative Fit Index	CFI > 0.90	Bentler (1989)	CFI = 0.95 is a good fit
	TLI	Tucker-Lewis Index	TLI > 0.90	Bentler and Bonett (1980)	TLI = 0.95 is a good fit
	NFI	Normed Fit Index	NFI > 0.80	Reinard (2006)	NFI = 0.95 is a good fit
Parsimonious	Chisq/df	Chi Square/Degree of Freedom	Chi square/df< 5.0	Marsh and Hocevar (1985)	The value should be below 5.0.

SEM is used to measure the direct effects of structural model to predict the significant relationship among the factors of interactive persuasive learning among elderly. A two-step model building approach was used to analyse the two conceptually distinct models: the measurement model followed by the structural model. The fit and construct validity of the proposed measurement model was first tested and once a satisfactory measurement was obtained, the structural paths of the SEM were estimated. The evaluation of the measurement models and structural models was done using maximum likelihood estimation.

Demographic statistics

Among the respondents, 40.7% (122) were male and 59.3% (178) were female. The range age of the participants was 50-71 years old. Descriptive statistics of the respondents is depicted in Table-3.

Table-3. Demographic data of the respondents.

Demographic data	**Frequency**	**Percentage** (%)
Gender		
Male	122	40.7
Female	178	59.3
Age		
50 – 71 years old	300	100
Education level		
Primary School	47	15.7
Secondary School	163	54.3
College / University	90	30
Computer use		
Yes	155	51.7
No	145	48.3
Computer-Based learning material use		
Yes	107	35.7
No	193	64.3

Measurement model

The measurement models were assessed based on the significance of each estimated coefficient or loading, the convergent validity and discriminant validity. All items loaded significantly on their latent construct ($p < 0.05$). Convergent validity was assessed using composite reliability and average variance extracted. A commonly used threshold value for composite reliability is 0.6 (Awang, 2012) whereas for average variance extracted is 0.5 (Hair, Black, Babin, Anderson, & Tatham, 2006). The composite reliability and average variance extracted are in the acceptable range. The scales were therefore considered satisfactory for SEM. Discriminant validity appeared to be satisfactory for all operationalization as the estimated correlations were less than 0.85. Discriminant is achieved if indicator correlates more highly with the construct that it is intended to measure than with other constructs (Garson, 2009). Table-4 shows the acceptable model fit that was obtained since all the chosen fit statistics was verified to the requirements. While all the factors have acceptable reliability value, each factor can also be measured individually depending on the nature of the research.

Table-4. Summary of measurement scales

Construct	**CR** (above 0.6)	**AVE** (above 0.5)
IM feature	0.9547	0.7016
Cognitive	0.8561	0.6040
Motivation	0.9206	0.5653
Experience	0.8468	0.5889
Emotional	0.9128	0.8757
Learning outcome	0.6545	0.9296

Before proceed to modeling the structural model, the normality assessment for the data is examined. The value of skewness shows that all of the items have the skewness values that fall within the range of -1.0 and 1.0. This indicates that the data distribution is normally distributed.

Structural model

Figure-5, Table-5 and Table-6 show the results of the structural model. The test yields the standardized path coefficients, which indicate the positive relationships between the constructs, and their statistical significance. In addition, the goodness-of-fit measures are provided to assess the fit of the model. The overall goodness-of-fit measures indicated an acceptable fit of the model (Chisquare> 0.05, GFI = 0.905, CFI = 0.962, Chisquare Ratio = 1.987,RMSEA = 0.061). All estimates were within the admissible range (i.e., correlation coefficient less than 1 and no negative covariances) and in the theoretically expected directions. For the relationships between the constructs, all hypotheses except H8 were supported.

IM features were a strong antecedent to emotional appeal (beta = 0.92, $p < 0.05$), motivation (beta = 0.88, $p < 0.05$), cognitive (beta = 0.84, $p < 0.05$), and experience (beta = 0.83,$p < 0.05$). All the psychological elderly learning factors were strong antecedents to learning outcomes except motivation: experience (beta = 0.95, $p < 0.05$), cognitive (beta = 0.91, $p < 0.05$), and motivation (beta = 0.52,$p < 0.05$).

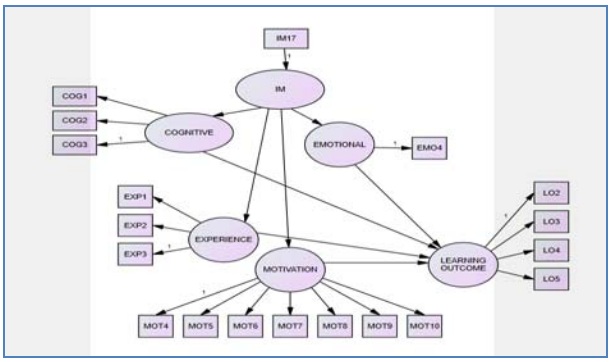

Figure-5. Final structural model.

Table-5. The assessment of fitness for the structural measurement model.

Fit Indices	Fit statistics	Recommended Fit criteria	Conclusion
Absolute fit indices			
Chisq	268.261	P > 0.05	Satisfactory
RMSEA	0.061	Range 0.05 to 1.00 acceptable	Satisfactory
GFI	0.905	GFI > 0.90	Satisfactory
Incremental fit indices			
CFI	0.962	Over 0.90	Satisfactory
Parsimony fit index			
Chiq/df (Ratio)	1.987	Below 5	Satisfactory

Table-6. The results of hypothesis testing.

Hypotheses	Construct	Path	Construct	Estimate	*p*-value	Hypothesis result
H_1	IM Feature	→	Cognitive	0.84	0.000	Supported
H_2	IM Feature	→	Motivation	0.88	0.000	Supported
H_3	IM Feature	→	Experience	0.83	0.000	Supported
H_4	IM Feature	→	Emotional Appeal	0.92	0.043	Supported
H_5	Cognitive	→	Learning Outcome	0.91	0.000	Supported
H_6	Motivation	→	Learning Outcome	0.52	0.003	Supported
H_7	Experience	→	Learning Outcome	0.95	0.000	Supported
H_8	Emotional Appeal	→	Learning Outcome	1.52	0.077	Not Supported

DISCUSSIONS

In our study, all the direct effects were found to be positively significant except relationship between emotional appeal and learning outcome. The positive relationships are supported by various studies. (Mayer, 2001) suggested several methods of using the interactive media features combination that is appropriate with the human cognitive process. It is found that cognitive process would be significantly better when there are improvements in interative media features such as its layout and consistency; navigation; simuation; and minimal input devices. According to (Keller & Suzuki, 1988), many learners are attracted to the novelty of interactive media use, at least initially; however, the appealing will not persist long if there are no motivational components included in the design. It is evident from this study that interactive media features would evoke motivation of the elderly in using computer-based learning systems.

The relationship between the interactive media features and the experience in computer-based learning environment are proven to be significant on elderly because a system which is embedded with simulations always promises unwavering experience to the users (Chilcott & Smith, 2011). This study used virtual reality technology to perform life-like environment hence it is proven that interactive media features provides compelling experience to elderly during their encounter with the computer-based learning environment. One of the methods to elicit emotional influences in a computer system is via an expressive interface. (Fogg, 2003) stated that the used of persuasive words or texts can be a persuasion element in changing people's behaviour and attitude; including layout, typography, font size, and color scheme. Based on the finding, it is proven that interactive media features positively influences emotional appeal on elderly. This emotional appeal is triggered by the use of persuasive narrations and graphics as well as adjustable font sizes.

In learning, psychologist and educators believed that both cognition and learning process is mutually beneficial. Not only the way of teaching and learning environment should be, but also how to convey the

information effectively, whether directly or indirectly to learners (Mayer, 2002). It is evident from this study that cognitive positively influences learning outcome. It is found that motivation positively influences learning outcome on elderly. Motivation has been found to have influences to determine learning process effectiveness. In order to encourage as well as to change perception and behaviour towards an interactive media learning application; it is essential to study how the designers can accelerate the learners' motivational level through the medium (Noor, 2012).

Experience positively influences learning outcome on elderly in interactive persuasive learning. Previous studies have shown the importance of learners control and active learning to the computer based learners (Lee, Wong & Fung 2010). In fact, it provides meaningful experience for them in learning process also can hold their interest to be engaged in the process (QOTFC, 2007). Interactive media is able to provide adequate user experience to the elderly hence the better learning outcome.

Based on the findings, emotional appeal does not influence learning outcome on elderly. Emotional appeal is one of the important elements in designing and developing computer systems (Bardzell, Bardzell & Pace, 2008), but it rarely discussed in most studies. When discussing about the emotional appeal in computer system design and development, one prominent aspect is the aesthetic look of the design. Aesthetic also associates with human emotions, affects, feelings or moods whereby it influences how human make their judgments and perception based upon information they received (Zhang, 2009). Emotional appeal would help elderly or even any learners to engage with the computer application and eventually provides as an incentive for learning to occur (Packer & Ballentyne, 2002). Indirectly, it can be said that in computer-based learning system, aesthetic look is also important as the feature can motivate learners' to visit or use the system but there is no influence on learning. In other words, emotional appeal of the interactive media would only persuade elderly to use the computer application but no influence would be on their learning outcomes.

CONCLUSIONS AND FUTURE RESEARCH

This study has significantly contributed to the understanding of interactive persuasive media potentials in supporting and enhancing learning among elderly. An initial conceptual model consisting determinants of learning effectiveness in an interactive persuasive media among elderly is determined. Theoretical constructs and their relationships in an interactive persuasive media learning environment has been identified and has been developed into a generic model where its fit has been systematically and empirically tested. The findings of this study suggest that the interactive media developer must work hand-in-hand with instructional designers to provide effective learning and strengthen their interactive media learning implementation. Further work to be considered can be a rigorous theoretical framework for constructing other important determinants of learning effectiveness in an interactive media learning environment because the findings of this research is for the elderly only.

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REFERENCES

Alavi M. and Leidner, D. E. (2001). Research commentary: Technology-mediated learning - A call for greater depth and breadth of research. Information Systems Research, 12(1), pp.1-10.

Awang Z. (2012). SEM using AMOS graphic. 8th edition, UiTM Press.

Bardzell J., Bardzell S. and Pace T. (2008).Emotion, engagement, and internet video.Emotion, pp.1 - 11.

Bazerque J. A., Baingana B. and Giannakis G. B. (2013). Identifiability of sparse structural equation models for directed and cyclic networks. Proceedings of the IEEE Global Conference on Signal and Information Processing, Austin TX (GlobalSIP), 2013, pp.839-842.

Bentler P. M. (1989). EQS: Structural equations program manual. Los Angeles, CA: BMDP Statistical Software.

Bobeth J., Schmehl S., Kruijff E., Deutsch S. and Tscheligi M. (2012). Evaluating Performance and Acceptance of Older Adults using Freehand Gestures for TV Menu Control. Paper presented at the 10th European Conference on Interactive TV and Video, Berlin, Germany.

Boulton-Lewis G. M., Buys L., Lovie-Kitchin J., Barnett K. and David L. N. (2007). Ageing, learning, and computer technology in Australia. Educational Gerontology, 33(3), pp.253-270.

Browne M. W. and Cudek R. (1993).Alternative Ways of Assessing Model Fit, in Testing Structural Equation Models, K. A. Bollen and J. Scott Long, eds., Newbury Park, CA: Sage Publications.

Chilcott M. and Smith A. (2011). Ageing well and learning through online immersive participation using a multi-user web 3d environment. Paper presented at the 2011 Third International Conference on Games and Virtual Worlds for Serious Applications (VS-GAMES), Athens, Greece.

Conley S., Muncey D. E. and You S. (2005). Standards-based evaluation and teacher career satisfaction: A structural equation modeling analysis. Journal of Personnel Evaluation in Education, 18(1), pp.39-65.

Czaja S. J. and Lee C. C. (2007).The impact of aging on access to technology.Universal Access in the Information Society, 5(4), pp.341-349.

Fogg B. (2003). Persuasive technology. Using computers too change what we think and do. Amsterdam: Morgan Kaufmann.

Gardner M. P. and Raj S. (1983). Responses to Commercials in Laboratory versus Natural Settings: A Conceptual Framework. Advances in Consumer Research, 10(1), pp.142-146.

Garson G. D. (2009). Structural equation modeling. Statnotes: Topics in multivariate analysis.

Gerbing D. W. and Anderson J. C. (1985). The effects of sampling error and model characteristics on parameter estimation for maximum likelihood confirmatory factor analysis. Multivariate Behavioral Research, 20(3), pp.255-271.

Giotakos O., Tsirgogianni K. and Tarnanas I. (2007). A virtual reality exposure therapy (VRET) scenario for the reduction of fear of falling and balance rehabilitation training of elder adults with hip fracture history. Paper presented at the Virtual Rehabilitation 2007, Venice, Italy.

Hair Jr F. J., Black W. C., Babin B. J., Anderson R. E. and Tatham R. L. (2006). Multivariate Data Analysis. Upper Saddle River NJ: Pearson.

Jamaan A. R. (2010). Panduan Lengkap Haji &Umrah. Johor: UniversitiTeknologi MARA.

Kankainen A. and Lehtinen V. (2011).Creative personal projects of the elderly as active engagements with interactive media technology. Paper presented at the 8th ACM Conference on Creativity and Cognition, Atlanta, Georgia, USA.

Keller J. M. and Suzuki K. (1988). Use of the ARCS Motivation Model In Courseware Design. In D. H. Jonassen (Ed.), Instructional Designs for Microcomputer Courseware, England: Lawrence Erlbaum Associates, pp. 401-434.

Lee E. A., Wong K. W. and Fung C. C. (2010). How does desktop virtual reality enhance learning outcomes? A structural equation modelingapproach. Computers& Education, 55(4), pp.1424-1442.

Looije R., Neerincx M. A. and Cnossen F. (2010). Persuasive robotic assistant for health self-management of older adults: Design and evaluation of social behaviors. International Journal of Human-Computer Studies, 68(6), pp.386-397.

Lorenz A. and Oppermann R. (2008). Mobile health monitoring for the elderly: Designing for diversity,‖ Pervasive and Mobile Computing.

Marsh H. W. and Hocevar D. (1985). Application of confirmatory factor analysis to the study of self-concept: First-and higher order factor models and their invariance across groups. Psychological bulletin, 97(3), pp. 562.

Mayer R. E. (2001). Multimedia Learning. Cambridge, United Kingdom: Cambridge University Press.

Mayer R. E. (2002). Cognitive Theory and the Design of Multimedia Instruction: An Example of the Two-Way Street Between Cognition and Instruction. New directions for teaching and learning, 2002(89), pp.55-71.

Mayer R. E. and Moreno R. (2002).Aids to computer-based multimedia learning.Learning and instruction, 12(1), pp.107-119.

Neo T. and Neo M. (2004).Integrating Multimedia into the Malaysian Classroom: Engaging Students in Interactive Learning.The Turkish Online Journal of Educational Technology, 3(3), pp.31-37.

Noor N. M. (2012). Al-Adab : Islamic Sex Education (ISE) Courseware from Cognitive Theories. (Master Thesis, Universiti Utara Malaysia, 2012).

Nunnally Jum C. (1978). (second edition). Psychometric theory. New York: McGraw-Hill.

Packer J. and Ballentyne R. (2002). Motivational factors and the visitor experience: A comparison of three sites. Curator, 45(3), pp.183-198.

QOTFC. (2007). Adult Learning Theory and Principles. Retrieved 30 January 2013, from http://www.qotfc.edu.au/resource/?page=65375

Reinard J. C. (2006). Communication research statistics. Sage.

Staphorst L., Pretorius L. and Pretorius T. (2013). Structural equation modelling based data fusion for technology forecasting: A generic framework. Proceedings

of the Technology Management in the IT-Driven Services, San Jose CA, (PICMET 2013), pp.2163-2170.

Shuell T. J. and Lee C. Z. (1976).Learning and instruction. Monterey, CA: Brooks-Cole.

Thangarajoo Y. (2008). Computer-Based Motorcycle Engine Diagnosis and Troubleshooting Module Usability and Training Evaluation.(Master Thesis, Universiti Utara Malaysia, 2008).

Tucker L. R. and Lewis C. (1973). A reliability coefficient for maximum likelihood factor analysis. Psychometrika, 38(1), pp.1-10.

Watering M. (2005). The impact of computer technology on the elderly, from http://www.marekvandewatering.com/texts/HCI_Essay_Marek_van_de_Watering.pdf

Yasothaa K. C. and Zamin N. (2014). M3DITRACK3R: A design of an automated patient tracking and medicine dispensing mobile robot for senior citizens. Proceedings of International Conference on Computer, Communications, and Control Technology, Langkawi, Malaysia (I4CT), pp 36-41.

Yusoff M. F. (2012). Virtual Hajj - A Persuasive Hajj Learning Procedures Courseware. Sintok: Universiti Utara Malaysia.

Zaccarelli C., Cirillo G., Passuti S., Annicchiarico R and Barban F. (2013, 5-8 May 2013). Computer-based cognitive intervention for dementia Sociable: motivating platform for elderly networking, mental reinforcement and social interaction. Proceedings of the 7th International Conference on Pervasive Computing Technologies for Healthcare, Venice, (PervasiveHealth), pp 430-435.

Zhang P. (2009). Theorizing the relationship between affect and aesthetics in the ICT design and use context. Proceedings of the 2009 International Conference on Information Resources Management, Dubai, United Arab Emirates, pp 1-15.