Critical Analysis in Proposing Persuasive Multimedia Model of Truancy Awareness (PMTA)

Mohamad Lutfi Dolhalit[1], Sobihatun Nur Abdul Salam[2], Ariffin Abdul Mutalib[2], and Muhamad Saiful Bahri Yusoff[3]

[1]Universiti Teknikal Malaysia, Malaysia, lutfi@utem.edu.my
[2]Universiti Utara Malaysia, Malaysia, {sobihatun; am.ariffin}@uum.edu.my
[3]Universiti Sains Malaysia (Kelantan), Malaysia, msaiful_bahri@usm.my

ABSTRACT

This article reports on the ongoing research to propose a persuasive multimedia model of truancy awareness (PMTA) for secondary school students. Accordingly, 9 related models were compared and systematically analyzed with the main objectives to: i). Review and analyses the previous applications and models that are related to the development PMTA Model. ii). Identify and select the generic component in designing the PMTA model. Accordingly, by investigating the selected model, this study suggest the common components applied by the researchers in developing a persuasive application to create awareness. The result of the reviews, shows there are four general components and seven sub-component were outlined. In addition, future work need to be conducted to extract and gathering the detail of sub-component that contains in each common component.

Keywords: Persuasive Technology, Multimedia, Truancy Awareness.

I INTRODUCTION

Literature review on a number of awareness studies by using persuasive technology have been reported on pro-environmental awareness (e.g., Centiero, Romao and Dias, 2011), passengers safety in aircraft evacuations (e.g., Chittaro, 2012), fire safety (e.g., Chittaro and Zangrando, 2010), environmental health (e.g., Filonik, Medland, Foth, Rittenbruch, 2013; Foster et al., 2010), healthy lifestyle among patients with chronic disease (e.g., Gasca, Favela and Tentori, 2008), sustainable lifestyle (e.g., Kuznetsov and Paulos, 2010; Thieme et al., 2012), public awareness and discourse (e.g., Valkanova, Jorda, Tomitsch and Vande, 2013), and stretching for heavy computer users (e.g., Chen, 2014). In most of the awareness studies, persuasive principles, methods, techniques and models have been used to build a certain awareness level of persuasive technology.

As reported by Byrnes (2015) from Massachusetts Institute of Technology (MIT) Technology Review 2015, persuasive technology had been embeded by software developers by using this technologies to measure customer behaviour and to design a products that are not just persuasive but specifically aimed at building new habits. Fogg (1999) explained, a technology designed purposely to change attitudes or behaviour of the users through persuasive messages and social influence is called persuasive technology or captology derived from "computer as persuasive technology" as illustrated in Figure 1.

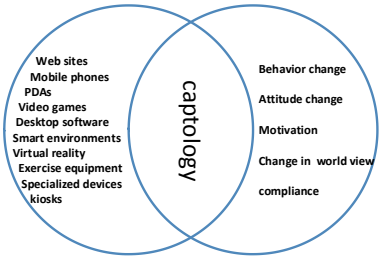

Figure 1. Captology

Multimedia influence as persuasive technology have been discussed by Holbert and Tchernevv (2013) and Mayer (2009). Multimedia technology in education has offered a new way of learning in which the learners can have access to the material and learn from various platforms in obtaining the knowledge (Mayer & Moreno, 2002). The applications of multimedia technology played an important role in assisting the delivery of persuasive messages Spagnolli, Chittaro and Gamberini (2016) thus can assist in behavior change.

In the context of truancy awareness, as reported by Ministry of Education Malaysia from year 2008-2012 in 2012 school session, there are a total of 107,191 students were involved in discipline problems. Report shows that, the highest number of students' misbehaviour was truancy (17343) followed by impolite behaviour (15407), criminal behaviour (14321) and smoking (14298). This figure demonstrated that there is a need to propose a strategy in handling with truancy behaviour in secondary schools.

As suggested by Chong, Lee, Roslan and Baba (2015), research shows self-awareness is identified as one of the important areas that can improve student attendance and student performance besides school policies, supervision and program. However study by

Kuo and Kuo (2015), surprisingly found that very little indication exists that school systems are using multimedia instruction as a solution for truancy prevention Thus the lack of studies on the effects of using multimedia technology on truancy awareness prompts questions about its importance. This finding are also supported from preliminary studies by Mohamad Lutfi, Sobihatun and Ariffin (2016) where it is found that there is no such multimedia application in truancy awareness or any educational materials to support the learning process.

In conjunction with the statement, the main purpose of this study is to propose a persuasive multimedia model of truancy awareness (PMTA) among secondary school students, with two specific objectives as follows:

1) To review and analyses the previous applications and models that are related to the development PMTA Model.

2) To identify and select the generic component in designing the PMTA model.

This paper is presented in the following order; introduction, methodology, followed by the systematic review, comparative analysis, findings and discussion and ends with the conclusion and future work.

II METHODOLOGY

In order to achieve the stated objectives, three phases of activities were employs which are (i) literature review, (ii) systematic review and (iii) comparative analysis. The relationship between the activity and output of this study is summarized in Table 1.

Table.1. Summary Of Activity

Activities	Output
1. Literature Review	Selection and justification of 9 previous persuasive technology applications and models.
2. Systematic review	Understand the common component of PT model.
3. Comparative analysis	Selection of generic elements of PMTA model.

As illustrated in Table 1, the first phase started with literature review, which involved 9 selected models related to persuasive technology and awareness studies from reputable journal. The selected models were reviewed and analyzed to validate the suitability of the model with this study. Second phase involved a systematic review in which the common elements were selected. Lastly comparative analysis conducted to extract the generic component for the development of PMTA model. The finding of the related activities is discussed in the following section.

III SYSTEMATIC REVIEW ON EXISTING MODEL

Prior to proposing the components of PMTA model, a systematic review and analysis of the selected model and application were conducted. They are discussed critically as follow:

A. The Persuasive Power of Virtual Reality.

The use of virtual reality (VR) as a simulation tool provides users with experience of their actions and effects in a vivid and memorable ways. This study by Chittaro (2010) concern on how to create awareness of personal fire safety, which focus on attitudes towards smoke in evacuating buildings. The model utilizes social cognitive theory by Bandura (2004) which emphasized learning through observation/simulation. The virtual simulation experience was created that allows the user to realistically experience an evacuation of a burning building and try for herself the effects of staying in smoke or avoiding it. In terms of functional roles of computer, this study adopts computer as a persuasive tool and as a media simulation by using the principle of cause & effects, virtual rehearsal and suggestion in the application development.

B. A transformational product to improve self-control strength.

Although the field of Persuasive Technologies only emphasises in a way on how to change attitudes and behaviour, sometimes it often neglects the science of self-awareness to change the attitude or behaviour. Research by Kehr, Hassenzahl, Laschke and Diefenbach (2012) is an example of how to foster self-awareness through an interactive machine called "Chocolate Machine". Chocolate machine consists of a slim container filled with wrapped chocolate balls and every 30 minutes the machine will test users' resistance by releasing a chocolate ball onto the desktop. The user can choose either to eat the chocolate or return it back to the machine. This machine is an example on how persuasive technology can be as a tool in which principle of conditioning and self-monitoring is embedded while providing a continuous positive experience.

C. Inair: Indoor Air Quality Measurements And Visualizations

The awareness of the indoor air quality is important due to the contribution to chronic diseases. Kim, and Paulos (2010) suggested inAir, a real-time measurements and visualizations device of indoor air quality and sharing the information within a social network. As a tool inAir device provides users

measured indoor air quality and the explanation on how to improve the pollutant. Sharing mechanism to trigger positive activities by social influence plays important role in understanding the relative level of air quality across people. Thus principle of self-monitoring, surveillance and conditioning were applied in this study. inAir device also act as computer as persuasive media where, as a media it is simulating the cause and effects the consequences of pollutant to human wellbeing.

D. UpStream: Motivating Water Conservation with Persuasive Displays.

The most precious natural resources for human being is a water. However the increased demand for water has led to worsening quality of water. Thus, a study by Kuznetsov and Paulos (2010) aims to raise awareness and motivate water conservation through the integration of persuasive displays and a water-flow sensors in a public and private homes. Persuasive display named "UpStream" were used a tool to display water usage by individual and the collective water usage is displayed in a persuasive interface. This persuasive display functions as a self-monitoring system which suggest the amount of low, average and above average water use. In the context of computers roles the "UpStream" functions as a persuasive tools and media simulation.

E. Mobile Persuasive Application to Encourage Reduction of Users' Exposure to Cell Phone RF Emissions

The risk of exposure to the radio frequency (RF) emission is possibly harmful to human except hands-free devices such as earphones were used. Therefore, to foster awareness in reducing the emissions, Burigat and Chittaro (2014) proposed BrainSaver, an Android application to monitors user's call behaviour and gives feedback about how the user is behaving with respect to the use of earphones. Health-related messages such as notifications and visualizations based on persuasive principles were used in a way to provide users with feedback about their behaviour. Principle of tailoring, suggestion and conditioning is the main principle in a persuasive technology tools used in the Brainsaver, such as reminder, feedback, reinforcement and engagement. Cause-and-effects, virtual rehearsal and virtual rewards act as persuasive technology media in the application.

F. The Perception of Sound and its Influence in the Classroom.

The effects of class noise substantially gives disadvantages to the students' learning. Noise is related to the disturbance to both students and teachers. To control the student's noise Reis and Correia (2011) proposed a game named "The Castle of Count Pat" an experimental study which capture sound and represent the noise in graphical data in a real time. An avatar character name "Pat" and "Moon" act as a persuasive social actors which attract student to keep quiet, reward will be given if the student managed to achieve a certain level of noise. This game act as persuasive tool and social actor as a persuasive strategy where this functional role influence the students' attention towards teacher.

G. Persuading Users They Need Up-to-Date Antivirus Protection

Security option by antivirus software to persuade users to update the antivirus pattern appears to have limited effect of the user's behaviour. Thus, there is a need to outline a strategy to apply instructional intervention education to solve this issue. Zhang-Kennedy, Chiasson and Biddle (2014) proposed infographic and an online interactive comic (webcomic) to increase users' awareness and motivate them with the correct use of antivirus protection. Persuasive technology as media is the main component of this study, especially when mental model infographics on how the antivirus works in reality were used. Principle tailoring suggestion and conditioning were applied in both of the prototype.

H. ECOISLAND: Persuading users to reduce CO2 emissions.

In response to the global climate issues and awareness on the CO2 emissions reductions, Takayama (2009) proposed a game application named EcoIsland, a with the aim to persuade and assisting individual families in changing their lifestyle patterns to reduce CO2 emissions. House surrounding installed with a display which present as a virtual island. Gamers can customise their own avatar as social actors which reflect the similarity to the gamer's character. Principle of tailoring were used such as selecting the target setting of CO2 by 20% and the gamers should follow the rules to achieve the target. Along with the game play, the game will suggest the type of activity that should be achieved to maintain the CO2 level. Gamers will collaborate to monitor members' activities and will be penalized if fail, resulting in game over.

I. Designing for reflection and social persuasion to promote sustainable life-styles.

This paper by Thieme et al., (2012) aims to contribute to an understanding of how technology can promote ecological awareness and environmentally sustainable lifestyles in individuals. To develop the awareness, BinCam a social persuasive system to motivate reflection and behavioural change in the food waste and recycling habits of young adults were created. BinCam employed transtheoretical model (TTM) as a strategy to support the individual in achieving

behaviour change. Whereas the theory of planned behaviour (TPB) serves as a conceptual framework in which to predict can and explain behaviour. Other than that, to support engagement and reflection with BinCam social influence using Facebook was used to share their efforts in recycling. This will trigger reflections on their own using pictures of activities and collaboration with others recycling and food waste behaviours.

IV FINDING OF SYSTEMATIC REVIEW

Based on the analysis and review, there are a number of reasons why the model was selected for the purpose of this study. In general, most of the studies are basically focused on persuasive design guideline or process to ensure the developed persuasive application will match with the targets users especially in awareness study. Other than that, some of the model discuss persuasive strategy that includes principle, technique and approach to increase their awareness toward certain context or issues. Some of the studies suggested the importance of learning theory, approach and instructional strategy to support behaviour change.

Some of the studies also stress on the methods, technologies and medium used to deliver the persuasive contents, this include comprehensible presentation, some with the logical presentation structure, and some with the good persuasive contents to support the intended outcome. In can be concluded that, the process of development of PMTA must include four general aspects its persuasive system design as listed below.

i. **The intent** focus on the intended outcome of the persuasive system towards user's attitude or behaviour or both.
ii. **The strategy** is important in analysing the direct or indirect message to be delivered. Strategy guidelines more emphasizes on two strategic elements namely, macrosuasion strategy and microsuasion strategy to deliver the message and to route of the messages
iii. **The event** focus on implementation of the persuasive system from the problem domain to encourage users to set goals and assist them to discover new ways for achieving specific targets in a systematic way.
iv. The **prototyping process** focus on the development process of persuasive system application for evaluation and demonstration.

Other components that include in the design guideline is i. Persuasive Principle ii. Persuasive Technique iii: Technology or medium, v. Instructional technology vi. Prototyping process.

In short, it has to be emphasized that, this analysis was carried out to discover the essential components in PMTA model based on the general aspects as above. Hence next section will discuss a comparative analysis of to form the general structure of PMTA model.

V COMPARATIVE ANALYSIS

Accordingly, in formulating the general component of the PMTA model a comparative analysis was conducted to get generic component for the development of PMTA model. The analysis was conducted through the model, function and snapshots of the developed prototype and the elaboration of discussion and finding of the selected study. Then the common components of the model are extracted.

Table 1 plot the common component of each of the selected conceptual design models and categorized it in terms of their common components.

Table 2. Common Component Of Model

Common Component	A	B	C	D	E	F	G	H	I	T
Intent										
Problem Specification	**x**		**x**		**x**	**x**		**x**	**x**	**6**
Problem statement		**x**		**x**	**x**			**x**		**4**
Strategy										
Macrosuasion Strategy	**x**	**x**		**x**	**x**			**x**	**x**	**6**
Microsuasion Strategy	**x**			**x**	**x**	**x**	**x**	**x**	**x**	**7**
Event										
Learning Theories						**x**	**x**			**2**
Learning Approach		**x**	**x**							**2**
Instructional Strategy						**x**	**x**			**2**
Instructional Design		**x**				**x**		**x**	**x**	**4**
Prototyping	**x**		**x**	**x**		**x**	**x**	**x**	**x**	**7**

X: indicates the persuasive component used in the model/application
T: Total
A-I: Model and application

VI FINDING OF COMPARATIVE ANALYSIS

Based on the comparative analysis, there are four main components that are compulsory to be included in the PMTA model. Problem specification and statement will be combined since its share the same features and meaning in model development. As most of the listed model shares the similar format, so it is essential to have the structural component to formulate the general structure of PMTA model. With the aim of this study to propose a conceptual model to assist developers/designers a successful design step in developing truancy awareness applications, therefore

the common component gathered from the existing model is illustrated in Figure 2. This general structure of PMTA model does not specify the specific step, rather than an iterative process to complete the development process.

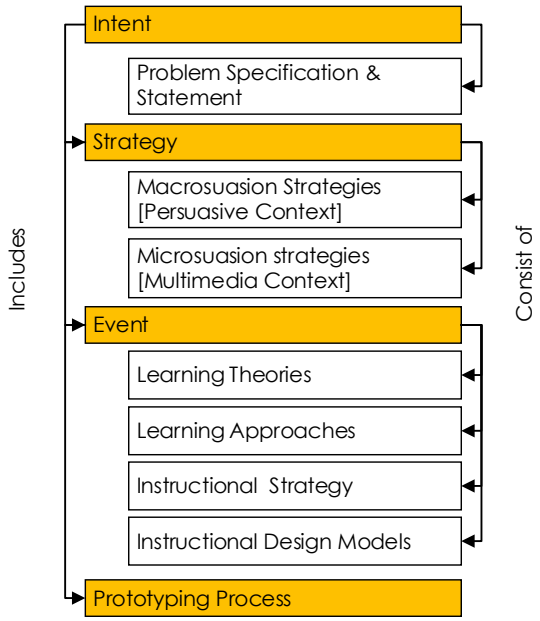

Figure 2. General Component Of PMTA Model.

VII CONCLUSION AND FUTURE WORK

Overall, most of the reviewed article showed that, persuasive technology can be an effective tool for changing attitudes and learning purposes concerning in creating awareness topics. Having understood the general process of persuasive system development for PMTA will leads to the construction of the complete structure of the PMTA model. Derive from comparative study four main components were proposed, intent, strategy, event and prototyping. Accordingly, each sub-component were also extracted this include problem specification and statement, macrosuasion and microsuasion technology. Besides that instructional technology were also important to create learning application.

In summary, the proposed PMTA model gives particular attention on how to create awareness using multimedia contents with the help of persuasive strategies. Thus, understanding the common components applied by the researchers in developing a persuasive application to create awareness towards certain behavior really implicated this study. Accordingly, by understanding the related components it will help to develop PMTA model in a systematic way.

The next step of this study will involve with more comparative analysis to extract and gathering the detail of sub-component that contains in the common component. In addition, consultation with expert will be conducted to review and validate the model. Afterward, the complete validated model will be tested through a prototyping. The finding of the future research will be presented in the next articles.

ACKNOWLEDGMENTS

The authors are momentously obliged to UUM, UTeM, and Malaysian Ministry of Education (MOE) for providing financial assistance through FRGS grant for the research reported in this paper and providing support and facilities that have facilitated the research process along this year.

REFERENCES

Bandura, A. (2004). Social cognitive theory for personal and social change by enabling media. Entertainment-education and social change: History, research, and practice, 75-96.

Byrnes, N. (2015). Technology and Persuasion. Retrieved Mei 06, 2015, from http://www.technologyreview.com/news/535826/technology-and-persuasion/

Burigat, S., & Chittaro, L. (2014). Designing a mobile persuasive application to encourage reduction of users' exposure to cell phone RF emissions. In Persuasive Technology (pp. 13-24). Springer International Publishing.

Centieiro, P., Romão, T., & Dias, A. E. (2011, November). A location-based multiplayer mobile game to encourage pro-environmental behaviours. InProceedings of the 8th International Conference on Advances in Computer Entertainment Technology (p. 31). ACM.

Chen, Y. X., Chiang, S. S., Chih, S. Y., Liao, W. C., Lin, S. Y., Yang, S. H., ... & Hung, Y. P. (2014). Opportunities for Persuasive Technology to Motivate Heavy Computer Users for Stretching Exercise. In Persuasive Technology (pp. 25-30). Springer International Publishing.

Chittaro, L. (2012). Passengers' safety in aircraft evacuations: Employing serious games to educate and persuade. In Persuasive technology. Design for health and safety (pp. 215-226). Springer Berlin Heidelberg.

Chittaro, L., & Zangrando, N. (2010). The persuasive power of virtual reality: effects of simulated human distress on attitudes towards fire safety. In Persuasive Technology (pp. 58-69). Springer Berlin Heidelberg.

Chong, A. M., Lee, P. G., Roslan, S., & Baba, M. (2015). Emotional Intelligence and At-Risk Students. SAGE Open, 5(1), 2158244014564768.

Filonik, D., Medland, R., Foth, M., & Rittenbruch, M. (2013). A customisable dashboard display for environmental performance visualisations. In Persuasive Technology (pp. 51-62). Springer Berlin Heidelberg.

Fogg, B. J. (1999). Persuasive Technologies. Communications Of the ACM, 42(5), 26–29.

Gasca, E., Favela, J., & Tentori, M. (2008). Persuasive virtual communities to promote a healthy lifestyle among patients with chronic diseases. In Groupware: Design, Implementation, and Use (pp. 74-82). Springer Berlin Heidelberg.

Holbert, R. L., & Tchernev, J. M. (2013). Media influence as persuasion. The Sage handbook of persuasion, 36-52.

Joshi, D., & Dutta, I. Emotional Intelligence among Secondary Students: Role of Gender and Type of Schools. MIER Journal of Educational Studies, Trends & Practices, 4(2), (2014), 167–182.

Kehr, F., Hassenzahl, M., Laschke, M., & Diefenbach, S. (2012, May). A transformational product to improve self-control strength: the chocolate machine. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (pp. 689-694). ACM

Kim, S., & Paulos, E. (2010, April). InAir: sharing indoor air quality measurements and visualizations. In Proceedings of the SIGCHI

Conference on Human Factors in Computing Systems (pp. 1861-1870). ACM.

Kuznetsov, S., & Paulos, E. (2010, April). UpStream: motivating water conservation with low-cost water flow sensing and persuasive displays. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (pp. 1851-1860). ACM.

Kuo, Y. C., & Kuo, Y. T. (2015, March). Online Learning and Dropout Prevention in K-12 education. In Society for Information Technology & Teacher Education International Conference (Vol. 2015, No. 1, pp. 364-373).

Mayer, R. E., & Moreno, R. (2002). Aids to computer-based multimedia learning. Learning and Instruction, 12(1), 107–119. http://doi.org/10.1016/S0959-4752(01)00018-4.

Mohamad Lutfi, D.,Sobihatun Nur, A.S., & Ariffin, A. M. (2016). A Preliminary Study: The Availability of Multimedia Applications in Truancy Awareness. International Journal Of Interactive Digital Media, Vol. 4(1), ISSN 2289-4098, e-ISSN 2289-4101

Reis, S., & Correia, N. (2011). The Perception of Sound and its Influence in the Classroom. In Human-Computer Interaction–INTERACT 2011 (pp. 609-626). Springer Berlin Heidelberg.

Spagnolli, A., Chittaro, L., & Gamberini, L. (2016). Interactive Persuasive Systems: A Perspective on Theory and Evaluation. International Journal of Human-Computer Interaction, 32(3), 177-189.

Takayama, C., Lehdonvirta, V., Shiraishi, M., Washio, Y., Kimura, H., & Nakajima, T. (2009, March). Ecoisland: A system for persuading users to reduce CO2 emissions. In Future Dependable Distributed Systems, 2009 Software Technologies for (pp. 59-63). IEEE.

Thieme, A., Comber, R., Miebach, J., Weeden, J., Kraemer, N., Lawson, S., & Olivier, P. (2012, May). We've bin watching you: designing for reflection and social persuasion to promote sustainable lifestyles. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (pp. 2337-2346). ACM.

Valkanova, N., Jorda, S., Tomitsch, M., & Vande Moere, A. (2013, April). Reveal-it!: the impact of a social visualization projection on public awareness and discourse. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (pp. 3461-3470). ACM.

Zhang-Kennedy, L., Chiasson, S., & Biddle, R. (2014). Stop clicking on "update later": Persuading users they need up-to-date antivirus protection. In Persuasive Technology (pp. 302-322). Springer International Publishing.