

A Future Strategy Towards Smoking Cessation: Persuasive Multimedia Application (PMA) in Strengthening Motivation towards Smoking Prevention and Cessation

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Abstract—Smoking cessation or successful quitting depends a lot on one of its identified crucial factors - motivation. The PRIME Theory of Motivation has listed five motivation domains in the human motivational system. These are Plans, Responses, Impulses, Motives and Evaluations. For the purpose of this study, Persuasive Multimedia Application (PMA) has been produced and used as a learning and persuasion approach through the use of Persuasive Technology. PMA has adopted a cause-and-effect principle from Persuasive Technology as a learning strategy at the macro-persuasion level, and Multimedia and Redundancy principles draw from Mayer's Multimedia Learning Principles as a design strategy at the micro-persuasion level. A total of 54 respondents have been selected and have undergone a 2x2 quasi-experimental research design experiment. Considering the limitations of this study, only three selected PRIME domains in the form of Plans, Evaluations and Motives were measured by using an instrument adapted from the PRIME questionnaires and later analyzed using IBM SPSS 20. The results of the study prove that the PMA developed by using the cause-and-effect principle, specifically one in the Multimedia and Redundancy mode (Mode B), has produced a significant impact on motivation towards smoking cessation, especially in terms of the evaluations domain.

Keywords-*Persuasive Technology; Captology; Persuasive Multimedia Application (PMA)*

I. INTRODUCTION

Teenagers or adolescents are defined as individuals in the 10 – 19 year age group according to the World Health Organization (WHO) and the Canadian Paediatric Society [1]. WHO [13] added that there are more than 1.1 billion adolescents worldwide, and 85% of them live in developing countries. Heikkinen et al. [4] stated that smoking is associated with other types of unhealthy behaviours such as alcohol consumption. Thus, all efforts to control smoking are worthwhile, especially when intervention programmers have not paid attention to smoking cessation among adolescents [4].

In the United States, tobacco use remains the leading cause of death, although its use is voluntary [12]. Research has proved that smokers, who quit, live longer than those who continue to smoke and those who receive intensive treatment receive a mortality benefit.

The article is structured as follow: Section 2 will discuss the related research. Section 3 will define and discuss the concept of a behaviour and motivation support system. Section 4 will discuss the methodology employed in the research. Section 5 will present the data analysis. Section 6 will discuss the

finding. Section 7 will discuss the research implications. Finally, section 8 will suggest the future research directions.

II. BACKGROUND TO THE PROBLEM

In their official website the World Health Organization (WHO) has also said that 80,000 and 100,000 children worldwide start smoking every day, and roughly half of them are from Asia [6]. About 50 teenagers in Malaysia below the age of 18 start smoking everyday according to a survey conducted by the Malaysia Ministry of Health (MOH) (2003) even after the 'Tak Nak' (Say No) campaign.

In 2003, the United States Center for Disease Control and Prevention (CDC) found that motivation and readiness to quit smoking are among predictors of successful quitting. They have also found from self-reports that 41% of current smokers (20.2 million) had tried to quit smoking for 1 or more days within the previous 12 months. Many smokers who try to quit cite a desire to improve their health as the main reason.

Parkinson et al. [8] also stated that beliefs about smoking are important predictors of smoking behaviour among youth. West [9] has also stated that human being's motive for doing something (including smoking) depends on his/her beliefs, or what he refers to as the 'Evaluations' domain in PRIME Theory.

Therefore, developing innovative and effective approaches to control tobacco use among youth, through both prevention and cessation strategies, remains a high public health priority [6]. Parkinson et al. [8] also suggested that anti-smoking media may be an important means of targeting beliefs about smoking among youth, especially when they often respond defensively to messages that threaten their lifestyle, attributes and prospects [5].

III. SIGNIFICANCE OF THE STUDY

Persuasive Technology is defined as any interactive computing system designed to change people's attitudes or behaviours [3]. Therefore, it has created a space for the development and the implementation of a Persuasive Multimedia Application which aims to increase motivation with regard to smoking prevention and cessation among teenagers.

Previous studies that have used this technology showed that Persuasive Technology is capable of changing people's attitudes or behaviour in terms of the expected attitudes or

behaviour. Hence, this study will produce a persuasive multimedia application that will contribute to the current efforts of the Malaysia Ministry of Health (MOH), the Malaysia Ministry of Education (MOE), the Malaysia Ministry of Youth and Sports and, especially, parents and teenage smokers themselves.

This PMA has been designed and developed based on Multimedia Learning Principles [7] and Persuasive Technology [3]. The finding will help to enlighten other researchers about which of the multimedia presentation elements (words, images or both) and Persuasive Principles work best in increasing teenagers' motivation with regard to smoking cessation, and then impacting on their smoking behaviour after gaining enough knowledge and motivation through persuasion.

IV. THEORETICAL FRAMEWORK

Two theoretical foundations of this study are the design and development of the PMA, which is based on Persuasive Technology [3], and Multimedia Learning Principles [2] and the use of PRIME Theory [10][11] to explain human motivational systems.

The theoretical foundations can be interpreted in terms of the following conceptual framework (Fig. 1):

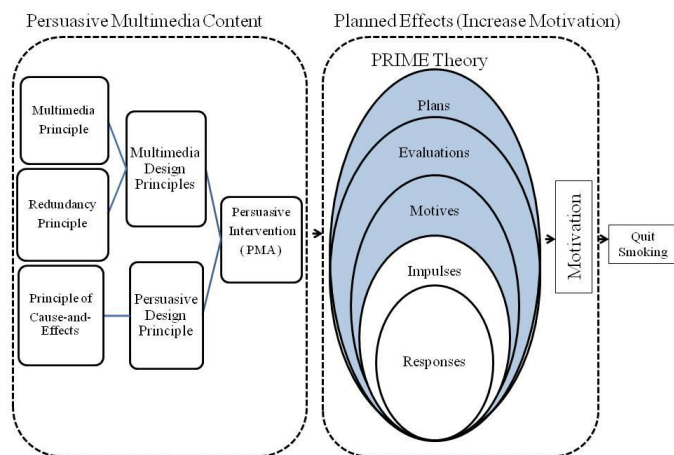


Figure 1. Conceptual Framework

Persuasive Multimedia Application (PMA) has been developed by using the principles in Persuasive Multimedia Content. In the Planned Effects (increase motivation), the motivation is called intrinsic motivation and it is based on the satisfactions of behaving "for its sake." This intrinsic motivation depends on what is known as internal environment in PRIME Theory [11].

V. LIMITATIONS OF THE STUDY

There are more principles related to Persuasive Technology and multimedia learning principles than can be dealt with in this study in order to maximize the full potential of Persuasive Technology. However, due to the limitations of the

timeframe, only one principle from Persuasive Technology (cause-and-effect), two from multimedia learning principles (Multimedia and Redundancy) and three domains of PRIME theory (Plans, Evaluations and Motives) are used in this study.

Finally, due to these limitations, this study could only focus on the proof of the persuasive multimedia model with the factors that foster intrinsic motivation based on three elements in PRIME Theory on the selected participants in the school's multimedia lab.

VI. METHODOLOGY

The main purpose of this study is to design and develop a persuasive multimedia application based on Persuasive Technology principles and Multimedia Learning Principles in order to increase teenagers' motivation in terms of smoking prevention and cessation in such a way as to enable them to quit smoking. The study also suggests an appropriate way to evaluate its effectiveness.

A. Method and design

It is suggested that the study employed a 2 x 2 quasi-experimental design in which two groups of participants will be tested twice using pre-test and post-test experiments with regard to a particular exposure to different modes of treatment as indicated by the following Table 1:

TABLE 1. RESEARCH DESIGN.

	Phase 1	Phase 2	Phase 3
Treatment 1 Group #1	Baseline motivation test (Pre-test) -using questionnaire adopted from PRIME theory	Persuasive courseware (PMA Mode A- Multimedia Principle) Treatment #1	Post motivation test (Post-test) -using questionnaire adopted from PRIME theory
Treatment 2 Group #2	Baseline motivation test (Pre-test) -using questionnaire adopted from PRIME theory	Persuasive courseware (PMA mode B- Redundancy Principle) Treatment #2	Post motivation test (Post-test) -using questionnaire adopted from PRIME theory

B. Participants

A total of 54 randomly selected participants were appointed to the experiment in which they were divided into two equal groups.

C. Instrument

- Adapting the PRIME Theory Questionnaire used in Smoking Cessation programme in the United Kingdom
- Persuasive Multimedia Application

D. Data Analysis and Results

The purposes of the analysis are to measure the effectiveness of Persuasive Multimedia Application on the teenager’s motivation towards smoking prevention and cessation, before and after the treatment. The scope for the analysis is based on the research hypotheses stated earlier in this study.

VII. DATA ANALYSIS

A. Combined effect of intervention and effects on modes of presentation

There is no significant difference between two multimedia principles on persuasive design principle (cause-and-effect) in two Persuasive Multimedia Applications in terms of increasing teenage motivation with regard to smoking prevention and cessation.

TABLE 2. TESTS OF BETWEEN-SUBJECTS EFFECTS. Dependent Variable: Combined smoking status post

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	30.036 ^a	48	.626	1.515	.345
Intercept	.734	1	.734	1.778	.240
Combined_smoking status_pra	1.230	1	1.230	2.978	.145
Combined_domain_post	21.507	47	.458	1.108	.513
Error	2.066	5	.413		
Total	586.609	54			
Corrected Total	32.102	53			

a. R Squared = .936 (Adjusted R Squared = .318)

Generally there was no significant effect of courseware on smoking status for both modes at F=1.108, p = 0.513 from the ANCOVA result after controlling for the effect of smoking status prior to the intervention. Hence H2 is rejected.

In terms of two different modes, group B in the redundancy mode showed a significant effect of courseware on smoking status at F=49.132, p = 0.004 from the ANOVA result.

TABLE 3. TESTS OF BETWEEN-SUBJECTS EFFECTS. Dependent Variable: B_Smoking Status Post

Source	Type III Sum of Squares	Df	Mean Square
Corrected Model	12.283 ^a	24	.512
Intercept	253.939	1	253.939
B_Domain_Post_B	12.283	24	.512
Error	.031	3	.010
Total	281.859	28	
Corrected Total	12.314	27	

a. R Squared = .997 (Adjusted R Squared = .977)

TABLE 4. TESTS OF BETWEEN-SUBJECTS EFFECTS. Dependent Variable: B_Smoking_Status_Post

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	12.283 ^a	24	.512	49.132	.004
Intercept	253.939	1	253.939	24378.128	.000
B_Domain_Post_B	12.283	24	.512	49.132	.004
Error	.031	3	.010		
Total	281.859	28			
Corrected Total	12.314	27			

a. R Squared = .997 (Adjusted R Squared = .977)

TABLE 5. TESTS OF BETWEEN-SUBJECTS EFFECTS. Dependent Variable: A_Smoking_Status_Post

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	16.463 ^a	23	.716	.526	.828
Intercept	280.585	1	280.585	206.144	.005
A_Domain_Post_A	16.463	23	.716	.526	.828
Error	2.722	2	1.361		
Total	304.750	26			
Corrected Total	19.185	25			

a. R Squared = .858 (Adjusted R Squared = -.774)

B. PRIME as a result of Persuasive Multimedia Application

Specifically, there is a significant difference at one domain (Evaluations) at F = 2.054, p = 0.038 as a result of PMA.

Domain Evaluations (Beliefs)

TABLE 6. TESTS OF BETWEEN-SUBJECTS EFFECTS. Dependent Variable: Combined_Smoking Status_Post

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	14.692 ^a	16	.918	1.951	.047
Intercept	2.726	1	2.726	5.793	.021
Combined_evaluation_pra	.948	1	.948	2.014	.164
Combined_evaluation_post	14.498	15	.967	2.054	.038
Error	17.410	37	.471		
Total	586.609	54			
Corrected Total	32.102	53			

VIII. DISCUSSION AND FINDINGS

This study adapted PRIME Theory by West [9], in order to simulate the three different domains under PRIME Theory in terms of smoking prevention and cessation. With the increase in the three preliminary domains of motivation, there will an increase in one’s motivation level which will promote smoking prevention and cessation.

Two types of Persuasive Multimedia Application (PMA) were developed as an intervention strategy to promote the three domains of motivation under PRIME Theory. The Persuasive Multimedia Application is developed based on Persuasive Technology Principle as learning strategy and Multimedia Learning Principles (Multimedia and

Redundancy) as a design strategy. The effectiveness of the Persuasive Multimedia Application (PMA) is tested using PRIME questionnaires developed by West [10].

A. Combined effect of intervention and effects according to modes of presentation

The overall analysis with regard to the second hypothesis also shows that, in general, there is no significant effect of courseware on smoking status for both modes at $F=1.108$, $p = 0.513$ from the ANCOVA result after controlling for the effect of smoking status prior to the intervention.

However, group B in the redundancy mode shows a significant effect in terms of courseware on smoking status at $F=49.132$, $p = 0.004$ from the ANOVA result, compared to group A in the Multimedia mode, where the result is $F=0.526$, $p = 0.828$. These results suggest that the redundancy mode related to group B had a more positive result in increasing teenage motivation with regard to smoking prevention and cessation, based on prior smoking status, compared to the multimedia mode.

Hence, despite the results of the overall analysis, the findings with regard to group B confirmed and were parallel with those of Toh, Waddah and Wan Ahmad Jaafar [11], where there are positive effects of redundancy principle on learning. One possible explanation is that the narration used in the redundancy mode in this study might have reduced the split-attention effect and learners' cognitive load, which then promoted their motivation.

B. PMA supports PRIME Theory

The overall results show that there is no significant effect of Persuasive Multimedia Application on three different domains of PRIME Theory in increasing teenage motivation towards smoking prevention and cessation at $F = 1.868$, $p = 0.252$ from the ANCOVA result in general. Specifically, however, there is a significant difference in terms of one domain (Evaluations) at $F = 2.054$, $p = 0.038$.

This finding supports the PRIME Theory that the internal environment and the stimulation of the human motivational system depend on the external environment. In this study, Persuasive Multimedia Application (PMA) acts as the external environment or stimuli to stimulate them. The results show that one domain of the human motivational system - the Evaluations domain - shows a significant difference after the treatment. This result is vital in strengthening teenage motivation towards smoking prevention and cessation. As West [10] stated, human motives in doing something (including smoking) depend on their beliefs or what he referred to as 'Evaluations' in PRIME Theory.

As the Evaluations domain is one part of the human motivational system, the results of the analysis with regard to the evaluations domain shows the effects of an interactive programme (Persuasive Multimedia Application) which in general is similar to the work of Fogg [3] in which an interactive programme can help someone to quit smoking when the urge (motivation) is strong.

The results of the analysis with regard to the evaluations domain also proved the belief of Parkinson et al. [8] that anti-smoking media may be an important means of targeting beliefs about smoking among youth. "Beliefs" is the same as the Evaluations domain in PRIME Theory. Therefore, findings with regard to this domain are vital for future research.

IX. IMPLICATIONS OF THE STUDY

The results of this study have confirmed that Persuasive Multimedia Application developed by using the principle of cause-and-effect as a persuasive design principle has stimulated human motivational system at macro level through stimulation.

On the other hand, the Redundancy principle as a multimedia learning principle, has shown the significant impact of stimulating the Evaluations domain in PRIME theory in terms of the human motivational system at micro-level.

Hence, in order to ensure that persuasive messages are successfully delivered through a multimedia application in terms of stimulating the human motivational domains, and thus strengthening human motivation levels in terms of the targeted behaviour, the following design guidelines may be considered:

- Persuasive Multimedia Application may be used as a medium for stimulating and strengthening human motivation, where the focus is on the cause-and-effect principle as the main learning strategy.
- The redundancy principle should be the main design strategy in delivering the persuasive message, especially when teenagers are the target group.

Based on the above design guidelines, a few suggestions have been made for future research.

X. SUGGESTIONS FOR FUTURE RESEARCH

Due to the study limitations, some areas were not covered in this study. The following are the areas that need further research based on the findings and the literature on which this study was based:

- A combination of persuasive principles with an integrative theory (CMOB: The Behaviour System and PRIME Theory of motivation) to provide a systematic basis for designing a Persuasive Multimedia Application and developing behaviour change techniques in order to elevate and strengthen the individual's motivation which will lead to smoking cessation.
- A combination of other persuasive principles in designing and developing a Persuasive Multimedia Application to maximize teenage learning.

- The effects of Persuasive Multimedia Application in elevating and strengthening the five domains of human motivational system according to PRIME Theory by using mobile persuasion strategy.

Findings, discussions, implication and suggestion for future research have led to the following conclusion.

XI. CONCLUSION

Smoking has been identified as one of the major problems in Malaysia. The literature review has revealed that motivation is closely connected with persuasion. Therefore, this research has added a new insight in terms of motivation with regard to the field of Persuasive Technology.

Persuasive Technology has been used in many fields of study including education and health, where one of the ultimate aims is to change people's attitudes or behaviour. Researchers have applied and tested different models and principles of design and used a variety of approaches in their studies, with various purposes and target audiences. Most of their attempts have produced significant results.

The Persuasive Multimedia Application (PMA) used in this study were designed and developed by integrating Persuasive Technology and PRIME Theory, as these are firmly believed to be able to elevate and strengthen teenagers' motivation with regard to smoking prevention and cessation.

Stimulating and strengthening human motivation levels is a fundamental and also a vital step in terms of the ultimate goal which is to change people's attitudes or behaviour. In this case, we are interested in smoking cessation. This Persuasive Multimedia Application thus is a preliminary intervention aimed at stimulating and strengthening motivation in terms of smoking cessation.

West [10] stated that recovery occurs when an individual is no longer experiences powerful motivations to engage in an addictive activity to an extent that is harmful. Therefore, developing an intervention with regard to reducing an individual's powerful motivation towards smoking is fundamental. This can be done by stimulating and strengthening the human motivational system.

Based on the findings from the study, specifically both Persuasive Multimedia Application (PMA) that uses the cause-and-effect Principle derived from Persuasive Technology [3] as a learning strategy are confirmed as having a significant impact on smoking status treatment.

The findings also confirm that a PMA that uses the Redundancy Principle from Cognitive Theory of Multimedia Learning [7] as a design strategy, will have a significant impact on the Evaluations domain. Therefore, a PMA that uses the Redundancy Principle is proven to be an effective tool in elevating and strengthening teenagers' motivation towards smoking prevention and cessation among the two multimedia principles. It is also a proof that Persuasive Technology may provide the right kind of encouragement to help a person quit smoking [3].

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