Persuasive Technology in Intervention Programs for Health Issues:
A Comparative Review

Nurul Ulfa Abdul Aziz[1], Nur Hazwani Mohamad Roseli[2], Suzila Mat Salleh[1], Nurulnadwan Aziz[3]

[1]Faculty of Business Management, Universiti Teknologi MARA,Terengganu, Malaysia
[2]Faculty ofBusiness Management, University Teknologi MARA, Bandaraya Melaka, Malaysia
[3]Department of Research, Industrial Linkages, and Alumni, Universiti Teknologi MARA,Terengganu, Malaysia

ABSTRACT

Computer technology and Internet are vital tools to enhance various aspect of life. Apart of being the main medium for connectivity, it also perform significant role in influencing mentality, behaviour and decision making of an individual. Persuasive technology through computer applications and programs is used to persuade and aid health awareness, treatment and prevention. The purpose of this paper is to investigate and review persuasive technology on health intervention programs. Thus paper related to persuasive technology to design health intervention is selected. The scope of this study covers various health problem which varies among different countries. The review is presented based on the objective, referred theory, research method and the final findings. As a conclusion persuasive technology show positive and relevant outcome in preventing, aiding treatment and providing support for patients and family involved in health problem. Last but nor least, persuasive technology proves to change people behaviour and choice regarding health practices. .
KEYWORDS: Persuasive Technology, Health Intervention Programs

INTRODUCTION

In the early years of computer invention, computers were used for calculating, retrieving and storing. Following the vast changes of human life, computer function evolves to become the main communication device use to persuade and influence people in making the best decision. Currently computer is used to play the role of teachers, therapists, doctors, and sales person, ultimately this lead computer application as a persuasive technology designed to change people's attitudes or behavior [6]. Persuasive technology could be seen in many forms such as the Web, Mobile phone, "smart" devices, social networks, blogs and network groups. In most cases persuasive technology function may not even been visible to the users although it is integrated into everyday life. There are few applications that is used by many users with "invisible" persuasive roles such as controlling the speed of a car through GPS by giving alert of the maximum speed on roads, FACEBOOK that persuade people sharing detail personal information and activity, LAZADA and GROUPON that attempts people to purchase more product, booking.com and agoda.com persuading people to charter certain accommodation and visit chosen places suggested by the web.

LITERATURE REVIEW

Persuasive Technology in Health Intervention

Throughout the years the main method in delivering health service is done through meeting the health service provider via face to face at any health center. Currently health intervention using internet and computer technology (ICT) have started to take place. Various study has been done to investigate the effectiveness of adopting ICT as the tools for intervention in providing health services to patients and family. The nature of ICT create possibility to reach maximum people by just one posting and ease of updating information to everyone within second at minimum cost. [8] have reported intervention able to improve convenience to user including saving time, require less effort, more accessible and enable user not to be physically presence at certain facility. Some medical health issues create isolation of people for example those living with HIV/AIDS and Alzheimer, These people reserved to go out easily because of the risk factors and health problem such as fatigue and disability. There are also those who suffer from conditions that caused embarrassment and stigmatized. By the help of ICT, it enables people with similar health issue to be connected, receive some kind of support and openness of communications. The technology breaks geographical, health condition and stigmatized barrier. Some people face problem receiving medical or health service due time constraint but by using ICT this problem is solved. All information and advice could be delivered at any time thus helping the caregiver, parents,

---

Corresponding Author: Nurul Ulfa Abdul Aziz, Faculty of Business Management, Universiti Teknologi MARA, Dungun, Terengganu, Malaysia, E-mail: nurul728@tganu.uitm.edu.my

people who work on shift to care for those with serious health condition. For certain health issues the patient needs advice at the time of crisis therefore continuous access provided by the technology seem significantly helpful. Nowadays ICT is the main tools in communication since people feel more comfortable communicating virtually hence this trigger the use of this technology on matters concerning health issues and services.

Among the earliest attempt in using computer program to promote health and increases workplace productivity appeared in the 1970s and 1980s. Body Awareness Resource Network (BARN) was developed in the late 1970s to teach adolescent health issues such as smoking, drugs, exercise and activities to promote behavior in maintaining a healthy lifestyle. The emerging use of internet in the 90's boasts more people to adopt persuasive technology. Computer has become one of the vital resources to persuade and motivate people in changing their behavior, attitudes and mentality.

RESEARCHMETHODOLOGY

In this research, an online literature search is conducted by using Google Scholar and qualitative review through books, journal and proceeding paper to identify study and research regarding persuasive technology in health intervention. During our electronic searches, search strategy conceptualized the following: Health AND Persuasive Technology AND <health promotion keywords>. The search terms were "persuasive technology" AND "health promotion" OR "health issues" OR "health education" OR "health intervention" OR "Health Intervention Program" OR "Web as Health Intervention Program" OR "Using computer In Health Intervention Program" are adopted.In addition, bibliography from related articles, journals and book chapters to identify relevant research are also screened. The date of study range from January 2005 to December 2016. All studies written in English and Bahasa Malaysia were included and the keyword search were conducted in December 2016.

FINDINGS AND DISCUSSION

Teaching Problem Solving through Computer Simulations

This research is designed by [17] to investigate the effectiveness of a computer simulation in enhancing student learning about health matters. The main theory behind the study is the approach using structured learning and computer simulation. The research compared the effect of using structured learning only versus learning with the integration of computer simulation. To discover the effectiveness, the research adopted the qualitative method. Students was thought by structured learning for 12 consecutive days about health-related issues during first half of a day. During second half, the teaching uses computer simulation for traditional enrichment and application exercise. In the end students were tested by basic facts, concepts and health problem skills. The research results show that combinations of structured teaching and computer simulation increase teaching effectiveness by not only improving factual level of knowledge but higher cognitive skills as well.

Dietary Behavior and Obesity

Dietary behavior is important in preventing diet related disease such as diabetes type II, heart disease, high blood pressure and certain cancer. Based on these facts, [4] have developed a program that used tailoring technology as persuasive tools to find the impact of message tailoring on dietary behavior change. The study investigate the effect of individually computer tailored messages to decrease the amount of fat intake and increase the intake of fruit and vegetable. A survey was done randomly within a control intervention group. One group consist of individually tailored messages whilethe other group consists non tailored nutrition messages. Result show tailored intervention produced significant reduction of fat intake compare to group with non-tailored massages. Nevertheless, the survey showed that fruit and vegetable intake did not increase in any group. The study concluded tailored message are effective in promoting reduction of fat intake.

Concerning about obesity health issue [10] have developed an application called MYHEALTHKIDs with the main objective to create an intelligent obesity intervention system for primary school children. The application encompass three modules; obesity prediction, children persuasive and recipe suggestion module. For the obesity prediction Naïve Bayes is used to predict the children likelihood to be obese while the persuasive module is used to encourage and motivate the children to do physical activities and follow a healthy eating habits. The third module is the knowledge bases system used to give recommendation for canteen operators to prepare healthy food. During the study, questionnaire include the parents and children profiles, obesity classification and prediction technique is used to predict the chances of becoming obese. The questionnaire was answered by parents and information related to the obesity risk factors was obtain and used to predict the obesity category of the child. Furthermore persuasive module Encourage Friendly Competition (EFC) is used to motivate children to do exercise and increase the physical activities. The other method used in this module is Physical Activities Based Games (PABG) to increase the enthusiasm and physical activities by playing games. In this game, it is tailored is such a way that to move and play to the next stage user is required to exercise more. The main intention is to encourage health dietary behavior by changing how user think and understand about

healthy eating. The third module known as the recipe suggestion module is designed to generate daily and weekly menu for canteens operators. In this module, 3 main components including recipe, set meal generation and weekly menu generation are developed. The module is developed based on Case-Based Reasoning (CBR) and Rule-Based Reasoning (RBR) technique, which is used to find the best meals sets every day in a week This preliminary test on the MyHealthyKids reveals that the accuracy of prediction ofchildhood obesity is to be around 73.3%. According to user, the persuasive module is able to persuade and instill healthy lifestyle habits in the mindset of the children and recipe suggestion module is able to advise different menu for the children.

Health Education Video Game

Video game is also a computer program that can be a persuasive tools in changing people attitude and choices. [11] studied the theory and best design to develop Health Education Video Games for Children and Adolescents. The study examined the role of video games as an effective health education and therapeutic interventions for children and adolescents suffer from diabetes. Throughout the study the researcher focus developing and using Educational Games that include elements of challenge, motivation role, models simulations, repetition and feedback. In order to identify the effectiveness of the health education video game it involved interviews before and after routine visits, testing of glycated hemoglobin, and video game to take home and play. After 6 months, participants rated the games. Interviewers examined time spent playing the game, social support, knowledge, and self-care. At the end, the finding indicated that by using health education game user significantly improved their self-care behaviors, self-efficacy, and health outcomes.

Smoking Cessation

Smoking is considered one of the most concerned matter in health care due to the short term and long term effect caused by the smoker towards himself and others. It is believed that smoking have become one of the main factor that cause serious health problem such as cancer and heart problem related disease. Hence a research need to be done to persuade smoking cessation. [16] develop a web base computer tailoring smoking cessation program as a supplement to nicotine patch therapy to help smoker to achieve their goal to stop smoking. This study assess the efficiency of computer web based tailored behavioral cessation materials among nicotine patch users. During the study two types of intervention have been used, the first intervention is a web based tailored behavioral smoking cessation materials and the second one is a web based non tailored materials. The main types of tools in this persuasive technology is the tailored behavior concept. Three analysis approach have been adopted in the study in a period of 6 to 12 week. The analysis reveals different outcomes depending on respondent logged on activity, usage of the program material and did not use other cessation treatments and lastly is how the user responded to follow up. The result of the findings show benefit of web based tailored behavioral support materials used in conjunction with nicotine replacement therapy. A web based programs that gathers related information from users and tailored intervention to specific needs had significant advantages compared to non-tailored web based cessation program.

A continuing effort to stop the smoking habits is being done by [19]. The research focus on Persuasive Multimedia Application (PMA) to strengthen motivation towards smoking prevention and cessation. Throughout the study three selected PRIME domains in the forms of plans, evaluations and motives were measured using questionnaire as the instrument. The questionnaire was distributed among 54 respondents that have undergone the research design experiment. The study analysis result points out that persuasive design principle does stimulate human motivational system at macro level. As conclusion PMA should be used as a medium for stimulating and strengthening human motivation and the main learning strategy is on the cause and effect principle.

Motivate people to exercise

The application to motivate people to exercise is one of the preventive healthcare measures. [15] have develop an application name Chick Clique to motivate and promote teenage girls to exercise. Teenage girls were chosen as the target users because this group has higher tendency to be less active and also based on a two year research by [7] teenage girl is more responsive towards health behaviour intervention. The main objective of the research is to help motivate teenage girls to exercise and stay connected with their peers on matters related to healthy weight. The research suggested the following types of persuasion tools to be adopted such as goal setting, self-monitoring, positive reinforcement and social support. To investigate the effectiveness of the application, the girls were given a pedometer and the PDA prototype. Stimulation via automatic text messaging, where their steps count is being communicated on a regular interval using text or instant messaging is being established. Pre-study and post-study questionnaires as well as post-study interviews yielded the quantitative and qualitative result of the investigation. The main result from the post-study expose group performance as the most influential way to change behavior and user agree that the application able to increase exercise activity.

Alcohol Consumption

Alcohol consumption is one of the main cause that is associated to certain health problem. Uncontrolled consumption can cause to addiction that will adversely affect life productivity. Studies also shown the connection of alcohol and serious disease such as cancer. Therefore, health intervention has been developed as an aid in controlling alcohol consumption per person [4] have review studies using persuasive technology in web based application that focus to reduced alcohol consumption. All relevant articles published since 2006 were reviewed in a systematic manner. Based on the review the author concluded that there is inconsistent evidence on the effectiveness of electronic screening and brief intervention (eSBI) foralcohol use. The studies concluded that web-based interventions are generally well received. However further controlled trials are needed to fullyinvestigate their effectiveness, this is to identify the best elements in producing the expected outcome and understand the different elements for which is best needed to engage low and high risk drinkers.

Wellness application

Wellness application is designed to help user maintain positive motivation and feeling. An application called Happier Together was developed by [13] using social network as the main platform for sharing information and propagate wellness information among user. Positive psychology theory is the main focus of the psychological wellness believing that the goods able to trained people to be happy. Each participant was requested to post three good things that they endure each day and the reason why it happen, the other participants congratulate on good things, comment on them and share good things that they experienced as one of their own. The study found that it's possible to transfer wellness intervention using social network and the benefits that is shared in this intervention is encouraging.

Mental health treatment

ICT intervention for depression have shown a promising future. To see the effectiveness of this intervention program a feasibility trial were done by [12]. The study explain the feasibility trial for multimodal E-mental health intervention to increase devotion to overcome depression. The intervention needed user to frequent login for self-monitoring and feedback purposes as well as follow up by email and brief telephone support. The main objective of this study is to investigate if ICT intervention with the manual telephone support program able to add the adherence rates and improvement in depression outcomes. This study were done through a trial of 7 week intervention. Findings show that patients that follow the intervention within 7 weeks display significant reduction in depression. Thus the findings support the practicality of developing multimodal e-mental health treatment. Although the result is still premature for any conclusion but based on the data, the idea of the intervention for depression treatment is hopeful.

Sleep Behavior and Insomnia Therapy

Sleeping is essential in maintaining a healthy body and mind. Those who have sleeping disorder will have effects on their level of productivity and to an extent, causes other serious health problem such as heart disease. [5] have used persuasive technology to promote healthy sleep behavior. The technology propose the importance to improve people's sleep habit by persuading the user to achieve their sleep related goals. This application applied the self-monitoring and feedback features principle to create awareness about sleep habits. The author plan to design a sensor suite that tracks sleep and evaluating the accuracy, increase user awareness by obtaining data collected from the sensor suite and feedback and lastly to evaluate the long term effect of in-home sleep monitoring. [2] designed persuasive strategies in insomnia therapy using mobile technology. The therapy uses the persuasive strategies such as tailoring, alignment and adaption and motivational support. This study reveals the underlying principle of therapy for insomnia by the use of mobile technology which is still in the early stage.

Physical activity in chronic pain

Health intervention for physical fitness needs is emerging however there are still minimal or none application that focuses the need of executing physical activity among chronic pain patients. Hence [14] uses human computer interface (HCI) for psychological needs to promote fitness among users with chronic condition. Study focus on the theory and concept of pain management approach, personalization/tailoring, exercise adherence, supportive functions and visual representative. The method used for the study are interview and observation technique. Researchers interviewed and observed physiotherapists and people who suffer chronic pain. This effort is to identify physical and psychological needs that must be included in the technology to promote and support physical activity within targeted population. Result expose that relevant elements are connected with the needs of physical, cognitive and emotional needs of the users however users require more guidance and flexibility in the goal setting due to the problem of pain flare-ups and setbacks.

Serious game for Cerebral Palsy

[9] have developed a serious game for children with Cerebral Palsy. This pilot trial discusses various approach focusing at the impaired sensory system considering factor of longevity play experienced, requirements from therapists and researchers, and the interface needs from the participants themselves. The main theory of the study is serious game design for sensory rehabilitation and user accessibility principle. During the trial two games was developed, one child with cerebral palsy evaluated the games for feedback about entertainment, engagement and replay value. The study discovered that the games have potential in promoting good level of engagement and replay. The games were played for about 4-5 minutes per session over the period of 14 days and to indicate user interest in playing the games.

Children dental anxiety

Dental anxiety is about the uneasiness feeling that people feel when they have to make a visit to the dentist. To help overcome this feeling [1] have design a research on using persuasive design principles in motivational feeling aiming towards Children Dental Anxiety (CDA). The study focusses on the attempt of using persuasive design principle into educational material using CD ROM based multimedia learning environment to overcome CDA. Education material involved principle of virtual rehearsal, similarity, praise, social learning and multimedia learning theory. This experimental research design evaluate the prototype by evaluating 240 children from the age seven to nine. Based on the analysis, the presentation modes have significant positive effects in reducing children dental anxiety.

Stress awareness

[18] have formulate and develop a prototype of persuasive multimedia software to increase awareness on the effects of stress. The research involved three phases, the first phase is a simple briefing about the prototype, during second phase sample were given grounded by Perceive Stress Scale (PSS) questionnaire to assess their stress level and in the third phase, sample were asked to use the application of persuasive multimedia within 20 minutes. The Instructional Materials Motivation Scale (IMMS) questionnaire were distributed to know their feedback of motivation towards the persuasive multimedia application. The findings based to ANCOVA results show that awareness stress level between genders is not significant and the students were not in stress condition during the survey period. Whilst MANOVA testing show that result for the IMMS revealed that the persuasive multimedia application has significant effects on the student's motivation particularly for satisfaction element.

CONCLUSION AND RECOMMENDATIONS

In this review, we examine studies about persuasive technology for health intervention programs. This approach is a gateway for current and future research to realize the effect and significant of persuasive technology to trigger awareness, changing mind, behavior and respond of patients and people towards health issues. However, it is not conceivable to determine credibility of the effectiveness health intervention program based on reading an article solely. According to the review the numbers of studies associate to persuasive technology in health intervention is hopeful and need to be further endeavors in the future. To develop an intervention health program more effectively, persuasive technology technique and principle that are best used to tackle health issues need to be identify. Further research is also needed to increase the understanding of how persuasive technology lead to positive health outcomes across diverse type of health problems and populations.

REFERENCES

1. Abdul Salam, S. N., W. A.J.Wan Yahaya, and A. Mohd Ali, 2010. Using Persuasive Design Principles in Motivational Feeling towards Children Dental Anxiety (CDA). InPloug T., Hasle P., Oinas-Kukkonen H. (eds) Persuasive Technology. PERSUASIVE 2010. Lecture Notes in Computer Science, 6137. Springer, Berlin, Heidelberg.

2. Beun, R. J. 2012. Persuasive Strategies in Mobile Insomnia Therapy: Alignment, Adaptation, and Motivational Support. Personal and Ubiquitous Computing, 17(6): 1187–1195.

3. Bewick, B. M., K. Trusler, M.Barkham, A. J.Hill, J.Cahill, &B. Mulhern, 2008. The Effectiveness of Web-Based Interventions Designed to Decrease Alcohol Consumption — A Systematic Review. Preventive Medicine, 47(1): 17–26.

4. Campbell, M. K., B. M. DeVellis,V. J.Strecher, A. S. Ammerman, R. F. DeVellis, and R. S. Sandler, 1994. Improving Dietary Behavior: The Effectiveness of Tailored Messages In Primary Care Settings. American Journal of Public Health, 84(5): 783–7.

5. Choe, E. K. 2011. Design of Persuasive Technologies for Healthy Sleep Behavior. In Proceedings of the 13th International Conference on Ubiquitous Computing,1-4

6. Fogg, B. J. 2003. Persuasive Technology: Using Computer to Change What We Think and Do , Massachusetts: Morgan Kaufmann Publisher.

7. Gortmaker, S. L., K. Peterson, J. Wiecha, A. M. Sobol, S. Dixit, M. K. Fox, and N. Laird, 1999. Reducing Obesity via a School -Based Interdisciplinary Intervention Among Youth. Arch Pediatr Adolesc Med 153(4): 409-418.

8. Griffiths, F., A. Lindenmeyer, J. Powell, P. Lowe, and M. Thorogood, 2006. Why are Helath Care Interventions Delivered Over the Internet? A Systematic Review of the Published Literature, Journal of Medical Research, 8(2): e10

9. Henschke, M., D.Hobbs, and B. Wilkinson. 2012. Developing Serious Games for Children with Cerebral Palsy: Case Study and Pilot Trial. In Proceedings of the 24th Australian Computer-Human Interaction Conference, pp. 212-221.

10. Husain, W., M. H. M. Adnan, L. K. Ping, J. Poh,and L. M. Meng, 2014. MyHealthKids: Intelligent Obesity Intervention System for Primary Scholl Children, Digital Information Processing and Communications, 1(1): 627-633

11. Lieberman, D. 1998. Health Education Video Games for Children and Adolescents: Theory, Design, and Research Findings. Retrieved from http://eric.ed.gov/?id=ED422312

12. Mohr, D. C., J.Duffecy, L.Jin, E. J.Ludman, A. Lewis, M.Begale, and M. McCarthy Jr., 2010. Multimodal e-Mental Health Treatment for Depression: A Feasibility Trial. Journal of Medical Internet Research, 12(5): e48

13. Munson, S. A., D. Lauterbach, M. W. Newman, and P. Resnick, 2010. Happier Together: Integrating a Wellness Application into a Social Network Site. In: Ploug T., Hasle P., Oinas-Kukkonen H. (eds) Persuasive Technology. PERSUASIVE 2010. Lecture Notes in Computer Science, 6137. Springer, Berlin, Heidelberg.

14. Swann-Sternberg, T., A. Singh, N. Bianchi-Berthouze, and A. Williams: 2012. User Needs for Technology Supporting Physical Activity in Chronic Pain. Proceedings of the Annual Conference Extended Abstracts on Human Factors in Computing Systems, 2441-2446.

15. Toscos, T., A.Faber, , S. An, and M. P. Gandhi, 2006. Chick Clique: Persuasive Technology to Motivate Teenage Girls to Exercise. Extended Abstracts on Human Factors in Computing Systems, 31(3): 1873–1878.

16. Victor, J. S., S. Shiffman, and R. West, 2005. Randomized Controlled Trial of a Web-based Computer-tailored Smoking Cessation Program as a Supplement to Nicotine Patch Therapy. Addiction, 100(5): 682-688.

17. Woodward, J., and A. Others, 1987. Teaching Problem Solving through Computer Simulation. American Educational Research Journal, 25(1): 72–86.

18. Wan Yahaya, W. A. J., S. N. J.Ahmad, and Zain, M. Z. M. 2012. Application of Persuasive Multimedia to Raise Stress Awareness among the Secondary School Students. IERI Procedia, 3, 105–113.

19. Wan Yahaya, W. A. J., R.Che Din, and M. Hashim, 2014. A Future Strategy Towards Smoking Cessation: Persuasive Multimedia Application (PMA) in Strengthening Motivation towards Smoking Prevention and Cessation. Global Health, 2014: The Third International Conference on Global Health Challenges, 37-41.