

## **Online patient education design features: are there any differences in opinion based on consumer's stage of change?**

### **Naffisah Mohd Hassan**

Faculty of Business and Management  
Universiti Teknologi MARA (UiTM) Selangor  
Selangor, Malaysia  
Email: naffi885@puncakalam.uitm.edu.my

### **Khin Than Win**

School of Computing and Information Technology  
Faculty of Engineering and Information Science  
University of Wollongong  
NSW, 2522  
Email: win@uow.edu.au

### **Harri Oinas-Kukkonen**

Information Processing Department  
Faculty of Information Technology and Electrical Engineering  
University of Oulu  
Email: harri.oinas-kukkonen@oulu.fi

## **Abstract**

Patients' stage of change towards their disease management plays an important role in healthcare. The aim of this study is to explore whether there are any differences in the patients' perceptions toward the design features of online patient education according to the patients' stages of change. Patients and carers who use chronic disease websites from Australia were invited to participate in the study to understand their perspectives on the design features. The statistical analysis package for the social science 19.0 (SPSS 19.0) and Smart PLS were used to perform statistical analysis for answering the research questions and related hypotheses. The results indicated that the patients' perceptions tended to differ in terms of online patient education design features, interpretability and presentation of content, according to their stages of change. The patients, across different stages of change, did have differing perceptions regarding certain constructs within the online patient education design features.

## **Keywords**

Design features, online patient education, health education, stage of change, tailoring

## 1 Introduction

Health education is defined as a systemic learning experience in which a combination of methods is generally used, such as the provision of information, advice and behavioural modification techniques, to influence the way that a patient promotes his or her state of health (Van den Borne 1998) (Win 2010a). With the widespread use of the Internet and the availability of health information online, there is a growing demand for effective educational material online for patients. Traditionally, health education about chronic diseases has fallen within the ambit of doctors, nurses, and other healthcare professionals. Receiving personalised advice and support-material from a healthcare professional with whom a patient has a good relationship is known to be very effective, albeit time consuming (Orleans et al. 1985). Providing Online Patient Education tailored to patients has the potential to assist in patient education. Many benefits have been claimed for online patient education but in order to confer the optimal results, online patient education sites must be designed appropriately.

## 2 Background

Online patient education is typically targeted towards improving health outcomes, but it can also be used to enhance patients' social support (Wise et al. 2008). Improved health outcomes, improved health education and knowledge acquisition, improved patient awareness of the disease, increased patient confidence towards treatment, improved self-care behaviour and management, reduced hospitalization and adherence to treatment have been identified as benefits in health outcomes associated with online patient education (Win et al. 2015). Additionally, improved quality of interaction with physicians, easy access to educational material, time and cost effectiveness, improved social support and improved patient emotional state and satisfaction have also been noted (Hassan et al. 2013).

The benefits of online patient education for those who suffer from chronic disease can be anticipated to be optimised if the development process is based on design features, which have evidence of their effectiveness. A review of the literature of research into design features of online patient education identified a number of relevant studies, including studies on behaviour change support systems (Hassan et al. 2013). Key design features of importance for online patient education are identified and presented in previous study (Hassan et al. 2013). These features include: patient tailored information; interactivity; credibility; presentation of content; interpretability and multimedia graphics (Win et al. 2016). The design principles of tailoring, interactivity, credibility, and presentation of content are all applicable to the behaviour change support system features of Oinas-Kukkonen and Harjuma (2009) (Matthews et al. 2016). Further details were shown in table 1 below.

Groups	Design Features	Study
Patient Tailored Information (5 items)	PTI1: Information tailored to patient's symptoms	(Crutzen et al. 2009; Goessens et al. 2008; Koivunen et al. 2008)
	PTI2: Guidance is appropriate for patient's self-care management regime	(Clayman et al. 2008; Ferney and Marshall 2006; McKay et al. 2002) (Heinrich et al. 2012)
	PTI3: Advice is tailored to patient's personal treatment preferences	(Doupi and van der Lei 2003; Doupi and van der Lei 2005; Heinrich et al. 2012; Oenema et al. 2001)
	PTI4: Tailored feedback provided	(Clayman et al. 2008; de Vet et al. 2008; McKay et al. 2002)
	PTI5: Mode of delivery of treatment information	(Ferney and Marshall 2006; Smith and Weinert 2000)
Interactivity (6 items)	I-act1: Live chat	(McKay et al. 2002; Rezailashkajani et al. 2008; Smith and Weinert 2000)
	I-act2: Animations and interactive learning material	(DeGuzman and Ross 1999; Ferney and Marshall 2006; Kim et al. 2004)

	I-act3: Email function	(Ferney and Marshall 2006; Smith and Weinert 2000)
	I-act4: Linked to social networks such as Facebook & Twitter	(Fisher and Clayton 2012; Yamout et al. 2011)
	I-act5: Patient forums	(Ferney and Marshall 2006; Rezailashkajani et al. 2008)
	I-act6: Interactive quizzes	(Kim et al. 2004; Tate et al. 2001)
Content (8 items)	Cont1: Date of content update	(Doupi and Van Der Lei 1999; Morrison et al. 2012)
	Cont2: Personal information is secured	(DeGuzman and Ross 1999; Doupi and van der Lei 2003)
	Cont3: Accredited by a recognized healthcare organization	(Doupi and Van Der Lei 1999; Eysenbach and Diepgen 2002; Thakurdesai et al. 2004)
	Cont4: Patient's rights are displayed on the homepage	(Kim et al. 1999; Smith et al. 2002)
	Cont5: Must use login information in order to see patient's personal information	(Smith et al. 2002; Win 2010b)
	Cont6: Accreditation by a healthcare organization is displayed	(Doupi and Van Der Lei 1999; Thakurdesai et al. 2004)
	Cont7: Author's name and contact information are displayed	(Doupi and Van Der Lei 1999; Eysenbach and Diepgen 1999; Kim et al. 2004)
	Cont8: Adherence to quality guidelines	(Kim et al. 2004; Thakurdesai et al. 2004)
Presentation of content (6 items)	PC1: Colour contrast-readability	(George et al. 2001; Kim et al. 2004; Smith et al. 2002)
	PC2: A screen-reader that vocalizes the textual messages	(Demiris et al. 2001; Kim et al. 2004; Smith et al. 2002)
	PC3: Multilingual functions	(Rezailashkajani et al. 2008)
	PC4: Descriptive text/captions	(Doupi and van der Lei 2005; Kim et al. 2004; van Weert et al. 2011)
	PC5: Simple and realistic pictures illustrating medical concepts	(Doupi and van der Lei 2005; Ferney and Marshall 2006; Kim et al. 2004; Smith et al. 2002; van Weert et al. 2011)
	PC6: Easy navigational instruction for all levels of users	(Ferney and Marshall 2006; Kim et al. 2004)
Interpretability (2)	I-pret1: Free of medical jargon	(Clayman et al. 2008; Demiris et al. 2001; Rezailashkajani et al. 2008)
	I-pret2: Glossary of medical terms provided	(Kinzie et al. 2002; Rezailashkajani et al. 2008)

Table 1: Items in the Design Features Construct (sources were cited from Hassan et al. 2013)

## 2.1 Health Behaviour change

Online patient education sites are intended to improve patients' behaviour in terms of adherence to their disease management regimen. The literature indicates that characteristics of the patient are important to consider because some patients might not be ready to change their behaviour towards their healthcare.

Consumers' readiness to change or adopt the targeted behaviour can be identified by the Transtheoretical model (Wright et al. 2015). The model has been widely applied in healthcare (Prochaska et al. 2008b) and used by health professionals for informing, undertaking and evaluating interventions for patient behavioural change (Prochaska 2008). The TTM proposes that people progress through five distinct stages of behaviour change: pre-contemplation, contemplation, preparation, action, and maintenance. These stages describe how people move from being unaware, unwilling, or too discouraged to change, to considering the possibility of change, then to becoming committed and prepared to make the change, and finally taking action and sustaining the change in the longer term (Liang et al. 2006).

Studies on patient behaviours, intervention methods, medication acceptance, smoking cessation, participation in mammography screening, sun protection, reduction of dietary fat consumption and condom use have adopted a TTM framework (Prochaska 2008). It has been proposed that in employing the TTM that interventions need to be tailored according to a patient's stage of change (Prochaska 2008). In addition, the study also indicated that the maintenance stage has been a most difficult stage to sustain among all (Prochaska et al. 2008a). Different results for health behaviour change have been reported in previous studies. Differences in outcome were noted in a study conducted by Spittaels & de Bourdeudhuij. In their intervention study, the earlier stages have notable changes in behaviour compared to the maintenance stage (Spittaels et al. 2007). However, a study conducted by de Niet et al. 2012 indicates that providing tailored messages to consumers would optimise the maintenance stage (de Niet et al. 2012). Antypas & Wangberg 2014 also found that patients' stage of change plays an important part in effectiveness of the intervention.

Therefore, it is needed to explore which design features would affect consumers' behaviour change. Studying consumers' preferences of design features from different stages of health behaviour change would be beneficial.

Examples of studies in which stage of change has been considered include the development and design of online material for educating patients with chronic illnesses (Konda et al. 2009; Sanchez et al. 2008). Table 2 provides a summary of the Stages of Change in the TTM (Prochaska et al. 2008b).

Precontemplation	The consumer has no intention to take action within the next 6 months and is generally unaware or under-aware of the problem.
Contemplation	The consumer intends to take action within the next 6 months. He or she is aware that a problem exists but has not yet made a commitment to take action
Preparation	The consumer intends to take action within the next 30 days and has taken some behavioural steps in this direction
Action	The consumer changes his or her overt behaviour for less than 6 months
Maintenance	The consumer changes his or her overt behaviour for more than 6 months and works to prevent relapse and consolidate the gains attained

*Table 2: Transtheoretical model Stages of Change (Prochaska 2008)*

## 2.2 Research questions

The stages of change may differ amongst patients and this may be a key factor to consider when attempting observing the effect of online patient education design features so as to ensure that the user is conferred the maximum benefits.

The aim of this study is to investigate whether there are differences in patients' perceptions of the design features of online patient education according to the patients' stages of change for their health management. The research question posed is: "Is there a difference in the patients' perceptions toward the OPE design features, according to the patients' stages of change?"

In this study, the following hypotheses were formulated in order to answer the research question.

H: There is a significant difference in patients' preferences for online patient education design features according to the patients' stage of change.

However, since there are six (6) dimensions within the online patient education design features, it was sub-divided into six (6) sub-hypotheses.

Ha: There is a significant difference in preferences for Patient Tailored Information design features according to stage of change.

Hb: There is a significant difference in preferences for the Interactivity design features according to stage of change

Hc: There is a significant difference in preference for the credibility design features according to stage of change.

Hd: There is a significant difference in preference for the Presentation of Content design features according to stage of change.

He: There is a significant difference in preference for the Interpretability design features according to stage of change.

Hf: There is a significant difference in preference for the Multimedia graphic design features according to stage of change.

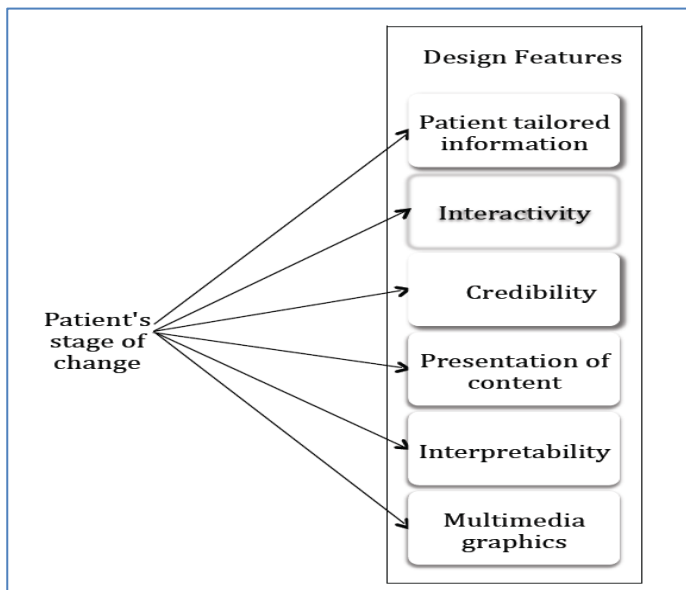


Figure 1: Relationships stage of change and OPE design features

### 3 Methodology

A stepwise approach was used to identify the design features. OPE design features were identified after literature review and consultation with health professionals, health informaticians and carers. The expert review of the items list was undertaken to validate the applicability of the items in the study context. A pilot study was conducted with 20 participants using semi-structured interviews and closed questions to generate constructs for the design of a quantitative survey instrument. Questionnaires were then refined based on the pilot test results. The interviews were conducted to determine the perceived importance, feasibility and content validity of the questionnaire. Subsequently, another set of questionnaires was administrated to a convenience sample of the target population via the Diabetes Australia website as another pilot test. All participants were chronic disease patients or family members of these patients, and

all had used online patient education sites. Based on the pilot test results, unreliable items from the questionnaire were removed after employing reliability and correlation analyses in order to examine the degree of internal consistency of the questions.

### 3.1 Studied population and sample

The survey drew upon the users of OPE sites for chronic diseases, such as diabetes and heart disease. For both groups, the data gathered related only to the participant's reaction to an online patient education site. Users of online patient education sites include carers, family members, and chronic disease sufferers; all of whom have a variety of requirements in relation to online patient education. Gathering data from these users is crucial in order to understand the process of designing and using online patient education sites effectively. Sampling: Users of OPE sites were recruited by means of several methods, such as links on various online patient education sites for chronic diseases, and also via emails and telephone calls to friends and associates who fitted the necessary parameters. All potential participants were provided with a link to Survey Gizmo, where the survey was located. Before commencing the survey, participants were given access to a Participant Information Sheet about the research study. The anonymous survey was completed online at the participant's convenience.

## 4 Analysis

Data were analyzed using SPSS 19.0. The Kruskal-Wallis test was conducted to compare the means of five group of patients for their stages of change against the OPE design features. Chi-square values and the degree of freedoms were tested to interpret the results.

## 5 Results

One hundred and forty-five (145) participants responded to the instrument during the data collection period. Four participants were excluded as they did not complete 95% of the questions leaving final sample size of n=141, outlined in Table 3.

Characteristic		N	%
Gender	Male	44	31.2%
	Female	97	68.8%
Age	25 to 34 years	14	9.9%
	35 to 44 years	12	8.5%
	45 to 54 years	23	16%
	55 to 64 years	31	24%
	65 years and above	61	42%
Computer Competency	Very competent	90	64%
	Somewhat competent	51	36%
Frequency of Internet Use	Once or more a day	122	86.5%
	A few times in a week	18	12.8%
	Hardly use Internet	1	0.7%
Stage of Change (SOC)	Stage 1	16	11.3%
	Stage 2	10	7.1%
	Stage 3	23	16.3%
	Stage 4	29	20.6%
	Stage 5	63	44.7%

*Table 3, Participants' characteristics*

Differences in Patient/Carer Perceptions of Online Patient Education Design Features according to

Patients' Stages of Change

SOC	Patient Tailored Information	Interactivity	Credibility	Presentation of content	Multimedia graphic	Interpretability
SOC1	72.94	89.81	62.97	88.44	78.97	83.56
SOC2	64.10	64.30	61.00	45.15	48.80	33.20
SOC3	60.59	59.48	62.80	58.54	66.26	70.61
SOC4	78.90	74.19	78.53	79.43	76.81	85.72
SOC5	71.77	70.02	74.15	71.34	71.56	67.17
Chi-Square	3.016	5.750	3.543	10.545	4.955	15.649
df	4	4	4	4	4	4
Asymp. Sig.	.555	.219	.471	.032	.292	.004
Hypotheses	Reject	Reject	Reject	Accept	Reject	Accept

TABLE 4: Differences in the Patients' Perceptions toward the Online Patient Education Design Features, according to stage of change

Despite most design features not being perceived significantly differently across the five groups of patients and their respective stages of change; two design features demonstrated significant differences. (See Table 4.) The patients' opinions toward presentation of content and interpretability differ significantly across the patients' stages of change:  $\chi^2(4, N = 141) = 10.545, p < .05$  for Presentation of content; and  $\chi^2(4, N = 141) = 15.649, p < .05$  for Interpretability. Post-hoc testing was used to confirm these results.

When rejecting the null hypothesis, there is a need to identify the pair(s) of groups that are significantly different. However, the Kruskal-Wallis test does not provide an embedded post-hoc test (Klein and Zhang 2005), (Field 2009). Therefore, further analyses were conducted before making the final decision. Specifically, a separate Mann-Whitney test (for each individual pair) was tested and adjustments were made in order to reduce any potential Type 1 error, by using the Bonferroni correction for the adjustment (Garamszegi 2006). A Mann-test was used for calculating the effect size.  $r = z \div \sqrt{N}$

Table 5 shows in detail the significant differences between the groups of patients according to their stages of change and their effect size on the presentation of content features. The differences between r was used to assess the overall effect size, where it has been suggested that 0.02, 0.15, and 0.35 constitute small, moderate, and large effect sizes respectively (Cohen et al. 2003). Thus, for Presentation of content, the groups that represent a medium effect size are SOC1 and SOC2 ( $r = -0.20$ ); groups SOC1 and SOC3 ( $r = -0.18$ ); groups SOC2 and SOC4 ( $r = -0.19$ ); groups SOC2 and SOC5 ( $r = -0.17$ ); and groups SOC3 and SOC4 ( $r = -0.15$ ). On the other hand, the groups that represent a small effect size are SOC1 and SOC4 ( $r = -0.07$ ); groups SOC1 and SOC5 ( $r = -0.13$ ); groups SOC2 and SOC3 ( $r = -0.08$ ); groups SOC3 and SOC5 ( $r = -0.12$ ); and groups SOC4 and SOC5 ( $r = -0.08$ ).

Between Group	Presentation of Content			Interpretability		
	Z value	P value	Effect size (r)	Z value	P value	Effect size (r)
SOC1 and SOC2	-2.364	0.018	-0.20	-3.034	0.002	-0.26
SOC1 and SOC3	-2.124	0.034	-0.18	-1.236	0.216	-0.15
SOC1 and SOC4	-0.826	0.409	-0.07	-0.375	0.708	-0.03

SOC1 and SOC5	-1.568	0.117	-0.13	-1.529	0.126	-0.13
SOC2 and SOC3	-0.961	0.337	-0.08	-2.759	0.006	-0.23
SOC2 and SOC4	-2.210	0.027	-0.19	-3.218	0.001	-0.27
SOC2 and SOC5	-1.996	0.046	-0.17	-2.636	0.008	-0.22
SOC3 and SOC4	-1.809	0.070	-0.15	-1.511	0.131	-0.13
SOC3 and SOC5	-1.391	0.164	-0.12	-0.434	0.664	-0.04
SOC4 and SOC5	-0.971	0.332	-0.08	-2.079	0.038	-0.18

TABLE 5: Effect Size for Presentation of Content and Interpretability According to the Different Stages of Change

For Interpretability, the groups that evidenced a medium effect size were SOC1 and SOC2 ( $r = -0.26$ ); groups SOC1 and SOC3 ( $r = -0.15$ ); groups SOC2 and SOC3 ( $r = -0.23$ ); groups SOC2 and SOC4 ( $r = -0.27$ ); groups SOC2 and SOC5 ( $r = -0.22$ ); and groups SOC4 and SOC5 ( $r = -0.18$ ). Finally, the groups that evidenced a small effect size were SOC1 and SOC4 ( $r = -0.03$ ); groups SOC3 and SOC4 ( $r = -0.13$ ); and groups SOC3 and SOC5 ( $r = -0.04$ ).

## 6 Discussion

From this study, it was noted that the patients' perceptions tend to differ in terms of online patient education design features, according to their stages of change. Consumers' opinions on having tailored information and credibility of the content do not vary much according to behaviour change stage in their disease management. However, preference on perceptions of design features on how the content are presented and, 'the interpretability,' varies. Therefore, the patients, across different stages of change, did have differing perceptions regarding certain constructs within the Online Patient Education design features. Further studies investigating patient health literacy and preferences of design features would assist in further understanding of these responses, particularly regarding the association between differences in opinion of 'the interpretability' and stage of change.

Follow-up tests were subsequently conducted in order to evaluate the pairwise differences amongst the 5 Stage of change groups. In terms of the Presentation of Content features, the earlier stages – i.e. patients in stage 1 (pre-contemplation) or stage 2 (contemplation) – had a medium effect, which was greater than the effect of those patients in the final stages: stage 4 (action) and stage 5 (maintenance).

As for the Interpretability features, patients in stage 1 (pre-contemplation) only evidenced a small effect size compared to patients within the final stages: stage 4 (action) and stage 5 (maintenance). However, the previous groups evidenced a larger effect than those patients did in stage 2 (contemplation) or stage 3 (preparation). This demonstrates that patients within the early stages tend to believe that the interpretability features are more important for the comprehension of the specific terms that are used in the OPE sites. This could be due to the fact that at these stages their understanding of health messages may be poorly developed, they are still at the stage of trying to understand about the disease or not aware of the disease. Therefore, interpretability of the information plays a major role when consumers are not aware of the problem or no intention to change.

Based on the results, few features that derived from persuasive systems design (PSD) are strongly related to benefits of online patient education. Design features from OPE that derived from primary task support category, tailoring, tunneling and self-monitoring features of PSD Model (Oinas-Kukkonen and Harjumaa 2009) are proven to be strongly beneficial to OPE websites. These results are also consistent with interactive features that derived from Computer human dialog and Social support features from PSD model. Designing features according to the consumers' stages of change will be beneficial as persons are usually at different points along a continuum in terms of being ready for initiating behaviour changes and having tailored guidance and feedback (Oenema 2005), self-monitoring activities and reporting the results to others (Antypas and Wangberg 2014) and endorsement and assistance by the person's general practitioner or health professionals (Ammann et al. 2013).



In addition to contributing new knowledge to the online patient education literature, the results obtained here may help healthcare providers, developers, and researchers in developing online patient education sites that are more helpful for patients with chronic diseases. This finding is significant for site developers in understanding users' perceptions toward OPE design features, thus facilitating the process of building better systems and websites which may confer all of the benefits that are expected by the users.

This study also demonstrates a significant difference in the perceptions toward two OPE design features, according to the patients' stages of change. Five stages of motivation to change were used to examine the different perceptions toward the design features of OPE. Developers were advised to take the patients' stages of change into consideration before developing OPE sites, because this is likely to help tremendously in terms of the desired behavioural change aspect associated with the use of OPE sites.

Having a well-defined set of design features to guide the development of OPE sites may ultimately maximize the user-benefits associated with OPE. In addition, these design features and the possible benefits of OPE were actually perceived by users in accordance with their respective stages of change. Developers unintentionally focused more on researching and developing design features for the young and the healthy users, rather than unhealthy users. The results of this study provide an important baseline-instrument in terms of understanding the perceptions of design features according to stages of change.

## 7 Conclusion

Patient education is to motivate patients to change their behaviour towards healthcare. Understanding patient's stage of change, that is, patient's readiness to change will assist in the health behavioural change process. It is significant for site developers in understanding users' perceptions toward OPE design features, thus facilitating the process of building better systems and websites which may confer all of the benefits that are expected by the users. This is a completed studies done in 2015 and it did not include recent technology innovations such as smart device interfaces and tactile functionality and will be included in future studies by author.

This study demonstrates a significant difference in the perceptions toward two OPE design features, according to the patients' stages of change. It is advisable to developers to take the patients' stages of change into consideration before developing OPE sites, because this is likely to help tremendously in terms of the desired behavioural change aspect associated with the use of online patient education.

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