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LEVERAGING THE WEB ENJOYMENT EXPERIENCE FOR INFORMAL ONLINE LEARNING: A FIELD STUDY

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Abstract

Online emotional experiences and their relationship to cognitive states are of growing interest. This study investigates one emotional experience – enjoyment – and its impact on informal online learning. The concept of enjoyable online learning, namely online learning that is not part of a formal instructional undertaking, has not been well studied or understood. The study treats enjoyment as a complex and multi-dimensional construct. A field study was conducted with an operational museum website and 1,815 participants. A cross-over experimental design was employed. Structural equation models were constructed to evaluate the relationship between the web enjoyment experience and informal online learning outcomes. This relationship was significant for all three experimental conditions. Analysis also showed relationships among the website design feature of interactivity, the user's level of enjoyment and informal learning outcomes: (i) the degree of interactivity influences the level of enjoyment; (ii) the degree of interactivity influences informal learning outcomes. Not all results, however, were in the expected direction. The study points to the need for more research in this complex area.

Keywords: Web Enjoyment Experience, Engagement, Positive Affect, Fulfilment, Informal Learning, Design Features

1. Introduction

Online users' emotional experiences and the linkages to their cognitive states, such as memory and attention, are of growing interest (Beaudry and Pinsonneault, 2010). This interest has been stimulated by work such as Norman's *Emotional Design* (2004). The study of emotional experiences in an online environment is of interest as it has significant practical implications, especially in the service sectors. In industry, service organisations are enjoined to take websites beyond functionality and usability (Bodine et al., 2007). In marketing research, some studies have reported positive relationships between consumers' emotional states of pleasure and arousal in online shopping behaviour (see Mummalaneni, 2005). Furthermore, as an indicator of the topic's importance, the European Union (EU) has launched a 6 million Euro project, HUMAINE, to investigate emotional computing (HUMAINE, 2009).

Online education is a further area that has significant theoretical and practical importance. Online education can be classed as either 'formal', where there are some compulsory learning activities and extrinsic motivators such as achievement of a qualification, or 'informal', where there are no formal requirements and motivators are largely intrinsic. Understanding the factors that enhance both formal and informal online education has important implications for practice and human-computer studies. Informal education is increasingly important because it includes the provision of advice and knowledge to clients and customers by service providers such as government agencies and the dissemination of cultural information by organisations such as museums.

As a museum is an institution serving society with the mission of providing study, education, and enjoyment for the general public (ICOM, 2009), museums provide a fertile context for study. The educational mission of museums is in part achieved by enabling informal learning, where there is not necessarily any extrinsic motivator for learning and, rather, the visitors to a museum's website are motivated by intrinsic personal interests. Compared with online learning in schools and universities (Hedesting and Kaptelinin, 2005; Shen et al., 2008), museums are not formal education institutions. Learning on a museum website does not involve formal lectures and does not lead to any degrees or certification. It is also different from organisational training for employees, which targets increasing organisational benefits (Aguinis and Kraiger, 2009). In the museum context, intrinsic motivators such as enjoyable experiences are particularly important.

This study considers one specific affective experience, *enjoyment*, and its role in informal online learning. The aims of the study are to investigate the design features that induce enjoyment, the enjoyment experience itself, and the outcomes in terms of informal learning. The study was conducted in the context of learning materials provided by the National Palace Museum of Taiwan. The study draws on literature from three streams of research to develop and test a causal model of the leverage of enjoyment in informal online learning: (i) the enjoyment experience as a positive emotion; (ii) informal online learning, and (iii) website design features. The study follows work by Lin, Gregor and Ewing (2008), which treats enjoyment as a complex and multi-dimensional construct (following Fischer et al., 1990; Warner, 1980) and benefits from the use of a validated instrument developed specifically to assess the web enjoyment experience (Lin et al., 2008).

The paper proceeds as follows. First, the concept of web enjoyment experience is explored in some depth. The justification for relating the enjoyment experience to informal learning is then provided. The research model and hypotheses for the study are then proposed. A field study with cross-over experimental design was performed. Subsequently, the results are discussed and concluded.

2. Conceptual Background

This study concentrates on two focal phenomena, namely the web enjoyment experience and online learning in the context of informal learning environment, and the linkage between these two phenomena.

2.1. Enjoyment Experience

Studies in information systems (IS) have devoted attention to the concept of enjoyment (Van der Heijden, 2004). “Perceived enjoyment” is regarded as the extent to which fun can be derived from using a system and can strongly influence web use for entertainment purposes (Van der Heijden, 2004, p.697). It has been argued that “an enjoyable user-technology interaction” depends on the interaction effects among challenge and the development of skills, as well as variation and the enabling of the decision-making authority of the user (Brandtzege et al., 2003, p.62). Three perspectives on enjoyment experiences can be identified: (i) as a prior stimulant (antecedent) (Davis et al., 1992; Venkatesh, 2000); (ii) a transactional element (Cyr et al., 2006; Van der Heijden, 2004; Webster and Ahuja, 2006); and (iii) a consequence (Huang, 2003). However, the IS realm still lacks a precise and generally agreed meaning of enjoyment, especially in relation to web usage. To thoroughly understand enjoyment, it is necessary to review concepts proposed in other research disciplines.

Philosophers, psychologists, and physiologists have provided insights into the true nature of enjoyment (e.g. Csikszentmihalyi, 1990; Warner, 1980). This study builds on Warner’s (1980) seminal study of enjoyment. The enjoyment experience consists of a certain harmony between three elements: the activity or experience itself; the concepts you believe apply to the activity or experience; and a certain desire in which the same concepts figure (Warner, 1980). Three necessary sub-constructs of enjoyment experience are: *Engagement*, *Positive Affect*, and *Fulfilment*. For people to enjoy an activity, they have to (Lin et al., 2008):

- (1) Engage in an activity. Attention is focused on some activity, with higher levels of activity being associated with more enjoyment (as in the flow experience);
- (2) Obtain a positive affect that could be designated by feelings of pleasure, happiness, contentment, or similar emotions; and
- (3) Fulfil some need or desire, although this need may not have been previously realised consciously.

This study argues that the enjoyment experience has a number of distinct dimensions and must be treated as a complex phenomenon, as suggested in other disciplines (see Fischer et al., 1990; Warner, 1980).

2.2. Informal Learning

Traditionally, learning takes place in formal educational institutions and leads to credits or degrees. “Informal learning”, on the other hand, is the outcome of everyday living experiences and this type of learning can be “noncredit, leisure oriented and short term” (Merriam and Caffarella, 1999, p.21). Currently many people in virtual learning environments are seeking to learn at their own pace and with their own preferred topics (Imel, 2003). As the internet provides for this type of learning, it offers not only substantial potential, but also enormous resources for informal knowledge dissemination.

A limited number of studies relate to informal online learning or informal learning with new technologies and the majority are in the educational literature (see Cranmer, 2006; Gray, 2004; Richards and Tangney, 2007). Some prior studies have indicated that many people have commenced technology-based informal learning at home and in a community (Gray, 2004; Richards and Tangney, 2007). Studies have shown that members of an informal online learning community access dynamic knowledge sources through interactions and sharing (Gray, 2004; Richards and Tangney, 2007). Some studies have focused on children and young people and found that the characteristics of “play” and “interactivity” and the “design” of new technology are important factors in attracting interest and motivation (Cranmer, 2006). These results demonstrate the potential for informal learning in a digital era.

2.3. The Enjoyment Experience and Informal Learning

A question remains: *Is an enjoyment experience associated with learning?* To answer this question, it is essential to go back to the third dimension of the enjoyment experience, which suggests that an enjoyable activity positively meets a person’s needs or fulfils some desire. The idea of meeting needs

leads to theories of human motivation. The current study makes use of work by Ford (1992), which integrates a number of other human motivation theories.

Ford (1992) categorised human goals as: (i) affective goals; (ii) cognitive goals; (iii) subjective organization goals; (iv) self-assertive social relationship goals; (v) integrative social relationship goals; and (vi) task goals. The connection between enjoyment and human learning goals can be established from the third dimension of enjoyment, *fulfilment*, occurring when some needs are satisfied, one of which could be learning. When a person has a need for learning, whether by formal or informal means, the learning activity itself can lead to feelings of fulfilment. Furthermore, the second dimension of the enjoyment experience is *positive affect*. It includes the notions of contentment, gladness, and good feelings. This dimension corresponds to the affective goals of happiness, bodily sensations, and physical well-being in Ford’s taxonomy of human needs. In summary, enjoyment can be associated with learning when it is accompanied by positive affect to a certain degree.

2.4. Museums Informal Learning and Interactive Website Features

Museums have a natural role in informal education as visitors to museums are likely to have intrinsic motives for learning. A museum’s educational mission is “to enhance the education of children and adults through the imaginative use of the museum and its collections” (Ambrose and Paine, 1994, p.45). Museums have a duty to provide study, education, and enjoyment for the general public (ICOM, 2010). However, “(museum) research into computer-based informal learning is rare, particularly for studies focusing on web-based informal learning” (Schaller et al. 2005, online). Yet museums are not formal education institutions: there are no formal lectures or examination. Learning from a museum website does not lead to any degrees or certification. Thus, museum websites offer a good opportunity to study informal online learning.

A positive online experience should consider intention, involvement, and individual participation (Heeter, 2000) and features such as interactive multimedia applications, allowing users to interact with systems and enjoy attractive content (Benyon et al., 2005). The literature has also noted that different features of a computer system (e.g. interactive media versus non-interactive media) influence users’ enjoyment experiences to different degrees (Nusair and Kandampully, 2008; Van der Heijden, 2004). Several studies have argued that interactive multimedia systems can enhance students’ knowledge experiences (Cheung et al., 2003; Low et al., 2003). Cheung et al. (2003) reported that multimedia systems could affect self-efficacy in obtaining knowledge. Based on these arguments, this study thinks that users can develop a sense of engagement, positive affect, and fulfilment, namely enjoyment, from using an interactive website. However, we do not yet know how engagement, positive affect, and fulfilment features can be embedded in online informal learning systems. The design concepts of experience computing with respect to online user behaviour require further exploration.

3. Research Model and Hypotheses

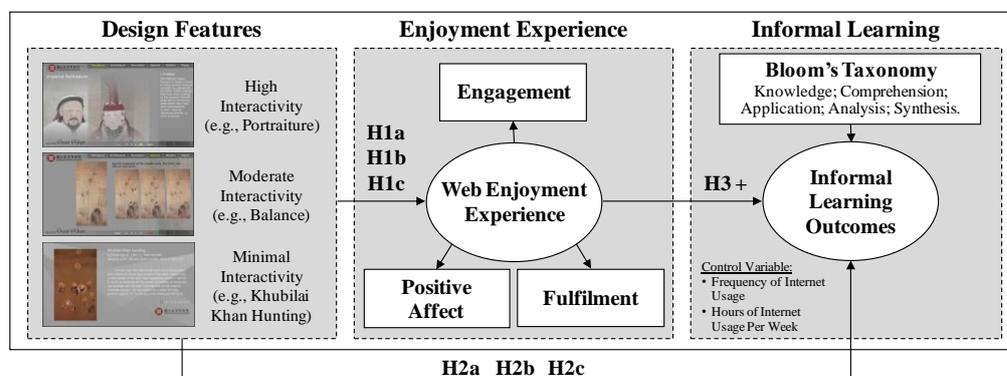


Figure 1. Research Model

The research model for this study relates the design feature of interactivity degree to the web enjoyment experience and informal learning outcomes (see Figure 1). The design rationales contrasted are a highly interactive section, a moderately interactive section, and a minimally interactive section.

3.1. Design Features and Web Enjoyment Experiences

The literature suggests that online interactive media and videos both engage and retain users' concentration on tasks because they allow users to interact with the web and enjoy attractive content, as noted earlier (Benyon et al., 2005; Heeter, 2000; Roth et al., 2009). Traditional minimal interactive website features, such as textual descriptions, plain image displays, or one-way audio broadcast, are restrictive and are less likely to lead to an enjoyment experience. Based on these arguments, we propose that the degree of interactivity in a website will influence the web enjoyment experience¹:

H1a: *A moderately interactive website design will result in users exhibiting higher levels of the web enjoyment experience compared with a minimally interactive design.*

H1b: *A highly interactive website design will result in users exhibiting higher levels of the web enjoyment experience compared with a minimally interactive design.*

H1c: *A highly interactive website design will result in users exhibiting higher levels of the web enjoyment experience compared with a moderately interactive design.*

3.2. Design Features and Informal Online Learning Outcomes

Learning activities take place when the stimulus situations (e.g. enjoyment experiences) along with the contents of memory affect a person's performance regularly (Gagné, 1977). Cheung et al. (2003) reported that multimedia systems could affect self-efficacy in obtaining knowledge. Studies focused on online interactive learning have shown that interactive learning can be rewarding in many aspects, such as student learning and understanding, and teaching effectiveness (Liaw, 2008). Iverson (2004) recommends five features for successful online learning: (i) be enjoyable and engaging, (ii) be positive and supportive, (iii) be active, (iv) be collaborative, and (v) provide context. Thus, we argue that the degree of interactivity in a website design will directly influence the degree of informal learning when visiting the site.

H2a: *A moderately interactive website design will result in improved informal learning outcomes compared with a minimally interactive design.*

H2b: *A highly interactive website design will result in improved informal learning outcomes compared with a minimally interactive design.*

H2c: *A highly interactive website design will result in improved informal learning outcomes compared with a moderately interactive design.*

3.3. The Relationships between Enjoyment and Informal Learning

Although a limited number of studies have explored the characteristics of informal learning, they directly linked learning design features to informal learning outcomes (see Richards and Tangney, 2007). Educational studies also have indicated that students' enjoyment experiences in a course can influence their learning (Blunsdon et al., 2003), but they were focused on the formal knowledge dissemination environments. The leverage from enjoyment experiences to informal online learning outcomes was still ambiguous. Therefore, these prior studies lead to the third hypothesis:

H3: *A higher level of the web enjoyment experience is linked to improved informal learning outcomes.*

¹ The hypotheses sets of H1 and H2 are presented with the permutations shown rather than a simpler form comparing minimal with moderate and then moderate with high, as the study was set up so that each participant saw only two website sections, to reduce participation time and minimise fatigue effects. The base, minimal, condition is compared with each of the other conditions in turn (within-subject) and then the moderate is compared with the high condition (between-subjects).

4. The Field Study

This section describes the three target website sections and participants in the study, the cross-over design experiment, the instrument for evaluating the web enjoyment experience, and the development of the assessment for informal learning outcomes.

4.1. Target Websites and Participants

It is desirable to establish comparable materials for the treatment conditions in an experiment (Shadish et al., 2002). The three experimental online sections were selected from the “Age of the Great Khan” website offered by the National Palace Museum, Taiwan (NPM). This currently operational site has received two international awards, indicating that it has a certain degree of quality. The three sections chosen relate to concepts for developing paintings from the same topic, the Mongolian Dynasty in the period of 1279-1368 A.D.. The highly interactive section (HIG) is *Portraiture*, which illustrates new painting techniques in that dynasty. It contained 27 steps with animated graphs, pop-up windows when requiring clicking, and extra external links, meaning the interactive mechanism is high and compounded. The moderately interactive section (MOD) is *Balance*, which demonstrates how to develop a balanced painting. Users interact with the section via a control panel. No pop-up windows when requiring clicking and extra external links in this section. The content is presented in six steps on one screen. The minimally interactive section (MIN) is *Khubilai Khan Hunting*, which presents an emperor and his empresses in a hunting scene with different tribal groups. Users can read through the content via hyperlinks to go to the next page and click on the painting to view an enlarged image. It is similar to traditional mono-mechanism websites. The minimally interactive condition provides a baseline for comparisons with the other two conditions in within-subject tests.

Data was collected by an online questionnaire over a period of one month. The sample population was drawn from two groups: subscribers to the NPM e-newsletter around the world and visitors to the NPM website. Participation in the study was voluntary and anonymous. The online experimental system, developed by the NPM website team, randomly and automatically assigned each participant to a treatment group. 1,815 valid data sets were generated for further analysis: 1,118 females and 697 males. Most participants were 21 to 40 years old (74.8%) and 88.1% used the Internet daily.

4.2. Cross-Over Experimental Design

A cross-over experimental design was deployed for the study. This form of experimental design can compare sensitive treatments and eliminate the order effects of treatments (Pigeon and Raghavarao, 1987). The literature has noted that residual effects might occur because some influences carry over from one treatment to the next when two or more treatments are applied in a research experiment (Pigeon and Raghavarao, 1987). Cross-over experimental design has been applied in many science research domains, such as medicine (Randell et al., 2005), biometrics (Oman and Seiden, 1988), and mathematics (Williams and John, 2007). However, it is less common in human-computer interaction research. Table 1 summarises the 2 x 2 cross-over design experiments for the study.

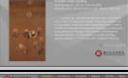
Group	FIRST Visit	→ Fill out FIRST part of the Questionnaire	→ SECOND Visit	→ Fill out SECOND part of the Questionnaire	Valid Data Set	
1		Fill out the enjoyment instrument and five informal learning questions for the moderately interactive section (MOD).		Fill out the enjoyment instrument and five informal learning questions for the minimally interactive section (MIN).	418	
2		Fill out the enjoyment instrument and five informal learning questions for the minimally interactive section (MIN).		Fill out the enjoyment instrument and five informal learning questions for the moderately interactive section (MOD).	440	Total 858
3		Fill out the enjoyment instrument and five informal learning questions for the highly interactive section (HIG).		Fill out the enjoyment instrument and five informal learning questions for the minimally interactive section (MIN).	533	
4		Fill out the enjoyment instrument and five informal learning questions for the minimally interactive section (MIN).		Fill out the enjoyment instrument and five informal learning questions for the highly interactive section (HIG).	424	Total 957

Table 1. The Cross-Over Experimental Design

4.3. Independent Variable – the Web Enjoyment Experience

A new instrument developed by Lin et al. (2008) to assess the web enjoyment experience was used. This instrument was validated in a comprehensive and rigorous process following the approaches outlined by Smith et al. (1996) and Lewis et al. (2005). Table 2 outlines the 12 items of this instrument, against the three dimensions of engagement, positive affect, and fulfilment.

Latent Construct	Item Description	
Engagement (Focused Attention)	While visiting the web section,	<i>I was deeply engrossed; I was absorbed intently; my attention was focused; I concentrated fully.</i>
Positive Affect	While visiting the web pages, I felt	<i>Happy; Pleased; Satisfied; Contented.</i>
Fulfilment (Need or Desire)	Visiting the web pages was	<i>Meaning a lot; Rewarding; Useful; Worthwhile.</i>
Scales: Seven-point Likert scales, scale values from strongly agree to strongly disagree		

Table 2. The Web Enjoyment Experience Instrument

4.4. Dependent Variable – Informal Learning Assessment

The evaluation for informal online learning outcomes utilized Bloom’s taxonomy (1963), which is based on cognitive complexity and includes the recall and understanding for developing intellectual abilities and skills. Bloom’s taxonomy has been applied for understanding informal learning in several disciplines, such as museum education (Kisiel, 2003), adult learning (Vivas and Allada, 2006). Five levels of Bloom’s taxonomy were employed to develop questions for each lesson: *Knowledge, Comprehension, Application, Analysis, and Synthesis* (Bloom 1963). A panel of six academics and five PhD candidates pre-tested the three sets of questions. Participants had to go through the whole section to be able to answer all the questions. Four experts were invited to independently re-examine which level of Bloom’s taxonomy as each question assessed. Their judgments were taken into account in developing the assessment matrix (see Table 3). Table 3 demonstrates that, at a micro level, the level of the question set is highest for the minimally interactive section, followed by the moderately interactive section, and then the highly interactive section set. Overall, the question sets were balanced because they took into account the degree of interactivity and the length of each section. In summary, there is expected to be no significant difference in difficulty among the three sets of learning questions.

Bloom’s Taxonomy	Minimally interactive Section					Total	Moderately interactive Section					Total	Highly interactive Section					Total
	MiQ3	MiQ1	MiQ5	MiQ2	MiQ4		MoQ5	MoQ1	MoQ2	MoQ4	MoQ3		HiQ4	HiQ1	HiQ3	HiQ2	HiQ5	
Synthesis					•	1					•	1				•	1	
Analysis			•	•	•	3			•	•	•	2			•	•	2	
Application			•	•	•	3			•	•	•	3			•	•	2	
Comprehension		•	•	•	•	4		•	•	•	•	4		•	•	•	4	
Knowledge	•	•	•	•	•	5	•	•	•	•	•	5	•	•	•	•	5	

Table 3. The Assessment Matrix for Informal Learning Questions

5. Findings and Discussion

This section presents findings and discusses study limitations. The results show that **H1a**, **H1b**, **H2a**, and **H3** were supported. However, **H1c**, **H2b** and **H2c** were not supported.

A manipulation check was performed to verify the interactive levels of the three treatments. The result shows there are significant differences between these three web sections for the “web enjoyment experience” and “informal learning outcomes”. Further, this study conducted manipulation checks using Mann-Whitney Analysis and t-tests to demonstrate the effectiveness of the manipulations of web section order. A factor analysis was performed to re-confirming the four developed factors. The three-factor result, using Varimax rotation method, was also readily interpretable, with the three factors

identified as positive affect, fulfilment, and engagement. Therefore, the psychometric properties of the instrument were valid and reliable.

5.1. Support for Hypotheses

(1) **The impact of design features on the web enjoyment experience:** The results of the paired-samples t-test in Table 4 show that users had higher web enjoyment experiences with the moderately interactive section (MOD) than with the minimally interactive section (MIN), regardless of the sub-dimension of enjoyment considered. In Table 5, the results also show that participants had higher web enjoyment experiences with the highly interactive section (HIG) compared with the baseline section of MIN. This result shows that a higher degree of interactivity, compared with a baseline minimally interactive condition, leads to more enjoyment, across most of the results, except the dimension of Fulfilment (0.797) in Table 5. Thus, hypotheses **H1a** and **H1b** are supported.

Variable Name	Moderate Interactivity (MOD)			Minimal Interactivity (MIN)			Paired-Sample T-Statistic	Sig. (P-value)
	N	Mean	Std Dev	N	Mean	Std Dev		
Engagement (7 points)	858	5.93	0.792	858	5.34	1.027	16.412	.000
Positive Affect (7 points)	858	5.89	0.772	858	5.38	0.968	16.304	.000
Fulfilment (7 points)	858	5.97	0.757	858	5.72	0.796	10.149	.000
Enjoyment (average of Engagement, Positive Affect, and Fulfilment)	858	5.93	0.696	858	5.48	0.817	17.857	.000
Average Informal Online Learning Outcomes (5 questions)	858	3.41	1.134	858	2.78	1.214	13.515	.000

Table 4. Comparing Enjoyment Experiences and Informal Learning Outcomes (MOD vs. MIN)

Variable Name	High Interactivity (HIG)			Minimal Interactivity (MIN)			Paired-Sample T-Statistic	Sig. (P-value)
	N	Mean	Std Dev	N	Mean	Std Dev		
Engagement (7 points)	957	5.60	0.862	957	5.47	0.919	5.086	.000
Positive Affect (7 points)	957	5.68	0.804	957	5.54	0.909	6.007	.000
Fulfilment (7 points)	957	5.75	0.797	957	5.74	0.809	0.257	.797
Enjoyment (average of Engagement, Positive Affect, and Fulfilment)	957	5.67	0.758	957	5.58	0.793	4.860	.000
Average Informal Online Learning Outcomes (5 questions)	957	2.40	1.255	957	2.74	1.190	-7.580	.000

Table 5. Comparing Enjoyment Experiences and Informal Learning Outcomes (HIG vs. MIN)

Note the baseline condition, MIN, allowed a check between the experimental groups to ensure the soundness of research design. The differences between means for enjoyment experiences and online learning outcomes in Group 1 and 2 compared with Groups 3 and 4 were negligible (P-value is .283 for enjoyment and .870 for learning outcomes, also see Table 4 and Table 5 the MIN sections).

Hence, an independent-sample t-test was conducted to examine the H1c, which evaluates that is there any difference between the two more interactive conditions (see Table 6). The results were significant but in the opposite direction to that expected. The enjoyment experience was higher in the MOD than in the HIG. Thus **H1c** was not supported.

Variable Name	High Interactivity (HIG)			Moderate Interactivity (MOD)			Paired-Sample T-Statistic	Sig. (P-value)
	N	Mean	Std Dev	N	Mean	Std Dev		
Engagement (7 points)	957	5.60	0.862	858	5.93	0.792	-8.564	.000
Positive Affect (7 points)	957	5.68	0.804	858	5.89	0.772	-5.691	.006
Fulfilment (7 points)	957	5.75	0.797	858	5.97	0.757	-6.132	.000
Enjoyment (average of Engagement, Positive Affect, and Fulfilment)	957	5.67	0.758	858	5.93	0.696	-6.621	.000
Average Informal Online Learning Outcomes (5 questions)	957	2.40	1.255	858	3.41	1.134	-17.904	.001

Table 6. Comparing Enjoyment Experiences and Informal Learning Outcomes (HIG vs. MOD)

(2) **The impacts of design features on informal online learning outcomes:** It was expected that both of the more interactive sections would lead to more learning than the baseline minimally interactive

conditions (H2a, H2b) and that the highly interactive condition would lead to more learning than the moderate condition (H2c).

These hypotheses were supported only in part (see Tables 4, 5 and 6). The moderately interactive section (MOD) gave better learning outcomes than the minimally interactive section (MIN). On average, participants scored 3.41 correct answers to the five learning questions for MOD. In contrast, participants scored an average of 2.78 correct answers to the five questions for MIN. This is a significant difference in the paired-samples t-test (see Table 4). This finding is consistent with previous literature that suggests that online interactive media functions can engage user activities and retain their concentration on tasks (Gee 2003). This result means that hypothesis **H2a** is supported.

However, unexpectedly the highly interactive section (HIG) performed worse than both the MIN and MOD sections in terms of learning outcomes. On average, the participants scored 2.40 on the five learning questions for HIG, a lower average score than for the MIN section (2.74) (see Table 5) and also lower than MOD section (3.41) (see Table 6). Thus **H2b** and **H2c** were not supported.

A possible explanation is that when interactive media features are too over-interactive or too complex, they might actually discourage user learning experiences. This finding is interesting. The initial expectation was that interactive media functions would generally help online users to learn more. However, interactive media functions may in some cases be inappropriate for learning, as has, in fact been suggested by Heeter (2000) who showed that if informal online learning content is too long or if there is too much interaction in the online interface, users may not have sufficient opportunity to establish new information in memory and storing new knowledge may be limited.

(3) The relationships between enjoyment experiences and informal learning outcomes: Three Structural Equation Models (SEM) were constructed by using SPSS AMOS to examine H3, which established the connections between the web enjoyment experience and informal online learning outcomes (see Figure 2). For the highly interactive section (HIG) (see Figure 2), the standardised regression weight from web enjoyment experience (EnjoyHig) to informal online learning outcomes (LearnOutcHig) was 0.33, significant at the .001 level, showing that when the enjoyment experience was higher, the informal online learning outcome was also increased. A similar relationship was observed with the moderately interactive section (MOD). The standardised regression weight from web enjoyment experience (EnjoyMod) to the informal online learning outcome (LearnOutcMod) was 0.37 and significant at the .001 level. For the minimal interactive learning condition, the standardised regression weight from the enjoyment experience (EnjoyMin) to the informal online learning outcome (LearnOutcMin) was 0.23 and also significant at the .001 level, meaning that when the enjoyment experience was higher, the learning outcome was also getting increased.

The measures of model fit (Lewis et al. 2005), such as comparative fit index (CFI), root mean square residuals (RMR), goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), normed fit index (NFI), and non-normed fit index (NNFI), all indicate that the three models are appropriate (see 'Measures of Model Fit' in each aspect). Thus, H3 was fully supported, meaning the web enjoyment experience was shown to leverage informal online learning outcomes in three different experimental conditions.

5.2. Limitations of the Research

Several limitations should be acknowledged when interpreting the results of this study. First, the learning questions across treatment groups may not be exactly comparable, even though Bloom's (1963) taxonomy was used and every care was taken to ensure they were equivalent. Second, all three experimental sections were from Chinese fine art and painting, a topic which may not have been interesting to some participants. Third, most of the participants were subscribers to the Taiwan's National Palace Museum e-newsletter, so the data may not be generalisable to the general public. It is also acknowledged that the statistical tests employed had a high power because of the large paired-sample size (Meyers et al. 2006). The magnitude of the differences in scores between groups should be considered in addition to their statistical significance.

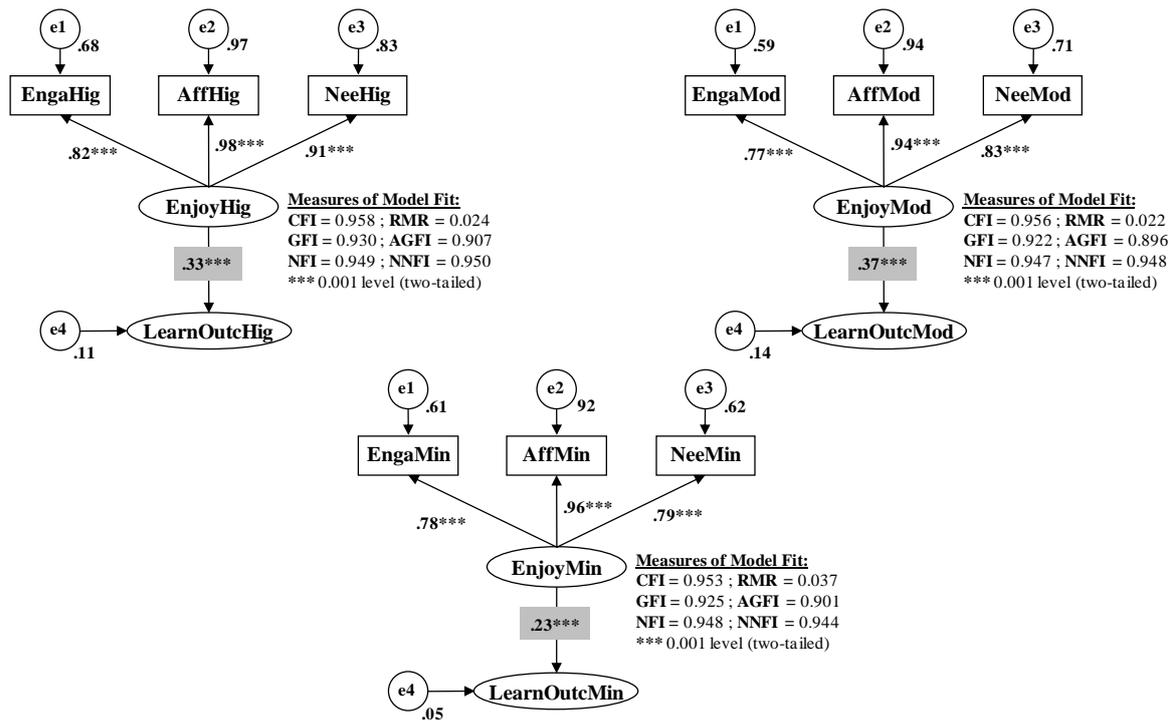


Figure 2. The SEM Analysis

6. Conclusion

Based on this large scale field study, the results can be summarized as follows: (i) different types of interactive media features influence the web enjoyment experience to different degrees; (ii) different types of interactive media features also influence informal learning outcomes; and (iii) a higher level of enjoyment experience can increase and facilitate online users' informal learning outcomes. This study has shown that the web enjoyment experience can leverage informal online learning outcomes in three different online experimental conditions. Very few studies investigate website application design with a focus on the web enjoyment experience and informal online knowledge dissemination and enhancement. Thus, this study has helped to fill a gap in the literature.

From the research aspect, this study found that the *web enjoyment experience* is a novel concept contributing to human-computer web design theory. Previous human-computer interaction studies have indicated that **enjoyment** is an important characteristic for designing websites and delivering information (Blythe et al. 2003). There are three conceptual features vital to website design for enjoyment: *engagement*, *positive affect*, and *fulfilment*. Furthermore, design features can influence online user online learning outcomes, especially for online learning that is not part of a formal instructional undertaking. The literature has described the experience of using interactive media systems for teaching and learning (Liaw, 2008), but they are more concerned with formal online learning for schools or workplaces. The results of the current study are congruent with these theories, albeit in the context of general knowledge enhancement and dissemination.

Importantly, the current study establishes a link between an enjoyment experience and online learning. The concepts of learning and enjoyment can be related analytically through the second and third dimensions of the enjoyment experience: positive affect and fulfilment. When a person establishes a goal to learn, whether by formal or informal means, the learning activity itself creates some kind of fulfilment. The current study maps online user learning goals to Ford's (1992) taxonomy of human goals (needs). Online informal and enjoyable learning corresponds to the affective goals of happiness, bodily sensations, and physical well-being.

In terms of implications for practice, the findings of this study offer practical guidance to museums and other types of informal learning organisations. This study will help website designers re-consider user engagement, sensation, and reaction and generate new design ideas. It will also assist website managers to re-think information offering approaches and plan future website modifications. Moreover, appropriate interactive media features could assist organisations to disseminate knowledge and achieve their educational missions. The “well-designed” and “appropriate” qualifiers are important. Designers should be aware that features that will be attractive to some (for example, long and complex interfaces) will not appeal to all users. The current study also has implications for institutions offering online learning programs for their staff. Enjoyable websites could help staff learn more and faster and more knowledgeable staff contribute to an organisation’s success. In sum, the study has demonstrated the important link between the web enjoyment experience and informal online learning, and shown how design features, such as interactivity can influence this effect.

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