

# Internet dependency: Its impact on online behavioral patterns in E-commerce

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**Abstract.** Delivering the right Internet service to the right person has been a major challenge to E-commerce strategies. Developers of E-commerce and online services have constantly faced the issue of scarce design guidelines to model their customers' online behavioral patterns. This has called for new research on the characteristics of Internet users so that appropriate E-commerce website design strategies can be developed. This study attempts to investigate the possibility of the non-detrimental effects of Internet dependency and proposes an instrument to measure both positive and negative Internet dependency. The authors further assess the effects of these two types of dependency on several online activities to delineate the characteristics of Internet users. This article is concluded with the managerial implications of the findings and the suggested E-commerce website design guidelines.

**Keywords:** Internet dependency, Internet addiction, E-commerce, website design, online behavioral differences



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## 1. Introduction

Mapping user's needs to software systems has been central to the software development process. The Internet introduces new challenges to this decades-old philosophy where users come online with different goals and the designers are basically free to promote the novelty of new user interfaces. In the traditional soft-

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ware paradigm, user-software interactions can be modeled into the design process and existing design guidelines are organized towards designing sequential navigation. However, the underlying technology of the WWW largely encourages non-linear navigation.

An E-commerce website designer can be tempted to clutter the limited space of a Web page with marketing information that is of little interest to the user. Trying to show the Web visitors all marketing details may impede visitors from making good decisions [5]. Even if a website is built to meet the traditional standards, a user might still find it less usable. Thus, ineffective computer use or frustration resulted from interacting with software is primarily a behavioral issue [7,31]. This issue becomes a major challenge for Web designers since E-commerce website visitors do not come to a site with the same goal and the same level of expertise with the user interface. Furthermore, this design issue and the nonlinear navigation structure of the WWW could make traditional design guidelines difficult to apply. Thus, research [4,21,22] has called for new studies on the characteristics of Internet users and their behavioral patterns so that an appropriate set of E-commerce website design guidelines can be developed.

One underlying assumption of the online user community is that the user population is largely heterogeneous. Users may visit websites with different intentions and expectations. In addition, studying each individual user and tailoring the site for individual preferences can be very costly. Pereira [21] suggested that certain features on the Internet are only relevant to certain groups of users. Pereira implies that a study on the group differences and similarities can be a feasible strategy to collect a working knowledge about Internet users. It has been suggested that Internet dependent users are different from nondependent ones in how they use the vast amount of Internet software [8,23]. However, the terminology of Internet dependency and its characteristics have been predominantly studied in the psychology context. Due to its disciplinary origin, Internet dependency was mainly examined on its detrimental effects to the user's personal lives [15].

Even though Internet dependent users are online more than others, excessive Internet use does not necessarily imply that a user is Internet dependent. This extent of Internet use may not result in all of the symptoms and behaviors associated with Internet "addiction" or dependency [2]. In addition, early addiction literature [9] has suggested that addiction or dependency may also produce positive, healthy, and even beneficial effects on personal lives. Definition of other patterns

of addiction has also appeared in the literature [1]. To the best knowledge of the authors, the positive (beneficial) effects of dependency in the context of the Internet have not been empirically researched.

The goal of this study is two folds. First, it recognizes the possibility of the non-detrimental effects of Internet dependency and proposes an instrument to measure both positive and negative Internet dependency. Second, it assesses the effects of these two types of dependencies on several online activities to delineate the characteristics of Internet users. This article is organized in the following manner. Next section presents the background and literature review of Internet dependency. The third section describes sampling procedures, instrument development, and analyses. The last section concludes the paper with a summary of managerial implications drawn from this research.

## 2. Literature review

Internet addiction (or Internet dependency), coined by Goldberg [10], was originally designed to describe the negative effects of excessive Internet use on personal lives. It is similar to substance abuse, such as chemical addiction, that addicts can suffer physically or emotionally from such dependency. Goldberg was the first to recognize that non-substance dependency can be a legitimate type of addictions. Internet addiction is similar to alcohol addiction that dependent users habitually expose themselves to the substance. Studies [2,3,10,11,15] have identified the following symptoms:

- Tolerance: a need for markedly increased amount of time online.
- Withdrawal syndrome: a reduction of Internet use results in anxiety, obsessive thinking about the Internet, and dreams about the Internet.
- The Internet is accessed more and for longer periods than was intended.
- A persistent desire exists to cut down or control Internet use.
- A great deal of time is spent in activities related to the Internet.
- Important social, occupational, or recreational activities are given up because of Internet use.
- Internet use is continued despite knowledge of having a persistent physical, social, occupational, or psychological problem that is probably caused by Internet use.

Even though symptoms of Internet dependency were identified this way, an agreement on the precise definition of this terminology among clinicians, researchers, and social policy makers has not yet been reached [26]. Thus, several terms describing similar concepts were used in the literature among several academic disciplines. These include pathological use [17], Internet dependence [33], technological addiction [11], computer addiction [28], Internet addiction disorder [10], and cyberaddiction [19]. Most of these terms carry the sense of social disapproval and indicate that this form of emotional attachment to the Internet or computer is trouble to oneself. We adopted a neutral term – Internet dependency to avoid debates such as whether this type of addiction should be limited in the context of substance dependency. We do not, however, intend to generalize psychological proof of what should or should not be part of Internet dependency, nor do we intend to identify clinical solutions to ease the effects that Internet dependency places on the users.

The dependency itself could be healthy or unhealthy. For example, book-reading can be habitual but is not generally regarded as a harmful dependency. There seems to be a blurred zone where a dependency is considered “healthy”. This is mainly because the positive or healthy side of Internet dependency has been barely researched because only a little literature could be found. Many people use the Internet on a daily basis, but they do not develop much of Internet dependency. The psychology discipline seems to lack of interest in identifying patterns of healthy (or positive) de-

pendency. If dependency varies as a matter of how subjects are “attached” to the substance (or non-substance) as suggested by Rauterberg [25], it is likely the dependency itself can result in non-harmful effects as well. Shaffer [26] suggested that addiction could be harmful or beneficial. Alexander and Schweighofer [1] further defined positive addiction to be “overwhelmingly involved with using and/or obtaining it, pervades total life activity and controls behavior in a wide range of circumstances, and high tendency to resume use after stopping”. Based on Jaffe’s [14] concept of a continuum of involvement with drugs, Alexander and Schweighofer also suggested that addiction can be categorized into nine levels according to how subjects are “attached” to the substance. Both positive and negative addictions are included on their list. Glasser [9] indicated that addiction could be positive and healthy, and beneficial to personal lives, thus the term “positive addiction”. Though positive addiction is considered beneficial to oneself, it still shares with negative (or pathological) addictions some symptoms, such as withdrawal symptom, persistent and repetitive use, and influence on subject’s lives. Table 1 compares and contrasts positive dependency and negative dependency summarized from existing research.

Shotton [28,29] was one of the first researchers who studied computer addiction. Although the results of her studies did not show evidence of significant pathological addiction, she indicated that some users who spent much time using computers might not develop computer addiction. Shotton also stated that those who

Table 1  
Positive dependency vs. negative dependency

Difference	Negative addiction (NA)	Positive addiction (PA)
Effect to personal lives	NA weakens or destroys people	PA strengthens our lives
Depression and frustration	Pathological addicts feel depression and frustration in their lives	Not discussed in the literature
Progression	The need for more time	Regular use
Withdrawal symptom	Withdrawal syndrome involved in NA	Withdrawal syndrome involved in PA
Time spent on the activities that the subject is addicted to	A great deal of time spent on the Internet	Activity is performed for a reasonable time
Nature of addiction	A form of escape. Internet to dependent users is not an informational or communication tool	The ability to become non-self-critical and at the same time try to improve
Effect gained from performing the addictive activities	Temporal	Long duration
Effect of addiction on personal life	Detrimental	Beneficial

were addicted to computers were a heterogeneous group implying that there may be different types of computer addictions. Both Glasser and Shotton's research shows that positive (or healthy) dependents may spend much time on activities that they are attached. Even their time spent on such activities may sometimes be comparable to that of negative addicts, they do not seem to be affected unhealthily. Thus, the amount of time that a dependent user spends on a substance or non-substance matter cannot be the sole determinant of this type of dependency alone. Recently, Patwardhan and Yang [20] studied Internet dependency and its impacts on online shopping, chatting, and news reading. Their research results did indicate that Internet Dependency has effects on online shopping and news reading, while no clear influence on online chatting. As echoed by the authors, more refined study on Internet dependency is needed.

### 3. Methodology

#### 3.1. Research procedural model

A graphical model depicting procedures undertaken in the current study is listed in Fig. 1. Internet users were classified into positive dependency (PD), little dependency (LD), and negative dependency (ND) groups based on the effects of their Internet use. Usage patterns of these three groups were analyzed on six Internet activities: online games, online chat, information searching, online shopping, online education, and email.

#### 3.2. Sample and procedures

Since there is no central directory of Internet users, it is very difficult to select users from the population at random. In addition, a representative pool of Internet users for experimental purposes is not feasible since Internet users are spread over wide geographical areas. Hence, a survey was adopted in this research. The questionnaire was designed to be accessible on the WWW. Lazar and Preece [16] suggested that Web-based surveys should be designed to ensure that the following guidelines are met.

- Make the survey error-proof.
- Make the survey accessible from all common browsers.
- Test the survey with different monitor sizes.
- Test the survey from network locations.

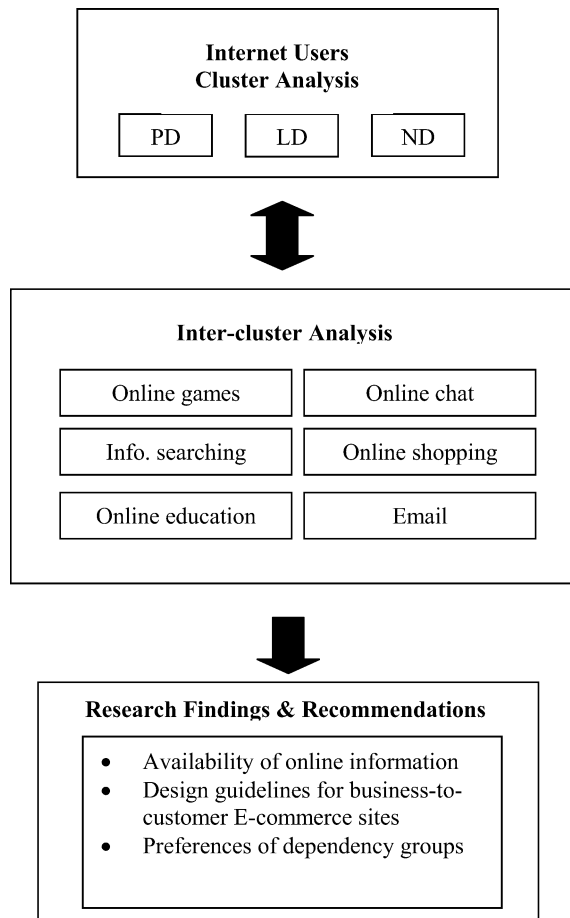


Fig. 1. Research procedural model.

- Capture identification information.
- Perform user testing.
- The survey should not require any extra software or hardware.

Based on these guidelines, the authors have taken extra precautions below. To reduce incomplete responses and to prevent potential errors, JavaScript was added to the survey so that respondents could be informed of questions missed. Since not all Web browsers support JavaScript, Common Gateway Interface (CGI) scripts were implemented on the Web server side to validate missing responses. The questionnaire was designed to be assessable from all common browsers including the text-only browsers. A pretest was conducted to assess both the content and the user interface to ensure smoother delivery of the survey. In addition, software used to design the Web-based survey does not require installations of any extra software and hardware on the user side. To encourage participation, respondents

were promised an executive summary of the results. The announcement of the survey was posted on news groups, Web pages, search engines and posters. The survey lasted about three months. Data were automatically stored in a backend database as the user filled out the survey.

### 3.3. Instrument

The questionnaire was designed to collect information about individuals' level of Internet dependency and their tendency of adopting commercial deliverables on the Internet. This study focuses on a broader definition of E-commerce activities by including not only activities that involve monetary transactions but also those that are "triggers" to off-line purchases. In fact, early potential of E-commerce might be more for selling or exchanging information on the Internet rather than other goods and materials. Many users use E-commerce services as a means of gaining pre-purchase information. This pre-purchase information obtained from a target business website can be of important value to potential buyers [6]. Therefore, dependent users were studied in their preferences of adopting online shopping and conducting information searching prior to their decisions of real online or offline purchases.

The items used to measure pathological Internet dependency were adapted from Young [32] and Egger [8]. Since there was no readily available instrument to measure positive Internet dependency, items were developed from previous research, such as Glasser [9] and others. The survey instrument was made available online to measure Internet dependency. Respondents were asked to indicate, on a 5-point Likert scale ranging from "Strongly disagree (1)" to "Strongly agree (5)", the importance of each item with respect to their online usage.

Table 2 summarizes the demographic profile of respondents. There were 400 Internet users responded to this study, of which 62% were men and 37% were women. Male users turned out to be the larger gender group who responded to this survey. Age distribution of the respondents ranged from 14 to 71 with an average of 29.69. Most respondents were in the 20–29 age group, with the 30–39 group being next. There were significantly less elder people (who were at or more than 50 years of age) participating this survey.

Table 2  
Demographics

	Category	Count	Percentage
Gender	Male	251	62.4
	Female	149	37.1
Age	11–19	17	4.2
	20–29	225	56.0
	30–39	108	26.9
	40–49	34	8.5
	50–59	13	3.2
	≥ 60	4	1.0

### 3.4. Instrumental validity

Reliability of the instrument was assessed using Cronbach alpha [18]. While the calculation of Cronbach's alpha can be obtained either from the variance/covariance matrix or by evaluating the average correlation among items in a scale, the difference in alpha values obtained using these two methods is generally as small as 0.01. Typically, reliability coefficients of 0.70 or higher are considered adequate [18]. Cronbach alpha of 0.88 was obtained for these twenty items indicating a high internal consistency or reliability.

## 4. Data analysis

K means cluster analysis was employed to classify Internet users into three groups: positive dependency (PD), little dependency (LD), and negative (or pathological) dependency (ND). A separate ANOVA analysis for each classification item indicates that there was a mean difference on every single classification item for the resulting groups ( $p < 0.001$ ). Due to missing data values, 385 respondents were correctly classified. The PD group consists of 175 respondents whose use frequencies were moderate on negative dependency items while high on positive dependency items. The 116 users who were clustered into the LD group had low to moderate frequency scores on all items. The ND group consists of 94 respondents who responded to the survey with high frequency scores on negative dependency items, and moderate to high frequency scores on positive dependency items.

Table 3 shows group means and standard deviations on the six use categories. One-way ANOVA (see Table 4) shows that these three group means differ in five out of six use categories ( $p < 0.05$ ). The only use category that user groups did not exert statistical difference

Table 3  
Group means and S.D. on six use categories

Dependency group	Game	Chat	Information searching	Online shopping	Online education	E-mail
Positive dependency	2.28 (1.35)	2.82 (1.40)	3.66 (1.07)	2.67 (1.21)	4.08 (1.14)	4.53 (1.17)
Little dependency	1.95 (1.13)	1.97 (1.18)	3.20 (1.09)	2.06 (1.21)	3.48 (1.32)	4.34 (1.25)
Negative dependency	2.57 (1.48)	3.95 (1.33)	3.86 (0.98)	2.61 (1.30)	4.10 (1.16)	4.56 (1.10)

\*S.D. in parentheses.

Table 4  
Mean comparison – six use categories

		Sum of squares	df	Mean square	F	Sig.
Game playing	Between groups	20.613	2	10.306	5.912	0.003
	Within groups	665.948	382	1.743		
	Total	686.561	384			
Chat	Between groups	202.211	2	101.105	58.008	0.000
	Within groups	665.805	382	1.743		
	Total	868.016	384			
Information searching	Between groups	25.356	2	12.678	11.393	0.000
	Within groups	425.070	382	1.113		
	Total	450.426	384			
Online shopping	Between groups	28.116	2	14.058	9.230	0.000
	Within groups	581.791	382	1.523		
	Total	609.906	384			
Online education	Between groups	29.460	2	14.730	10.268	0.000
	Within groups	547.984	382	1.435		
	Total	577.444	384			
Online emailing	Between groups	3.522	2	1.761	1.263	0.284
	Within groups	532.582	382	1.394		
	Total	536.104	384			

was online emailing, where the  $p$  value was over the 0.05 threshold.

A stepwise discriminant analysis was used to examine how these groups of users differ in the six use categories. The Mahalanobis distance was the stepwise criterion for inclusion of variables. The dependent variable was the Internet dependency groups, where PD, LD, and ND groups were assigned numeric numbers 1, 2, and 3, respectively. The independent variables include the six use categories: game, online chat, information searching, online shopping, online education, and email. The sample was split into the analysis sample for estimation of the discriminant functions, and the holdout sample for validation of the discriminant functions. Cases were randomly assigned to the two sub-samples.

The discriminant analysis generated two discriminant functions (see Table 5). Both functions are statistically significant as measured by the chi-square statistic. The first discriminant function accounts for 89.80% of variance explained by the two functions. The second one accounts for 10.20% of the variance. The total variance explained by the first function is  $0.8980^2$ , or 80.64%, while the next function explains  $0.1020^2$ , or 1.04%. Thus, the total variance explained by both functions is 80.84% ( $0.8064 + 0.0104 * (1 - 0.8064)$ ).

Table 5 also shows the initial discriminant loadings for the six variables, followed by rotated discriminant functions. We chose the most widely used procedure of VARIMAX rotation. Both versions indicate that online chat, online shopping and online education were substantial in discriminating the three Internet depen-

Table 5  
Summary discriminant analysis

Function	Eigen-value	% of variance	Cumulative %	Canonical correlation	Wilks' lambda	Chi-square	df	Sig.
1	0.33	89.80	89.80	0.50	0.72	123.77	6	0.00
2	0.04	10.20	100.00	0.19	0.96	14.16	2	0.00

	Structure matrix		Correlations between variables and rotated functions	
	Function		Function	
	1	2	1	2
Chat	0.95	-0.31	0.99	0.08
Game*	0.13	-0.01	0.02	0.75
Shopping	0.30	0.69	0.08	0.70
Education	0.35	0.61	0.13	0.05
Info. Search*	0.27	0.38	0.10	0.46
Email*	0.12	0.12	0.06	0.16

Functions at group centroids		
Dependency type	Function	
	1	2
PD	-0.03	0.22
LD	-0.62	-0.43
ND	0.83	0.13

\*The stepwise procedure excluded this variable from analysis.

dependency groups. The online chat variable stood out as the most influential variable that discriminates PD and LD groups versus the ND group (see the Structure Matrix and Functions at Group Centroids sections in Table 5). As the first function shows, the centroid for the PD group is -0.03, for the LD group is -0.62, and for the ND group is 0.83. Therefore, users with the negative Internet dependency (ND) tended to be involved in the communicative features on the Internet than the other two groups of users. Two variables with significant discriminating power in the second function are online shopping and online education (see also the Structure Matrix and Functions at Group Centroids sections in Table 5), which discriminate the PD and ND groups versus the LD group. The second function shows that the centroid for the PD group is 0.22, for the LD group is -0.43, and for the ND group is 0.13. As a result, both PD and ND groups seem to be more involved in the online shopping and education than the LD group.

The group membership prediction accuracy was measured on the analysis and the holdout sub-samples. The hit ratio for the analysis sample is 54.30%, whereas that for the holdout sample is 53.80% (see Table 6). Both ratios are close with a difference of

only 0.50%. To assess the appropriateness of these hit ratios and the classification accuracy for individual groups in the two sub-samples, two statistics were employed: the proportional chance criterion and the Press's Q.

The proportional chance criterion is the sum of squared proportion of individuals in each group. Since three Internet dependency groups were studied in this paper, the proportional chance criterion is calculated as  $0.35(0.45^2 + 0.30^2 + 0.24^2)$ . It is suggested that the classification accuracy should be at least one-fourth greater than that is achieved by chance [12]. Using the proportional chance criterion, the acceptable classification accuracy should be at least 0.44 ( $0.25 * 1.25$ ), or 44.00%. The overall classification accuracy for the analysis and holdout sub-samples are 54.30% and 53.80% respectively. Both exceed the threshold of 44.00% indicating that the classification results are better than chance. The percent of users correctly classified into individual groups for the analysis sub-sample are 59.40% for the PD group, 49.10% for the LD group, and 51.10% for the ND group. For the holdout sub-sample, they are 58.90% for the PD group, 49.10% for the LD group, and 50.00% for the ND group. Ap-

Table 6  
Classification results

		Dependency group	Predicted group membership			Total
			PD	LD	ND	
Original	Count	PD	104	42	29	175
		LD	52	57	7	116
		ND	38	8	48	94
		Ungrouped cases	8	2	2	12
	%	PD	59.4	24.0	16.6	100.0
		LD	44.8	49.1	6.0	100.0
		ND	40.4	8.5	51.1	100.0
		Ungrouped cases	66.7	16.7	16.7	100.0
Cross-validated	Count	PD	103	42	30	175
		LD	52	57	7	116
		ND	38	9	47	94
	%	PD	58.9	24.0	17.1	100.0
		LD	44.8	49.1	6.0	100.0
		ND	40.4	9.6	50.0	100.0

\*54.3% of original grouped cases correctly classified.

\*53.8% of cross-validated grouped cases correctly classified.

Table 7  
ANOVA – frequency and years online

		Sum of squares	df	Mean square	F	Sig.
Frequency of use	Between groups	114.53	2	57.26	20.33	0.00
	Within groups	1019.75	362	2.82		
	Total	1134.28	364			
Years online	Between groups	6.03	2	3.02	3.87	0.02
	Within groups	297.19	381	0.78		
	Total	303.23	383			

plying the same threshold, all individual classifications have met this criterion and thus are better than chance. The Press's Q statistic calculated for this study is 76.06, which is greater than the critical value at the significance level of 0.01. Thus, we would conclude that the predictions were also significantly better than chance. Both the proportional chance criterion and Press's Q statistic indicate that the classification accuracy is satisfactory.

Table 7 shows that these three groups of users have had different levels of Internet experience as measured by use frequency and years online. A series of t tests suggest that, the users in the ND group were online more frequent than the LD and PD groups ( $p < 0.05$  for both), while the latter groups did not show a statistical difference on the frequency of use. In terms of years online, the LD group were relatively new to the Internet than the other two groups ( $p < 0.05$ ).

## 5. Conclusion and recommendation

Delivering the right Internet service to the right person has been a major challenge to E-commerce strategies. Developers of online services have constantly faced the issue of scarce design guidelines to model their customers' online behavioral patterns. As Internet users are not homogeneous and they improve on their Internet literacy through interactions with the vast amount of Internet services, this study proposes to model user behavioral patterns through the concept of Internet dependency.

Respondents were classified into three dependency groups: positive dependency (PD), negative dependency (ND), and little dependency (LD). Their online behavioral patterns have demonstrated that they were involved in a different set of Internet or E-commerce activities. Users in the ND group tended to indulge

themselves in various interactive forms of online communications, such as online chat rooms and IRC. Existing studies [32,33] have suggested that their proactive involvement in online chats does not necessarily mean they are socially active in the real life. In addition, ND users can be involved heavily in online chats, email, online games, surfing, reading, and newsgroups [11,32]. However, the current study shows, the use of highly interactive forms of online communication, such as chats and IRC, is the most significant Internet activity that sets ND users apart from the other two groups.

Online shopping and online education have appeared to be the two most influential use categories that differentiate the LD group from the other two. It appears in the results of the current study that the LD group used the Internet less frequently than the ND group but their online frequency was similar to that of the PD group. However, both ND and PD groups appear to be online longer than the LD group. Online learning/education requires that the individual be knowledgeable in locating appropriate learning sources, which requires comparing candidate Web sites and surveying into others opinions for better learning resources. In the realm of online shopping, users can be involved in pre-purchase, and post-purchase information searching and comparisons. Both activities can be more demanding of an individual's time and effort than other types of Internet activities, such as emailing and game-playing. It is likely that this demand of time and effort be the source of "principle of incomplete gestalten", which the LD group lacks.

With many competing sites available to offer alternatives, a user frustrated with the site design may never come back. This study has shown to the practitioners that PD and ND groups are more into shopping and learning than the LD group even though the PD group was online less frequent than the ND group. This has an important implication to current Web marketing in that the "hit ratio" may not be an appropriate index to measure the effectiveness of Web pages. The "hit ratio" only shows the number of exposures of Web pages to visitors but it does not explain whether those visit counts have created favorable experience for the users. Nor does it show how the visit counts relate to the actual online sales. Following the findings from this study, the practitioners have two tasks at hand. Web site designers should investigate into LD users' preferences on navigational components and other features to foster a favorable online experience with the Web site. In addition, Web features that already are a plus for PD and ND groups should be surveyed and retained.

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