Investigating Usability Constructs in a Content Management System

İçerik Yönetim Sisteminde Kullanılabilirlik Yapılarının İncelenmesi

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Öz

İnternet, bireylerin bilgisayar sistemleri ile etkileşim sağladığı medya açısından zengin bir ortam sunmaktadır. Bilgisayarlar ve bireylar arasındaki bu etkileşimli ortam, sosyoteknik bir açıdan incelenebilir. Bu nedenle, bireylerin yeni teknolojiye yönelik davranışlarını, internet teknolojileri ile olan deneyimlerine ve içerik yönetimine dayalı olarak inceleme, araştırmalarda alternatif bir yaklaşım olarak ortaya çıkmıştır. Bireylerin davranışları, web sitelerinin kullanışlılığından çok fazla etkilenmektedir. Bu görüşten hareketle bu çalışmanın amacı, bir içerik yönetim sisteminin kullanışlılık yapılarını çok boyutluluk açısından araştırmaktır. Bulgular, kullanışlılık açısından en az iki olmak üzere model olarak çok boyutlu bir yapının varlığını göstermektedir. Bu bulgu, kullanışlılık açısından sosyoteknik bakış açısı ile içerik sunumunun ve mimari tasarımın farklı yapılar olarak ele alınması gerektiği görüşünü desteklemektedir.

Anahtar Sözcükler: Kullanılabilirlik, içerik yönetim sistemi, öğretim tasarımı.

Abstract

The internet provides a media-rich navigational environment where people interact with computer systems. This interactive relationship between humans and computers can be explored from a socio-technical philosophy. Thus, investigating individual behaviors toward new information technologies based on their experiences with the internet technology in general, and content management in particular emerged as an alternative stream of research. Since users' behaviors are heavily influenced by web sites usability, this study is aimed at exploring multidimensionalty in usability constructs of a content management system. The findings indicate that multidimensional model - at least- with two upper constructs exist in usability. This finding supports the socio-technical perspective in usability in that content presentation and architectural design were perceived as separate constructs by participants.

Key Words: Usability, content management system, instructional design.

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Introduction

The internet provides a media-rich navigational environment where people interact with computer systems and with each other in a networked environment. This interaction eventually leads to the production of vast amount of data to be transmitted and sharing them in a global community of users. As Preece (1994) puts it, this interactive relationship between humans and computers can be explored from a socio-technical philosophy. One application of such interactivity exists in educational contexts.

In educational settings, more data is being digitized as contemporary information technologies which tend to utilize multiple media and richer graphical interfaces into their curricula. This has resulted in an alternative stream of research with the purpose of investigating individual behaviors toward new information technologies based on their experiences with the internet technology in general, and content management in particular. In this tradition, constructs such as usability, which corresponds to the degree to which people (users) can perform a set of required tasks (Brinck et al., 2002), have been empirically explored to design usable systems which are "easy and efficient for people to achieve their goals without having to deal with an excessively complicated site" (Brinck et al., 2002, p. 2) as well as to facilitate knowledge acquisition (Fang and Holsapple, 2007) and dissemination through content management systems.

A content management system (CMS) can broadly be defined as a function or tool supporting the optimization of information assets. It encompasses people, processes, technology and content. One definition of a CMS is "… a software application that adds cross-platform utility to databases" (Valentine, 2003). Another definition proposed by Robertson (2003) is that a CMS "…supports the creation, management, distribution, publishing and discovery of corporate information" (p. 1). Thus, a content management system is a class of software application that enables instructors and students to deliver content information, including course materials, engage discussions and manage distance classes using the internet technologies from a web-based interface.

The terms knowledge management system and content management system are used interchangeably in the literature. However, the key point is to understand what makes those applications usable and how to measure usability. In exploring usability constructs, Fang and Holsapple (2007) identify five classes of features as joint contributors to Web site usability in knowledge management systems: task features, user features, provider features, system features, and environment features. Cho and Park (2005) add content layout and classification to these features. Among other constructs related to knowledge and/or content management systems include web site structure, user interface, web site appearance and visual design, intuitiveness, readability/comprehension/clarity, search facilities, and ease of navigation (See, Yang, Cai, Zhou, and Zhou, 2005).

These classifications referring to the concept of usability in content and/or knowledge management systems reveal that the construct is often treated as an essentially unidimensional construct. Yet, it is believed by some that most tests are multidimensional, meaning that they measure more than one underlying trait, concept, attribute, process and/or structure (Ackerman, Gierl, & Walker, 2003). This statement concurs with Law and Wong (1999) in that the nature of a multidimensional construct differs when different interpretations are attributed to the relations between the overall construct and its dimensions and among the dimensions as well. Law and Wong (1999) define a multidimensional construct as a construct involving more than one dimension or factors, which are usually moderately correlated and are imperfect representations of a high order (HO) latent construct. The factors are grouped under the same

HO because each dimension represents some portion of the overall multidimensional latent construct substantively. Yet, Walker, Azeni and Schmitt (2006) caution researchers to evaluate the test for its dimensional structure, even though the instrument is substantively multidimensional. They urge researchers to statistically test the assumptions of essential unidimensionality.

The multidimensionality can be described by an operating system metaphor from a socio-technical perspective. An operating system consists of a kernel and a shell component. Shell takes the user requests or input and passes it to the kernel. Kernel computes the input and returns the output to the user via shell. This process models the multidimensional nature of a content management system, where technical aspects and human aspects co-exist. Based on this model, a content management system can be defined as a networked infrastructure that supports the distribution of content. Content, here, refers to all kinds of digitized artifacts (such as, visual, audio-visual, textual information), which were shared by participating members by means of metadata. Metadata allows labeling, positioning, finding and managing this data.

Although the use of CMSs for educational purposes is a less explored area of research, this study holds couple of assumptions. First, most usability research has been conducted to explore the use of CMSs in business environments. Second, less research has addressed the cultural variables in exploring usability constructs. Third, the personal characteristics, such as age, occupation, gender, and educational status, might have an effect on usability findings. Thus, whether the setting, cultural variables and participants would interfere the dimensionality is under question. Having these assumptions taken into account and to explore the constructs for usability, the researchers developed a CMS to implement and test the dimensionality in an educational setting in Turkish context. In the next section, a brief description of the CMS will be provided.

Eniyisi: A Content Management System For Educational Use

In their review of usability professionals' current practices and future development, Gulliksen, Boivie, and Goransson (2006) argue that the usability professional must design and be actively and directly involved in the systems development projects, on a continuous basis, throughout the entire system lifecycle. Thinking in the same line with this motto, our team has built a content management system (CMS) called ENIYISI designed to help learners and instructors develop and modify a Web-based immersive environment for use in a classroom setting.

Knowledge makers, in ENIYISI context, refer to the academic users, who are responsible for developing and presenting the instructional materials for their students and peers in an academic setting. These students and peer colleagues come together to share a common understanding reaching at their own specific goals within their own community. In this context, university instructors and students form the community for ENIYISI. There exist three types of users defined in ENIYISI: Administrator, Instructor, and Learner. Each user has different functions to perform within the CMS. The users and their main tasks are illustrated in Table-1.

Table 1.
User Tasks in ENIYISI

Administrator	Learner	Instructor
User Status (create, approve, deny, wait, private)	Login to the System	Login to the System
Login to the System	News/Announcements	News/Announcements
News Status (create, approve, deny, wait, private)	Community	Community (create, approve, deny, wait, private, edit metadata)
Search	Search	Search
Favorites	Content (add, display, arrange, properties, share, status)	Content (add, display, arrange, properties, share, status)
My Space	Favorites	Favorites
Get Report	My Space	My Space
Logout	Get Report	Get Report
	Calendar	Calendar
	Logout	Create Group
		Logout

Content is developed by using a three-step Content Development Object design process; inclusion, defining, and reporting. These three steps in ENIYISI context are presented in Table 2. In inclusion stage, through the pre-determined rules, file is imported to the system. The limitations at this stage are grouped in two main categories; file extension and the size of the file. In registration stage, the pre-stored file in the system is defined with the Dublin Core metadata elements; yet, the flexibility of the Dublin Core metadata standards enable users both to define custom-made stages and to re-organize them in consideration of the system needs. At the last stage, reporting stage, reports about the processes and consequences of processes are created by the system automatically. The authenticated users can get real-time reports whenever they want.

Table 2.
Content Development Object Process in ENIYISI

Inclusion	Defining	Reporting
▪ File Extension	▪ Title	▪ Inclusion of the file system
▪ File Size	▪ Creator	▪ File type
	▪ Subject	▪ Sharing
	▪ Comment	▪ System file name
	▪ Publisher	▪ File size
	▪ Sharing	▪ Original file name
	▪ Type	
	▪ Format	
	▪ Language	
	▪ Rights	
	▪ Date	

Methodology

Data Collection Instrument

Several steps were followed to refine the scale to observe the usability of ENIYISI. Initially, a collection of constructs was gathered through a review of literature in evaluating the usability of web sites. Second, an item pool was organized according to these constructs. In the finalized form, there were 44 items intended to measure seven sub-dimensions (See Table 3).

Table 3.

Sub-dimensions of Measured Constructs

Dimension	Related Literature
Simplicity	Kowalski (2002); Bevan (2001); Shneiderman & Plaisant (2004)
Familiarity	Kowalski (2002); Nielsen (1994); IST (2006); Weiss (1994)
Consistency	Kowalski (2002); Shneiderman & Plaisant (2004); IST (2006); Pierotti (2004)
Visual feedback	Kowalski (2002); Shneiderman & Plaisant (2004)
Responsiveness	Kowalski (2002),Weiss (1994); Pierotti (2004)
Fault tolerance	Kowalski (2002); Bevan (2001); Shneiderman & Plaisant (2004)
Scalability	Kowalski (2002); Bevan (2001); IST (2006); Pierotti (2004)

This questionnaire was administered via the web site to the participants upon a semester-long (14 weeks) practice. Since each user had their own username and password, each participant could have accessed to the questionnaire once and filled the questionnaire during the class hour by themselves. Approximate time for each student was between 20-30 minutes.

Participants

The data were collected from the participation of 151 undergraduate students. At the time of data collection, students were taking computer education and instructional technology related courses at the department of computer education and instructional technologies in two different universities. The majority of the participants (73.2 %) were seniors, whereas the least number was juniors (9.4%). The gender distribution of the participants was 61.1% females and 38.3% males.

The department of computer education and instructional technology aims to train prospective teachers who would teach computer courses in K-12 institutions. It also provides individuals with professional skills in development, organization and application of resources for the solution of computer and instructional technology related problems within schools.

Data Analysis Procedures

In order to explore factorial structures of CMS usability constructs, a 7-sub-dimensional scale with 44 items was designed based on existing literature. These dimensions were labeled as (a) visual efficiency and consistency, (b) error handling and functional efficiency, (c) interface-task performance, (d) familiarity of interface, (e) interface-operation performance, (f) efficient and flexible access to content, and (g) efficiency of navigation. In order to measure and validate whether the scale is unidimensional or multidimensional in nature, four measurement models were tested (See Figure 1).

Model I- Strictly Unidimensional Model: Hattie (1985) defines unidimensionality as a set of items forming an instrument, all measures just one thing in common is a most critical and basic assumption of measurement models. Unidimensionality can be strictly or essentially defined.

This model is strictly unidimensional and assumes that 44 items measure a single factor (See Figure 1a). Model I has been tested by using first order confirmatory factor analysis.

Model II- Group Factor Model: This model was designed as a group factor model (Rindskopf & Rose, 1988) (See Figure 1b). In this study, this model has been tested based on 7 sub dimensional CMS scale. Model II has also been used during reliability of CMS usability scale. Since the measures in scale are congeneric and include measurements errors (Jöreskog, 1971), McDonald's omega (w) coefficient (McDonald, 1985) was preferred to Cronbach alpha (a) coefficient for reliability index (Komaroff, 1997; Raykov, 2001); yet, both of them are reported in the findings.

Model III- Essentially Unidimensional Model: For an instrument to be able to use a summed total score, it is necessary to demonstrate that the instrument shows either strict or essential unidimensionality. Strict unidimensionality indicates the presence of a single common factor (as in Model I) whereas essential unidimensionality shows the presence of a reasonably dominant common factor along with other secondary minor factors in first order factor analytic models. However, if sub dimensions in second order factor analytic models converge into a general latent factor or yields a second order factor structure, this finding is accepted as an evidence for the factorial validity (Byrne, 2003) and essentially unidimensionality. This model (See Figure 1c) was designed to test whether the structure in Model II is essentially unidimensional. In addition, this model has been used in exploring the factorial validity of the usability questionnaire.

Model IV- Multidimensional Model: Recent usability research initiated discussions on the unidimensionality of usability scales. In this study, it is questioned whether CMS usability could be multidimensional or at least bi-dimensional in nature. These upper dimensions were considered to refer technical and human aspects in CMS usability. Therefore, Model IV (See Figure 1d) is designed as multidimensional measurement model in order to observe how sub latent variables merge into upper constructs.
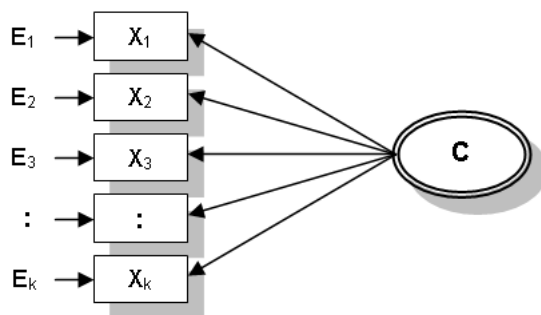

Figure 1a
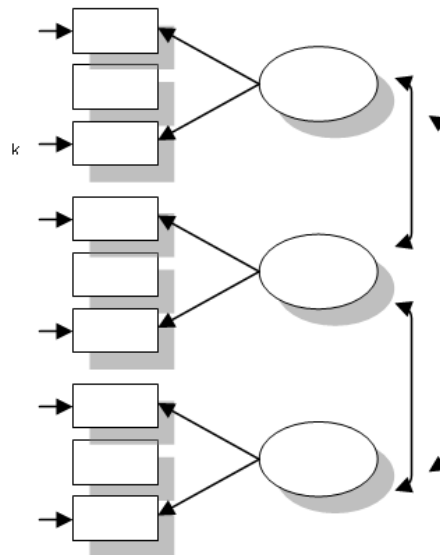
Strictly Unidimesional Model
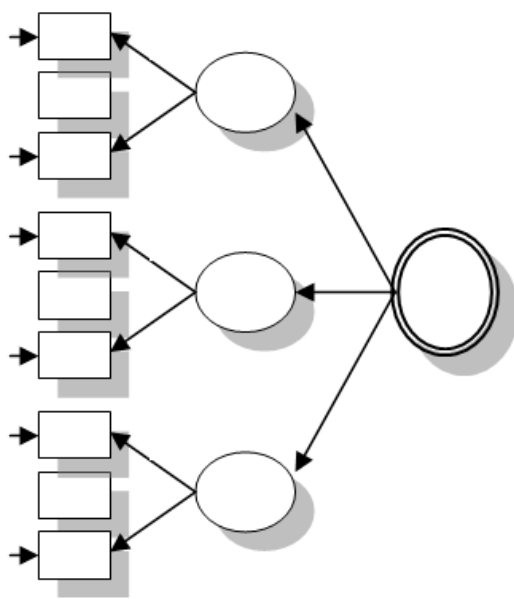
Figure 1b

Group-Factor Model

Figure 1c

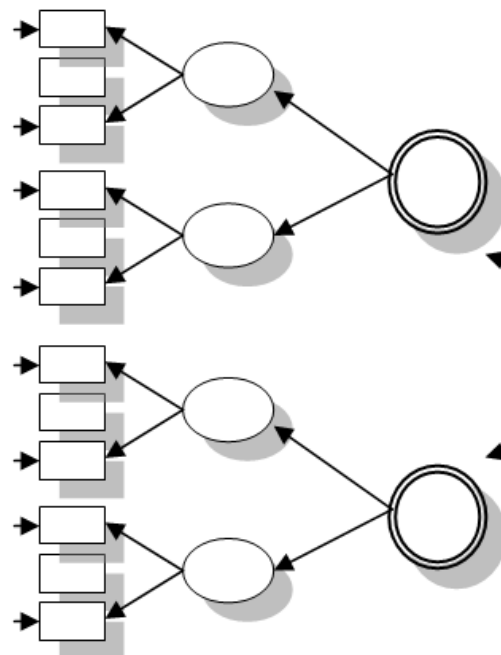Essentially Unidimensional Model

Figure 1d

Multidimensional Structural Model

Figure 1.
Measurement Models

Findings

This study aimed at exploring multidimensionality in usability constructs based on undergraduate students' perceptions about usability within a content management system. As an initial step, the statistical validity of models was tested by using model-data fit indices. The following table displays the fit indices for all models.

Table 4.
 Fit Indices of Models

Models	NNFI	CFI	RMSEA	SRMR
Model I	0.85	0.86	0.134	0,121
Model II	0.92	0.93	0.075	0,073
Model III	0.92	0.92	0.078	0,075
Model IV	0.92	0.93	0.075	0,062

In this study, fit indices were used to evaluate the model-data fitness. Fit indices can be categorized in three groups: absolute fit indices, relative fit indices and parsomany fit indices (Steiger, 1990;Yuan, 2005; Yurdugul, 2007). Another categorization model includes goodness-of-fit indexes (i.e., GFI, CFI) and lack-of-fit indices (i.e., RMSEA, RMR) (Yurdugul, 2007). This study adopted absolute fit indices (RMSEA and SRMR) to evaluate the lack-of-fitness; and, relative fit indices (CFI and NNFI) to evaluate the goodness of fitness.

As displayed in Table 4, the unsatisfaction fit indices were calculated for Model I, which was aimed to observe whether the scale is strictly unidimensional or not. This finding indicates

that 44 items in CMS usability scale do not refer to a single factor. In Model II, there are 7 sub dimensions, which are associated with 44 items and shows linear combinations of their respective factor and unique variables.

According to goodness-of-fit indices (NNFI=0.92, CFI=0.93) and lack-of-fit indices (RMSEA=0.075, SRMR=0,073), the model represents 7 sub dimensions with 44 items. In order to ensure internal consistency, Cronbach's Alpha was calculated to be 0.87 and McDonald's Omega was 0.97. The model-data indices for Model III indicate that the whole measurement model tends to be unidimensional. However, when the effect of each sub-construct on the general model was examined, Sub3 (interface-task performance) and Sub5 (interface-operation performance) were observed not to be predicting the general construct in the model. (See Figure 2).
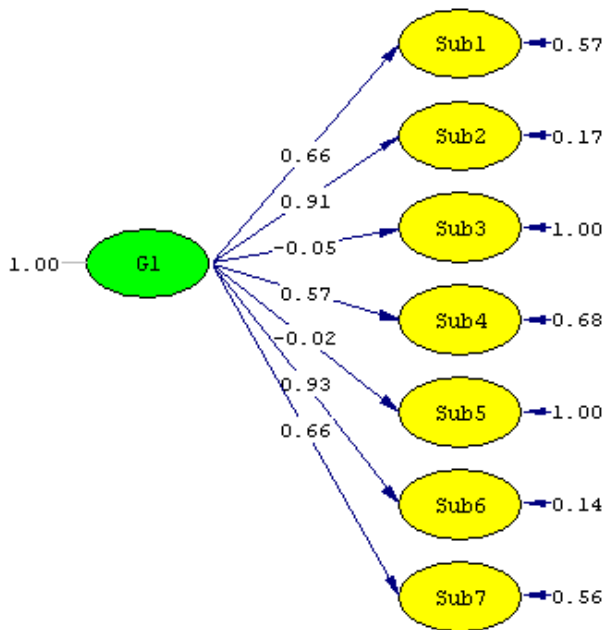

Figure 2.
Second Order Factor Model of CMS Usability

The second order standardized regression coefficiencies for Sub3 and Sub5 in Model III were not statistically significant (p> 0.05), which indicated a possibility of their converging into another upper construct. This result is also an evidence for the factorial validity of 7-subdimensional scale was not validated. On the other hand, Sub 3 and Sub 5 show a higher correlation between each other but lower correlations with other sub-constructs (See Table 5), indicate that CMS usability may have two different upper constructs. According to these results, participants are believed to perceive the CMS usability as two separate psychological constructs (namely as human and technical aspects).Based on this finding, Model IV was structured and tested.

The Estimation of Bi-dimensional Model of CMS Usability

The item scores were analyzed according to Model IV by using second order confirmatory factor analysis with covariance matrix. The solutions for Model IV are presented in Appendix A. According to these results, since CMS usability questionnaire has congeneric measures, Cronbach alpha values were either equal or lower than McDonald omega values (Komaroff, 1997; Raykov, 2001). The parameters include the unstandardized factor loadings, the terms of error, determination coefficients, reliability coefficients, and structural coefficients.

Determination coefficients of each measure are also defined as item reliability and these coefficients yielded higher values, which supports the quality of items. The covariance matrix of latent variables in Model IV was given in Table 5.

Table 5.

Covariance Matrix of Latent Variables in Model IV

	Sub1	Sub2	Sub3	Sub4	Sub5	Sub6	Sub7
Sub1	1.00						
Sub2	0.59	1.00					
Sub3	0.01	-0.01	1.00				
Sub4	0.37	0.52	-0.01	1.00			
Sub5	0.01	-0.01	0.64	-0.01	1.00		
Sub6	0.61	0.84	-0.01	0.53	-0.01	1.00	
Sub7	0.43	0.60	-0.01	0.38	-0.01	0.62	1.00
Upper1	0.66	0.91	-0.02	0.57	-0.01	0.93	0.66
Upper2	-0.01	-0.02	0.86	-0.01	0.74	-0.02	-0.01

Upper1 denotes the higher construct named as "human aspects" and Upper2 denotes the other higher construct referring to "technical aspects". This model indicates that users' behavior in a CMS environment shows difference in their perceptions toward the architectural design and the content presentation. Therefore, these upper constructs were named as "Architectural Design" (AD) and "Content Presentation" (CP) respectively. AD includes 2 sub-constructs, named "Sub3: interface-task performance" and "Sub 5: interface-operation performance". CP includes 5 sub-constructs, labeled as Sub 1: visual efficiency and consistency, Sub 2: error handling and functional efficiency, Sub 4: familiarity of interface, Sub 6: efficient and flexible access to content, and Sub 7: efficiency of navigation. The level of sub-constructs' effects on upper constructs are displayed in Figure 3.
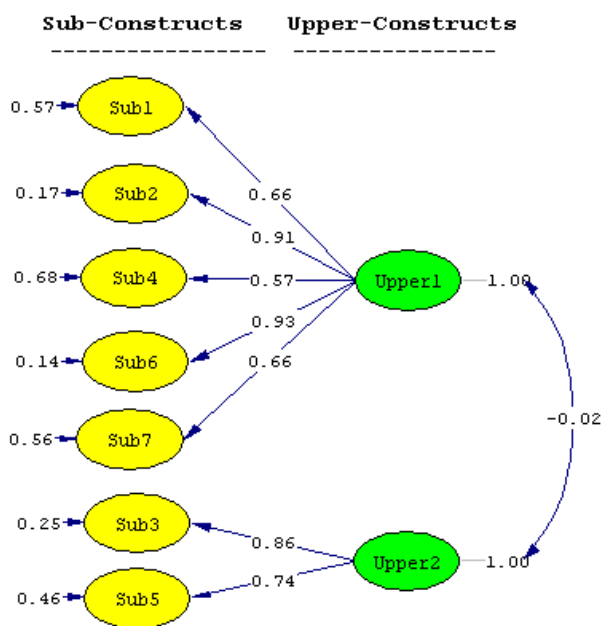

Figure 3
Bidimensional model of CMS Usability

As shown in figure 3, "Sub6: Efficient and flexible access to content" loads the highest value to Content Presentation (structural coefficient= 0.93), followed by "Sub2: Error handling and functional efficiency" with a structural coefficient of 0.91. It should be noted that users tended to interpret error handling messages as part of content presentation rather than an architectural design error. The highest value to Architectural Design is loaded by "Sub3: Interface-operation performance" with a structural coefficient of 0.86. The estimation of parameters obtained from Model IV is given in Appendix A. The sub-constructs and sample items in the finalized form of the scale are presented in Table 6.

Table 6.

Sub Constructs and Sample Statements

I- VISUAL EFFICIENCY AND CONSISTENCY
19. Labeling in interface design is consistent.
20. Interface responses are consistent.
43. Screen design is in line with visual design principles.
14. Interface has an understandable language.
II- ERROR HANDLING AND FUNCTIONAL EFFICIENCY
2. Error messages are easy to understand.
10. Error messages are explicit enough to understand.
50. CMS functions with no problem.
III- INTERFACE-TASK PERFORMANCE
5. User interface include too complex structure to accomplish a task..
6. User interface screens include too many technical elements.
IV- INTERFACE FAMILIARITY
12. This interface resembles to my earlier experiences.
13. This interface behaves similar to what I had been accustomed to.
V- INTERFACE-OPERATION PERFORMANCE
29. It takes a lot of time for the CMS to respond users' prompts..
30. Any small change on a page makes the whole page to be reloaded..
31. In order to complete a task, too many clicks are needed.
VI- EFFICIENT AND FLEXIBLE ACCESS TO CONTENT
4. The interface design for accessing content is not sophisticated.
9. All functions in the CMS can be performed without any special training.
38. A fast-access button exists to reach a certain file within the CMS.
40. Multiple choices exist to perform the same action.
49. CMS loads fast.
56. CMS has a flexible use.
VII- EFFICIENCY OF NAVIGATION
27. Critical navigational buttons are embedded in pull-down menus.
37. Increase in the volume of content within the CMS speeds down the navigation.

Conclusion and Discussion

This study was designed to develop and test the usability of a content management system within a university setting with the participation of teacher trainees. As prospective teachers, participants in two different institutions are urged to create their own learning community with their instructors throughout a semester-long course to create, share, and distribute content related to their learning domain. The results indicate that bidimensional model with two upper constructs exist in usability. This finding supports the operating system metaphor in that content presentation and architectural design were perceived as separate constructs by participants.

Content consists of two main parts: the encoded media and metadata. Metadata is expected to provide the means for efficient content retrieval, placement, and control of content in a community of practice. The management of content according to its properties (i.e. its description with metadata and the administration of different copies within the infrastructure) is also becoming part of the content infrastructure and referred to as content management (See, Plagemann, et. al., 2006). In this study, the multidimensionality of usability scale supports the importance of social dynamics in content creation, storage and retrieval process.

Apart from the technical efficiency of software, the findings in this study indicate the importance of studying community behavior and how community members perceive the usability for their learning community. In their study, for example, Calisir and Calisir (2004) report that both perceived usefulness and learnability are determinants of end-user satisfaction. Calisir and Calisir (2004) goes further to add that perceived ease of use and system capability affect perceived usefulness, while user guidance influences both perceived usefulness and learnability. Further research could explore the complexity of users' behaviors as predictors of learning outcomes.

In designing systems, socio-technical issues have been explored from various venues, among which include understanding the components of socio-technical environments (i.e., Heath and Luff 1991; Bentley, Rodden et al. 1992), and using accumulated knowledge to transfer into software design (i.e., Viller and Sommerville 1999; Crabtree 2003). In ENIYSI context, the findings confirm the socio-technical view in that participants consider the content management system as having two distinct components: social and technical dimensions. This multidimentional (or at least bidimensional) nature of usability is essential to better contextualize learners' behavior in a CMS.

There are some issues to be explored in future research. First, current content management systems have limited capabilities for structuring and interpreting documents (Uren, et. al.2006). In the emerging Semantic Web, designing CMSs by ontology-based semantic mark-up can be pursued. Secondly, users' perceptions and functional use of content management systems show differences in different settings. Therefore, more research is needed to explore the behaviors in learning communities as well as their roles within a social network perspective (Pereira, et. al., 2007).

In web site usability research, researchers are cautioned about the threats in applying unidimensional measurements (See, Seethamraju, 2004). CMS usability is a multi- or at least bidimensional construct and measuring it using a single instrument is difficult. Depending upon the purpose and goals in using the CMS the factors that correspond to the usability can differ. As well emphasized by Hvannberg, Law, and Larusdottir (2007), to cope with the problem of generalizability and transferability across contexts, extensive collaboration within the usability community to conduct multi-site experiments and to support exchange of ideas and experiences is deemed essential for the multidimensionality of usability scales as well.

Appendix A- A Hierarchical Factor Analysis Results and Estimation of Parameters for items

	Item	Mean	St. Dev.	λ	ψ	P^2	ξ	α	ω
Sub1	1	3,97	0,80	0,56	0,31	0,50			
	2	3,96	0,75	0,40	0,38	0,30			
	3	4,07	0,72	0,45	0,31	0,40			
	4	3,91	0,83	0,39	0,52	0,23			
	5	4,15	0,79	0,68	0,16	0,74	0,66	0,92	0,92
	6	4,15	0,79	0,70	0,14	0,78	(ξ_1)		
	7	4,18	0,67	0,54	0,15	0,66			
	8	4,27	0,64	0,52	0,14	0,66			
	9	4,24	0,72	0,58	0,18	0,65			
	10	4,15	0,85	0,68	0,26	0,64			
Sub2	11	3,81	0,78	0,45	0,40	0,34			
	12	3,61	0,76	0,42	0,39	0,31			
	13	3,60	0,91	0,55	0,53	0,36			
	14	3,44	0,72	0,46	0,30	0,41	0,91	0,85	0,85
	15	3,53	0,87	0,51	0,50	0,34	(ξ_1)		
	16	3,70	0,91	0,61	0,44	0,46			
	17	3,83	0,78	0,52	0,33	0,45			
	18	3,91	0,72	0,48	0,28	0,45			
	19	3,77	0,82	0,53	0,37	0,43			
Sub3	20	3,54	1,01	0,60	0,68	0,35	0,86	0,68	0,73
	21	3,36	0,89	0,67	0,34	0,57	(ξ_2)		
	22	3,69	0,97	0,70	0,44	0,53			
Sub4	23	3,25	0,95	0,45	0,69	0,23	0,57	0,48	0,60
	24	3,86	0,79	0,51	0,34	0,43	(ξ_1)		
	25	3,36	0,95	0,43	0,67	0,22			
Sub5	26	3,52	0,98	0,55	0,66	0,31			
	27	3,52	0,92	0,51	0,57	0,31	0,74	0,65	0,68
	28	3,05	1,02	0,53	0,73	0,28	(ξ_2)		
	29	3,30	1,06	0,73	0,55	0,49			
Sub6	30	3,89	0,89	0,53	0,51	0,36			
	31	3,46	0,97	0,48	0,71	0,25			
	32	3,44	0,84	0,42	0,52	0,25			
	33	3,81	0,86	0,40	0,53	0,23			
	34	3,56	0,91	0,54	0,52	0,36			
	35	3,65	0,82	0,56	0,34	0,48	0,93	0,84	0,86
	36	3,50	0,92	0,55	0,51	0,37	(ξ_1)		
	37	3,30	0,97	0,52	0,66	0,29			
	38	3,83	0,73	0,52	0,26	0,51			
	39	3,80	0,79	0,54	0,33	0,47			
	40	3,79	0,89	0,58	0,44	0,43			
	41	3,65	0,86	0,55	0,44	0,41			
Sub7	42	3,23	1,06	0,57	0,78	0,29	0,66	0,54	0,63
	43	2,70	0,99	0,75	0,41	0,58	(ξ_1)		
	44	2,97	0,94	0,38	0,53	0,21			

λ: Unstandardized factor loadings (path coefficients)

ψ: The measurement error.

ξ: The effects of sub- dimensions on general latent (obtained from second order factor analysis).

ω: McDonald's reliability coefficient

α: Cronbach's reliability coefficient

R^2: Determination of coefficients of item models (it is also item reliability index)

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