Evaluating Web-based e-government services with a citizen-centric approach[1]

Lili Wang
Research Associate, Center for Technology and Information Policy, Maxwell School of Citizenship and Public affairs, Syracuse University
lwang05@maxwell.syr.edu

Stuart Bretschneider
Professor, Center for Technology and Information Policy, Maxwell School of Citizenship and Public affairs, Syracuse University
sibretsc@maxwell.syr.edu

Jon Gant
Assistant Professor, Maxwell School of Citizenship and Public affairs, School of Information Studies, Syracuse University
jpgant@maxwell.syr.edu

Abstract

One of the challenges in delivering e-government services is to design the Web sites to make it easier for citizens to find desired information. However, little work is found to evaluate e-government services in this sense. In addition, current efforts on government Web site design mainly concentrate on Web site features that would enhance its usability, but few of them answers why some Web design is better than others to facilitate citizens' information seeking. This paper aims to contribute to both aspects: it equips government agencies with a model that can not only evaluate their Web-based e-government services, but also helps them understand why their Web sites succeed or fail to help citizens find needed information. In addition to the model itself, instruments for applying this model are also developed.

1. Introduction

As information technology, especially the Internet and the World Wide Web, continues to expand, it is not surprising to see all levels of government making more and more use of these approaches to deliver services. In part motivated to enhance the quality of service and operate more efficiently, government interest in the Internet continues to expand. Unfortunately, despite these ever increasing applications, little effort has been placed in evaluation of government service provided through the Web. In particular little work has focused on how characteristics of site interact with both the service and the client to effect the efficient delivery of services.

On the other hand, architects of e-government services have considerable flexibility in designing the form and function of the Web site that citizens use to access online services. Recent trends include creating so called "citizen-centric Web sites" where content and services are organized around the anticipated needs of Web visitors. The adoption of this approach is widespread as it is commonplace to find such citizen-centric features as in-site search, links to associated government agencies, GIS database, and personalized interface, etc. While many believe that this approach will make it easier to navigate a Web site, find information and meet citizen needs, there is little evidence showing if this effort is meeting these goals.

This paper aims to make contribution in both the above two aspects: developing an evaluation model for e-government services that focuses on how characteristics of site interact with both the service and the client to influence the efficient delivery of services; and helping answer why a government Web site designed to be citizen-centric in service delivery succeeds or fails. We do this by measuring how the information seeking behavior of users varies by e-government services and the design characteristics of them.

1.1 Web-based e-government services and their benefits

Currently, there is no commonly agreed upon definition for "Web-based e-government services". However, it is possible to develop a definition based on its various uses in the literature. For example, McClure [1] defined electronic government as government's use of technology, particularly Web-based Internet applications, to enhance the access to and delivery of government information and service to citizens, business partners, employees, other agencies, and government entities. Golden et al. [2] argued that, electronic government consists of using technology, particularly the Internet, as a

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means to deliver services to citizens, businesses and other entities with the purpose of providing convenient access to government information and services. In a report from the Momentum Research Group of Cunningham Communication [3], "e-government" is defined as "online government services", which can be any interaction one might have with any government body or agency.

If a definition for "Web-based e-government services" is needed, based on discussion in the literatures, it can be understood as the information and services provided to the public on government Web sites.

Benefits from delivering government services in a Web-based manner abound. Providing services to the public through the Web may lead to faster and more convenient access to government services with fewer errors. It also means that government units may realize increased efficiencies, cost reductions, and potentially better customer service. Attractiveness of these benefits has been successfully demonstrated by various e-commerce initiatives in the private sector. Success in business environment does not mean that government agencies can also successfully benefit from similar initiatives by simply loading their information and services on the Web. Without proper evaluation of Web-based e-government services, none of these benefits can be ensured.

1.2 Evaluation of Web-based e-government services

Evaluation is a necessary activity for ensuring returns from investments over time. Financial investment includes spending on equipment and technology necessary for delivering Web-based e-government services. Organizational investment, on the other hand tends to be unobservable, and includes the time and energy that government agencies need to rethinking, reorganizing and streamlining the service delivery system for the Web-based e-government initiatives.

Government investments on delivering Web-based e-government services are usually enormous. For example, the financial investment for implementing 10 to 15 services on an integrated portal can easily run to $100 million [4]. In order to make such investments worthwhile, government agencies must be able to justify some form of return on investment, which typically requires evaluation of the Web-based e-government services.

Performance of a government Web sites in facilitating interactions between the public and the government agencies are directly related to the return on government's investment in developing Web sites and delivering services online. At a minimum, assuming the unit cost for a delivered service is less on a Web-site than through alternative traditional means, each Web interaction represents a cost savings. In many cases, even without cost savings to the government, the cost of access by citizens can be the source of benefit, often in reduced travel cost. Therefore, to obtain the pursued benefits, government agencies need to move their customers – citizens – from the old service delivery system (i.e. traditional service delivery methods) to the new Web-based one. Since this type of benefits are based upon the scale of use, the more people use it, the more potential efficiency and cost reduction will be obtained. If a government Web site fails to facilitate the interaction between the public and government, the service delivery realized in this manner will not be advantageous while competing with the traditional ways of service delivery. The desired increase in citizens' use of the Web-based services – either through repeat visit of a citizen, or through recommendation from one citizen to another about the new type services – won't happen. As a consequence, not only the pursued benefits can't be realized, investment made by government agencies won't pay off, too. It is seen that, although the evaluation of web-base e-government services does not create the cost-saving effect directly, it is important in ensuring that the desired cost-saving effect happens.

However, despite the importance of the evaluation of Web-based e-government services, especially the performance of government Web sites in facilitating public-government interaction, little research has been generated. Most of the available work on Web-based service evaluation focuses on the private sector, which can be easily found in studies about Web usability (e.g. Benbunan-Fich; Yu & Ron; Tec-Ed Inc.) [5], [6], [7] and customer satisfaction (e.g. Zhang & von Dran) [8]. Other studies that look at government agencies do not consider behavioral aspects that effect the interaction between the public and government agencies.(e.g. Eschenfelder et al; Demchak et al; West) [9], [10], [11] In order to incorporate behavioral incentive for citizens' utilization of Web-based e-government services, this paper employs an evaluation approach we call ***citizen-centric approach***. In particular, we will not only answer if a government Web site is designed well to successfully deliver e-government services; also, we will try to find out the reason for the observed success or failure.

We expect this study will make two important research contributions: (1) provide a general evaluation framework for Web-based e-government services that bears the following qualities: it is from the perspective of the public which include behavioral effects, and it can help answer why in Web design leads to the success or failure in service delivery; (2) develop instruments to be used with the evaluation model in real e-government context. The next section of this paper reviews the relevant literature on Web-based service evaluation. The review is followed by a description of a newly developed evaluation model with a citizen-centric approach. Section four lays out an experiment designed to test the utility of the proposed

evaluation model. Implications from the experiment and potential application of the model are analyzed in the concluding section of the paper.

2. Existing research on evaluation of Web-based e-government services

2.1 Literature review on existing researches

Only a few previous studies attempt to evaluate e-government provision of services through the Web. Those studies generally fall in two categories, those that borrow lessons and suggestions from the evaluation of Web-based E-Commerce services for the private sector; and those that concentrate on government efforts of delivering Web-based services, but without reference to the attributes and behaviors of the citizens making use of the systems.

The work of Wood et al [12] is a typical study that tries to utilize lessons and experiences from evaluation of Web site performance in E-Commerce. The authors suggested use of a multidimensional Web evaluation strategy, which includes methods such as usability testing, user feedback, usage data, and Web and Internet performance, etc. that are common in the evaluation of commercial Web sites. Although this strategy could be useful, it was not adapted to the context of a government agency, which operates without competition or market considerations.

Researches by Eschenfelder et al, Demchak et al, and West, represent the second approach to evaluation of e-government Web sites. These works typically focused on characteristics of Web-site descriptively. In addition, although these research studies were done specifically on government applications, they did not consider characteristics of citizen or how such characteristics interact with Web characteristics to influence use. For example, the work of Eschenfelder et al [9] is an early attempt that explored Web site evaluation for the federal government. However, not only most of their evaluation criteria were borrowed from the private sector; these criteria also emphasized an organizational perspective of the government agency instead of one giving care to individual citizens. The work done by Demchak et al [10], especially their Website Attribute Evaluation System (WAES), while very systematic, is designed for evaluating the organizational openness of a government Web site solely from characteristics of the Web site itself. Lastly, the evaluation approach used by West [11] was developed only on the basis of characteristics found by observing Web sites (e.g. phone contact information, addresses, publications, databases, foreign language access, privacy policies, security policies, an index, disability access, services, email contact information, and search capabilities, etc). He assigned weights to these observable attributes of the Web site and used aggregate measures to evaluate e-government service delivery. This method, although is comprehensive in terms of studying Web site features, cannot reflect differences in service delivery mediated by citizens' individual variations.

2.2 Concerns in the evaluation of web-based e-government services

To evaluate Web-based e-government services in an effective way, several important characteristics must be considered. While characteristics of the Web site are important, they do not take into account the specific ways in which individuals react, nor do they take into account variation in the type of services being provided. Individual characteristics and attributes of services (or tasks performed by citizens on the Web site) are indispensable in the evaluation of Web-based e-government services. On the other hand, governments typically provide services that private firms do not and typically without using markets. This contextual distinction hence is also important in understanding how public organizations behavior differently than private firms and how effort to provide services will differ as well (Rainey; Rainey; Rainey) [13], [14], [15].

Given the necessity of considering characteristics more than those of the Web site and the different government context other than a business one, there are two concerns need to be paid attention to. The first one comes from the "unique" nature of services provided at a government's Web site. Many services provided by a government agency (e.g., registering a car or issuing a driver license) are only "uniquely" available, i.e. they can not be obtained from any sources other than the government. Therefore, if an online method is chosen, such services pursued by the public can only be reached at Web sites of government agencies. This is very different from services provided through the World Wide Web by a private company, which, if not satisfactory, can be available from a competitor's Web sites as well. To illustrate this point consider a typical private sector approach to evaluation of Web sites. Kano's Model of Quality [16] argues that business organizations should employ Web designs that will make customers *excited* at their Web sites. This criterion is about competitive advantage. How does one make the site for paying the income tax exciting? Why should a government even try? Since government agencies have their own distinct emphasis in Web site development, the interaction between the public and government agencies over the Web are different from the online customer-company interactions.

A second issue that distinguishes e-government from e-commerce is in the nature of the user. Citizens making use of government sites often are systematically different from individuals using e-commerce sites. Typically government services are provided to everyone or

specialized populations. This tends to create greater heterogeneity in the user base, which makes government agencies face greater variation in users' gender, age, education, career, income, literacy, etc. Accordingly, information needs and requirements from visitors of government Web sites could be very different, too. As well as the difference in services nature, these differences in individual characteristics also effect optimal design of a Web site and lead to different criteria for assessing a government Web site than for a business. For example, some government Web sites may tend to include too much information and too many functions on Web pages, leading to a heavy perceptual work load for visitors. This in turn can affect use especially among disadvantaged sub-populations. This type of challenges thus differentiates the evaluation of Web-based e-government services from that of Web-based E-Commerce services.

3. A new evaluation model developed with a citizen-centric approach

In general, citizens' activities on government Web sites are either looking for government relevant information or completing some kind of "transaction," such as online registration, online application, database access, form downloading, online complaints process, etc. One framework for integrating these activities is to think of these as a problem-solving process. A citizen always has a task to complete when he/she comes to a government Web site accessing e-services, i.e. he/she is always conducting a goal-directed activity, "with the resolution of a problem and/or the presentation of the solution as the goal." (Wilson, et al) [17] Before achieving a goal, uncertainty exists between a citizen's "current" position and the desired position. Only after eliminating the uncertainty, can a citizen realize the goal. By definition, information reduces uncertainty; and information seeking is viewed as an action undertaken to resolve doubts and uncertainty [17]. In this sense, accessing Web-based e-government services can be understood as an information seeking activity, which involves a problem-solving process.

Since performance of government Web sties, in terms of facilitating citizen activities, is the core in the evaluation of Web-based e-government services, the question is how to evaluate whether and how citizen's information seeking activities are facilitated? This implies that the performance of the citizens information seeking activities can be used as a measure of performance for an e-government Web based service.

3.1 The Evaluation Model

Information seeking is an activity of an information user going to a large body of information (i.e., information pool) to meet his need of solving certain information problem(s). It is essentially the interaction among three components – information user, information problem, and information pool. Given the circumstance of a government Web site, a citizen's information seeking activity on the site is related to the interaction of the citizen (as information user), information tasks to be completed (as information problem), and the government Web site (as information pool). Factors coming from any of these three components may influence the performance of a citizen's information seeking activity. In other words, information seeking performance is a co-result from citizens' characteristics, information task attributes, and web features together. This relationship can be summarized by the following equation.

$$P = f(C, T, S, C\times T, C\times S, T\times S, C\times T\times S) \quad \text{(F1.0)}$$

Where,

- P is a measure of the performance of Web-based information seeking;
- C is a vector of citizen's characteristics;
- T is a vector of the characteristics of information task; and
- S is a vector of the characteristics of government Web site.

Performance in this model is essentially viewed as the transaction between information users (i.e. citizens in current context), the task the citizen is attempting to complete, and the information pool (i.e. the government's Web site in current context) regarding the information task. The outcome or performance consists of two sub-dimensions: the process and substance. The process dimension focuses on how the task is conducted and the substance dimension looks at the actual results. Examples for process outcome are the time spent to complete an information task, actions taken or nodes visited during the information seeking session, etc. Substance outcomes, on the other hand, concern quality of the information found, appropriateness of information found, and satisfaction with the outcome.

Possible individual characteristics of a citizen in this context include gender (Kim) [18], age (Bilal & Kirby; Danielson) [19], [20], previous experience in using the World Wide Web (Danielson; Lanznder et al) [20], [21], domain expertise (Lazonder et al) [21], cognitive styles (Kim) [22], and problem-solving styles (Kim) [18], etc.

For information tasks, their uncertainty/predictability (Saracevic & Kantor; Vakkari) [23], [24], the appropriateness of being completed by using Web technology (Mathieson & Keil) [25], how clearly the information task is defined (Saracevie et al) [23], and how urgent it is (Case) [26], can all be factors influencing information seeking performance.

Finally for Web site attributes, the perceptual stimuli loaded on Web pages are corresponding with cognitive load for Web visitors, which may lead to variations in information seeking performance from person to person;

the structural attributes of a Web page design could make certain information seeking tasks become easy or difficult; and the reliability that a Web site has may make the information seeking experience frustrating or the opposite. Information seeking performance thus is likely to be affected by these factors as well.

3.2 Advantage of the New Evaluation Model

This newly proposed evaluation model has the advantage in taking the two evaluation concerns in to account. It not only incorporates government context factors, and does this through examining characteristics of citizens, characteristics of the information task (which is corresponding to services provided on a government Web site), and those of Web sites. For example, the level and functionality of a government agency determines the appropriate service population, its responsibilities and the set of services provided to the public, hence many of the information task characteristics. Also, government agencies are limited by specific institutional constraints in developing Web site; they have their own policies in conveying information and services; and they employ unique approaches in Web design. All of these can be reflected in Web site characteristics, and are influenced by government attributes like the level and functionality of that government agency, as well. The newly developed evaluation model therefore both examines characteristics more than those of the Web sites, and takes the background governmental factors in to account, too. Given this advantage, the proposed evaluation model can help tell a government agency whether its e-government services are delivered with high quality through its Web site. Also importantly, it can help identify those organizational factors which account for observed success or failure in Web-based e-government services delivery; i.e. it helps answer the question why a government Web site is successfully or unsuccessfully designed for service delivery. In such a way, services provided by a government agency on its Web site can be evaluated comprehensively; and solutions for improving the situation can be found effectively and efficiently.

3.3 Application of the model

The model proposed in F1.0 is a generic conceptual model. It cannot be directly used in the evaluation of any specific Web-based e-government services. This is because factors influencing Web-based e-government services vary from government agency to government agency, together with the variation in the populations they serve, services they provided, and responsibilities they are assigned, etc. For example, on the Web site of a local school district, a user's age, which identifies users as students and non-students, may matter for measuring performance of their information seeking activities; while, on the Web site of the Internal Revenue Service, differences in users' income would make more sense. It is therefore difficult to identify all the possible factors influencing performance in one model, and apply it everywhere as a one-fit-all tool. Indeed, the core utility of this model is that it provides directions for the evaluation, i.e. a generic set of factors influencing the success of Web-based e-government services.

Although not a one-fit-all model, the proposed conceptual framework has great advantages in its flexibility of being applied over a wide range of applications. In a specific government circumstance, the application of the proposed evaluation model for a specific government agency can be done by implementing the following steps:

Step1: Identify possible factors that may influence citizens' information seeking activities on this Web site;

Step2: Form a model from F1.0 with identified factors in it;

Step3: Measure the performance of citizens' information seeking activities;

Stpe4: Test the significance of identified factors with the agency-specific model.

By doing this, a government agency can address three questions that are critical for the evaluation of its Web-based e-government services:

Q1: Are citizens' information seeking activities facilitated on its Web site?

Q2: What are the factors that play a significant role in influencing citizen's information seeking activities?

Q3: What are the patterns among the identified factors, including both the direct effects and the interactive influences, that effect individual performance?

We will next apply our evaluation framework to a specific case setting based on using the Syracuse City School District as the proving ground to test the power of this model for real evaluation. The next section of the paper identifies the key factors relevant to this case. This is followed by an experiment designed to answer the three questions posed above, which are critical for the evaluation of its Web-based services.

4. Case study in Syracuse City School District

4.1 Study variables

Three core variables are used in this study based on observed factors influencing citizens' information seeking activities on Syracuse City School District (SCSD) Web site. Task complexity captures the single most salient factor in task attribute, while perceptual stimuli load on home page and presentation of task-related information are factors associated with Web site features. Since a government agency can not choose its Web visitors purposely, a variety of variables will also be used to measure individual characteristics, such as age and gender.

It needs to be pointed out that the variables picked in this study may not include all possible factors that can influence citizens' information seeking activities in this context. Since the purpose of current study is only to test the utility of the proposed evaluation model with real data, and current available resources do not allow us to encapsulate everything at one time, we therefore choose to keep this study as simple and easy to understand as possible.

Task complexity is an objective concept describing the relationship among elements (e.g., task requirements, skills required, resources needed, steps to be taken, etc.) involved in completing an information task in this study. Two aspects describe the complexity of a task: the number of elements involved in completing the task, and the interrelationship among these elements. The more elements involved in completing an information task, the more relationships there will be among them. A task will therefore be more complex as it contains more elements and relationships. On the other hand, the more complicated are interrelationships among task elements, the more complex that a task is, too. The number of elements and the extent of their interrelationships tend to be correlated with each other. The more elements involved in a task, the more interrelationships will exist among them, and the more likely these relationships become complicated.

The relation between task complexity and performance of an information seeking activity is straightforward. The more complex an information task is, the more mental resources needed to processes the interrelationship among the elements. **Task complexity leads to longer processing times and reduced likelihood of a satisfactory outcome.**

Perceptual stimuli load on home page is the amount of perceptual stimuli, such as text, pictures, charts, audio, video, etc., on the home page of SCSD Web site. In any information seeking process, there are decision-making steps, through which an information seeker travels while looking for desired information. Before each decision can be made, an information seeker goes through the information presented by the information environment. In a Web-based information seeking activity, this means the information seeker must scan the Web page and then decide where to move to next. Such a scanning activity is similar to what Allen [27] called document scanning, in which the Web page is an electronic document, consisting of text in combination with a variety of figures. All of these elements form perceptual stimuli for individuals visiting a Web site. According to Allen, differences in the type of perceptual stimuli can lead to differences in the amount of cognitive processing effort they require. Perceptual stimuli load therefore can be understood as a form of cognitive load or effort for processing information by the decision maker. For an individual to make the decision for next step on a Web page, the higher perceptual stimuli load carried by that Web page, the more cognitive processing effort he/she needs to spend on scanning it. **Such an effect will easily lead to longer processing times in completing an information task and potential loss of satisfaction with the information seeking process.**

Within the context of this study in SCSD, the perceptual stimuli load to be examined is limited on the home page of SCSD Web site. One reason is that the home page is important for a Web site. It provides the first impression of a Web site; and it is the primary interface between organizations and people on the Web [28]. In addition, among the three types of Web pages for a Web site – home page, navigation pages, and document pages, home pages tend to exhibit the greatest source of variation in perceptual stimuli load. Support for concentrating on perceptual stimuli load of home page alone can also be found in the literature. Ryan et al [28] showed that, over time, state government home pages exhibited growing variation in information density of these pages. Since information density is a concept closely relates to perceptual stimuli load, its would naturally lead to the variation in perceptual stimuli load.

Presentation of task-related information refers to the delivery of task-related information to a information seeker, including the delivery of information on task requirements and on how to complete the task. Since both kinds of information can reduce information processing efforts, the more such relevant information is presented to an information seeker, the easier it is for that individual to find out what to do and where to go for the next step.

In the study of SCSD Web site, task-related information only includes information on how to complete a task, i.e. the path information for doing the task. Since most information seeking searches are initiated by citizens, there is little apriori information as to what questions will be asked. This makes it difficult to establish a series of hints or specialize problem specific queues in advance. The emphasis in examining influence from presentation of task-related information hence is placed on the path information for completing an information task.

4.2 Experiment design

In our general model, individual characteristics not only effect directly, but also interact with other characteristics to influence the individual performance of information seeking behavior at a Web site. To limit these indirect influences, a repeated measures design is employed in this experiment to control variation in subjects' individual characteristics. Such a control is realized through having each subject receive all treatments. By doing this, each subject can be viewed as his/her own control, because all sources of variability between subjects are excluded from experimental error [29]. However, the advantage of repeated measures design can be impaired by order or carryover effect [29]. To minimize these possible problems influences each subject is presented with each treatment in a random order.

Four treatments are designed with different combinations of task complexity, home page perceptual stimuli load, and presentation of task-related information. Each subject is asked to complete four information tasks that are either simple or complex on two versions of SCSD Web site that have different perceptual stimuli load at the home page. Given the tasks assigned to each subject, presentation of task-related information is also designed to be different.

The *complexity* of information tasks is measured using three dimensions; (1) whether the information requirements for completing the task is clear or not; (2) whether there is any need to assess the searched information in terms of its properness for completing the task; and (3) whether the information to be searched is the destination of the task. After searching all possible information tasks that can be done on SCSD Web site, four (two pairs) tasks were chosen with variations in above dimensions: one pair are simple tasks and the other pair are complex ones.

Perceptual stimuli load on a Web page is positively

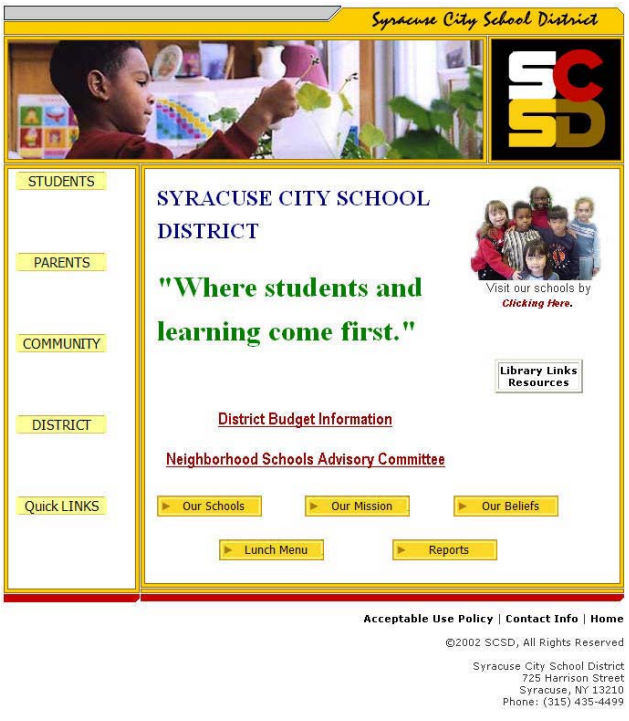

Figure 1. Home page of Syracuse City School District Web site with low perceptual stimuli load

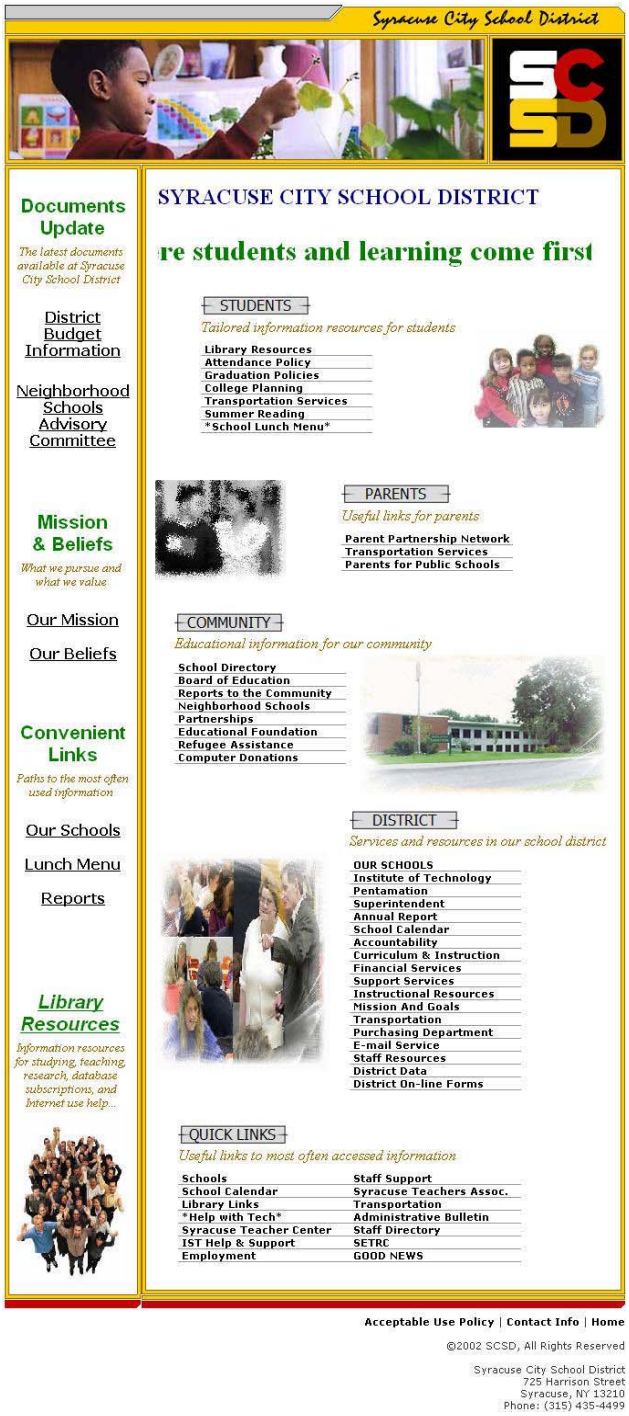

Figure 2. Home page of Syracuse City School District Web site with high perceptual stimuli load

related with the information density of that Web page. Information density hereby can be viewed as an indicator of perceptual stimuli load. Ryan's study on US state government home pages (Ryan et al., 2003) [28] showed that there are six types of home page design at US state government home pages, which are Long List of Text Links, Simple Rectangle Type, Short 'L' Type, High-Density/Long 'L' Type, Portal Type and Box Type. Among these home page types, *Simple Rectangle Type* has the lowest information density, whereas *High-Density/Long 'L' Type* has the highest information density. Utilizing this result, two versions of SCSD home page are designed on the basis of the official one. One version employs Simple Rectangle Type design to instrument lower perceptual stimuli load; the other version employs High Density/Long 'L' Type to instrument a higher perceptual stimuli load. (Snapshots of the designed home pages are showed in Figure 1 and Figure 2)

Task-related information in this study refers to the path information for completing a given task. In this experiment we operationalized the task as a hyperlink. *Presentation of task-related information* for a specific task therefore is manipulated as either a single direct hyperlink for the information needed or having the information available without use of a hyperlink at all.

Using *simple* or *complex* for task complexity, *high* or *low* for perceptual stimuli load on home page, and *with* or *without* direct hyperlink for information needed on home page, four sets of treatments are developed (as shown in Table 1). Each subject received all four treatments in a randomly assigned order. The experimental session begins with a pre-test questionnaire for collecting demographic information such as gender, age, and education level, etc. Such information is gathered to analyze possible influences on information seeking performance from individual characteristics and whether the repeated measures component succeeded in controlling for individual attributes.

Treatments are assigned to subjects after the pre-test questionnaire. Each time a treatment is completed, a post-test questionnaire is given to a subject. The purpose of this questionnaire is to obtain a subject's opinion on his/her experience doing the task involved in the specific treatment as well as measure of satisfaction with their information seeking *performance*. The process dimension of information seeking *performance* is measured by the time used on the task in a given treatment.

Currently, we are pretesting our experiment design. This pretest is designed to test the feasibility of the developed instruments and protocol. Four graduate students are chosen from volunteers in-house to carry on the four sets of treatment in design. They age from 30 to 37. Two are male; and the other two are female. Table 2 shows the raw data from the pretest for process performance of their information seeking.

Analysis of these pretest data is used to modify various aspects of the experiment. For example, each pair of tasks selected for the experiment is expected to match on complexity level but the pretest results suggest some

Table 1. Treatment sets for pretest

Treatment Set No.	$T_S \times PSL_l \times L_h$	$T_S \times PSL_h \times L_l$	$T_C \times PSL_l \times L_h$	$T_C \times PSL_h \times L_l$
Treatment Set #1:	T_{A-1} PSL_l L_h	T_{A-2} PSL_h L_l	T_{B-1} PSL_l L_h	T_{B-2} PSL_h L_l
Treatment Set #2:	T_{A-2} PSL_l L_h	T_{A-1} PSL_h L_l	T_{B-1} PSL_l L_h	T_{B-2} PSL_h L_l
Treatment Set #3:	T_{A-1} PSL_l L_h	T_{A-2} PSL_h L_l	T_{B-2} PSL_l L_h	T_{B-1} PSL_h L_l
Treatment Set #4:	T_{A-2} PSL_l L_h	T_{A-1} PSL_h L_l	T_{B-2} PSL_l L_h	T_{B-1} PSL_h L_l

T_S - Simple Task T_{A-1} - Simple task #1 T_{A-2} - Simple task #2

T_C - Complex task T_{B-1} - Complex task #1 T_{B-2} - Complex task #2

PSL_l - Home page with low perceptual stimuli load

PSL_h - Home page with high perceptual stimuli load

L_l - With direct link for task-related information on home page

L_h - Without direct link for task-related information on home page

Table 2. Raw data from pretest for process performance

	$T_S \times PSL_l \times L_h$ (min)	$T_S \times PSL_h \times L_l$ (min)	$T_C \times PSL_l \times L_h$ (min)	$T_C \times PSL_h \times L_l$ (min)	Mean	SD
Subject #1	1.92	0.75	1.55	3.40	2.48	1.31
Subject #2	0.16	3.20	2.80	1.40	2.10	0.99
Subject #3	1.90	0.58	2.98	1.80	2.39	0.83
Subject #4	1.60	2.36	2.08	0.85	1.47	0.87
Mean	1.33	1.51	2.44	2.20		
SD	1.01	1.47	0.78	1.06		

within pair variation due to complexity. Also, there are indications of wording problems that could confuse subjects when they answer questions in pre- and post- test questionnaires.

5. Conclusion

This paper presents a general theory for evaluation of Web based application and an experiment to test the validity of that approach. At this point the experiment has been pretested and will be conducted over the fall of 2004 using citizens from the Syracuse City School District. The theory model identifies a transaction between an individual and a Web site as the appropriate unit of analysis for evaluation. It further notes that to accurately measure both the process and outcome, a model must control for all the relevant sources of variation in process and outcome, task characteristics, site characteristics and individual characteristics. The model anticipates that these three clusters of variables are likely to interact with one another in determining the process and outcome of the transaction. The major contribution of this model is the direct incorporation of critical variable likely to influence system performance and the ability to sort them into factors that can be controlled and those that can not be controlled. The approach is labeled a citizen centric approach and one that is appropriate for e-government applications.

It is expected that data from our experiment built around the development of a Web site for the Syracuse City School District will demonstrate the utility of the proposed model. Also, instruments developed in SCSD experiment will provide useful references for other similar government agencies if they need to apply this model for the evaluation of their Web-based services. Such agencies could be other school districts or local government agencies that serve citizens directly. Accumulation of data for similar government agencies make it possible to derive lessons for improving Web-based e-government services that are specifically useful for that group or category of government agencies.

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