Enhancing User Experience in e-Government: A Deep Dive into e-Government Forms and Citizen Perceptions

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Abstract: Understanding citizens' perceptions is essential for improving e-government services and strengthening the relationship between citizens and the government. Therefore, this study focuses on the design principles of e-government forms and their impact on citizens' experiences. Specifically, it examines the context of e-government in the United States and seeks to understand citizens' perceptions. A web prototype for e-government forms was developed based on the US Web Design System (USWDS) guidelines. A web-based survey using a user experience questionnaire was conducted, with five scales: efficiency, trust, trustworthiness of content, quality of content, and clarity. Then, we recruited 200 US citizens to evaluate the implemented e-form. The results indicated positive user experiences across all scales. However, the trust scale received the lowest score, despite being considered the most important by citizens. Participants recognized the importance of trust but felt it was not fully established. More research is needed to investigate the trust value of e-government design principles in the US. By following established design principles and addressing trust concerns, governments can create user-friendly interfaces that foster trust and meet citizens' expectations.

1 INTRODUCTION

In the realm of e-government, governments strive to develop high-quality services that prioritize the quality of their content and delivery. Service content refers to the effectiveness and functionality of the services provided to fulfill citizens' needs. Meanwhile, service delivery encompasses the interaction between e-government providers and citizens, considering the mediums or channels employed to facilitate this interaction (Al-Besher and Kumar, 2022). The exchange of information and services in e-government presents challenges that necessitate a standardized information exchange process (Umbach and Tkalec, 2022). Electronic forms play a vital role in enabling this process within e-government (Scholta et al., 2019). Citizens benefit from electronic forms as they offer accessibility at any time and from anywhere, eliminating the need for physical collection efforts. Furthermore, users can identify and rectify errors prior to submission, saving time and enhancing access rates to government services.

However, the effective management of e-government forms faces numerous challenges from various perspectives, including design considerations. Designing excellent and efficient e-government forms proves to be a formidable task (Scholta et al., 2020). Efficient form design is crucial in reducing efforts and minimizing misunderstandings between governments and citizens.

To ensure the creation of valuable and precise e-government forms, it is imperative to prioritize the user experience. User experience encompasses the emotional, cognitive, and physical reactions that users have while engaging with a service, and it serves as a crucial criterion. ISO 9241-210 provides an explanation of user experience as a comprehensive concept (ISO 9241-210:2019, 2019). Several articles have discussed the technical aspects of user experience in the e-government domain and elucidated the construction of e-government services (Sukmasetya et al., 2018; Aldrees and Gračanin, 2021a; Aldrees and Gračanin, 2021b). In this paper, we conduct an analysis of the user experience related to e-government forms. We utilize the User Experience

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Questionnaire (UEQ) as a baseline measurement tool for a comprehensive and direct assessment of user experience (Hinderks et al., 2018; Hinderks et al., 2019). This approach enables us to gauge the acceptance of the e-government form design by citizens.

The rest of the article is structured as follows: section 2 presents the research background, while section 3 describes our research design. We introduce the results of this user study in section 4. We then discuss the findings and conclude the paper in section 5.

2 BACKGROUND

2.1 e-Government Forms

Essential for government service delivery, forms are the official communication channels and the information exchange interfaces between government agencies and citizens. They serve two main purposes: to start the process of receiving a specific government service or exchange the necessary information with the government. In e-government, electronic forms refer to specific graphical user interfaces used to transfer data requests and exchange information (Scholta et al., 2019). They are defined as a "structured interface that provides predefined labeled spaces for manual data input and is used repeatedly to transfer data to one or more natural or legal persons" (Scholta et al., 2020).

Recent research has focused on the usability of forms in web and mobile applications and has provided specific design guidelines. (Y Yu et al., 2021) assessed the electronic forms for patients as alternative to paper forms while (Shcherbyna et al., 2021) discussed the issues of concluding business contracts in electronic form. Yet, crafting forms within the realm of e-government presents a considerable challenge. Governments need to consider all required regulations to specify what data they need to capture from citizens. They also must focus on creating e-forms that effectively showcase government services. (Veeramootoo et al., 2018) concluded that the design of e-forms has a significant impact on citizens' perceptions of the quality of the offered e-government services. As previously stated, forms serve as the main communication bridges connecting citizens and governments. Therefore, it's crucial to assess the user experience of e-forms in order to guarantee the quality of e-government services.

2.2 User Experience Questionnaire

In the e-government domain, the implementation of e-government initiatives failed to achieve their assigned role due to a lack of the offered services, poor website functions, or lack of users' trust. A closer look at the failure aspects indicated how e-government initiatives drifted by focusing on the technology rather than understanding users' needs to adopt e-government services (Madariaga et al., 2019). Therefore, the research has started to improve the citizens-government relationship by evaluating their experience towards the e-government services to increase their satisfaction. The term user experience (UX) is defined as "person's perceptions and responses resulting from the use and/or anticipated use of a product, system, or service", including users' emotions, beliefs, perceptions, preferences, and behaviors that occur before, during and after using the offered service (ISO 9241-210:2019, 2019). The concept of UX in e-government has profound effects on citizens' satisfaction, perception, and expectations of government services (Kamaruddin and MdNoor, 2017). It aims to intensify and improve users' beliefs and emotions toward e-government services.

It is important to care of all UX aspects to provide a comprehensive evaluation of the UX for the offered services. Therefore, the User Experience Questionnaire (UEQ) is an effective quantitative tool to get valuable feedback from end-users to allow them to evaluate their feelings while interacting with the offered services and assess their overall UX (Laugwitz et al., 2008). The UEQ is a widely used questionnaire that represents and measures the most important UX aspects with six scales (Attractiveness, Efficiency, Perspicuity, Dependability, Stimulation, and Novelty). It aims to allow a quick and precise assessment by end-users to cover a comprehensive impression of UX. It allows users to express their feelings, attitudes, and impressions that appear while using and experiencing the given service or product. Each scale in the UEQ has four evaluation items that are semantic differentials with a 7-point answer scale (Hinderks et al., 2018). They consist of a pair of terms with opposite meanings that span a semantic dimension. An example of an item representing the scale efficiency is:

slow ○ ○ ○ ○ ○ ○ ○ fast

Hence, users rate each item on the 7-point Likert scale. Then, the answers are scaled from -3 (fully agree with the negative term) to +3 (fully agree with the positive term). Half of the items start with the positive term, and the others with the negative term (in randomized order).

However, the UX has different factors with high relevance not contained in the original UEQ. Therefore, UEQ+ is a modular extension of the UX questionnaire scales. It contains a larger list of UX scales, twenty scales, that comprehensively evaluate the UX in a given scenario. The UEQ+ is not a UX questionnaire, it is a tool to build specific questionnaires that are adapted to given scenarios (Schrepp and Thomaschewski, 2020). Hence, the researcher can pick the UX scales that are the most relevant for the specific scenario. In addition, each scale in the UEQ+ contains a rating concerning the importance of the scale, as shown below:
I consider the product property described by these terms as

Completely irrelevant ○ ○ ○ ○ ○ ○ ○ Very important

The importance ratings are used to calculate a key performance indicator (KPI). Hence, a single number represents the overall UX of the offered product or service (Schrepp and Thomaschewski, 2019).

Therefore, in this paper, we have focused on the trust, quality, and efficiency of the offered e-government services. Trust in e-government has been considered a significant direct determinant of adoption behavior towards the offered e-government services (Verkijika and De Wet, 2018; Chohan and Hu, 2020). Therefore, governments need to make e-government services more trustworthy to increase the level of adoption behavior. Moreover, efficient and high-quality services have a great impact to enhance the UX of the offered services. Hence, we have chosen five UX scales to evaluate the UX of e-government forms:

1 Efficiency: refers to the users' subjective impression that they can achieve the goals of using the offered services with minimal effort. The service responds quickly to users' actions.

2 Trust: refers to the users' impression that their data entered into the offered service is secured, safe, and not misused to harm them.

3 Trustworthiness of Content: refers to the users' impression that the information provided by the service is reliable and of good quality. The user has trust in the information provided by the offered service.

4 Quality of Content: refers to the users' impression that the information provided by the offered service is high-quality, accurate, well-prepared, and easy to understand. Users are interested to read the information provided by that service.

5 Clarity: refers to the user's impression of the design, structure, and visual complexity of a graphical user interface of the offered service (Schrepp and Thomaschewski, 2020).

3 RESEARCH METHODOLOGY

3.1 Research Design

In this study, we have designed a web prototype of an e-government form to understand users' perceptions and evaluate their experience while using this e-government form. The form was designed to seek citizens' information about their recent activities using the e-government services, and also their ratings of these services, and whether they have any suggestions or complaints to improve the current e-government services. The e-government in the US is a case study in this paper. The United States Web Design System (USWDS) is the federal government design system created by the US government in 2015 (US Gov., 2022). It is a library of guidelines, codes, and tools that helps government digital teams to share the design solutions of e-government portals and provide effective user-centered design practices. This library supports the design of dozens of US agencies and nearly 200 portals. Therefore, we have incorporated the USWDS guidelines as the reference design components for our e-government form prototype. We have successfully implemented the web prototype, featuring a 4-page e-government form.

This study employed a quantitative approach, utilizing a web-based questionnaire instrument to gather data. Participants were encouraged to explore the web prototype form and provide evaluations regarding their experience with the form. Web-based surveys are widely utilized due to their efficiency, cost-effectiveness, and accuracy in collecting information (Nayak and Narayan, 2019). As mentioned in subsection 2.2, the questionnaire was designed based on the UEQ+ (User Experience Questionnaire Plus) framework, incorporating the five scales mentioned above to collect empirical data on the user experience of e-government forms in the US. Each scale consisted of four measurement items that were incorporated to evaluate the specific aspects covered by the scale and enable participants to express their perceptions related to that scale.

3.2 Research Setting

The target population for this research study consists of individuals who are citizens or legal residents of the United States and are above 18 years old. To participate in the study, individuals are required to confirm

Table 1: Demographic data.

Demographics	Category	Total	Frequency
Sample size		200	
Gender	Male	106	53%
	Female	94	47%
Age	18–30 years old	58	29%
	31–40 years old	91	46%
	41–50 years old	33	17%
	51–60 years old	13	7%
	Above 60 years old	5	3%
Education level	No formal school	3	2%
	High school or less	37	19%
	Associate degree	42	21%
	Undergraduate degree	56	28%
	Graduate degree	62	31%

their nationality and age. Participants will be selected through random sampling techniques. The total sample size consisted of approximately 200 participants who were U.S. citizens or legal residents. The participants were recruited using the services of Amazon Mechanical Turk (MTurk), a reliable crowdsourcing platform utilized by researchers to hire workers who meet specific study criteria (Amazon, nd). As an incentive for their participation, each participant received a payment of $1 USD upon completion of the assigned task and questionnaire.

Data collection for this study was carried out using QuestionPro, an online survey software platform (QuestionPro, 2023). To ensure confidentiality, the data collection process was designed to exclude participants' names or any identifying information. Participants were given approximately 10–15 minutes to explore the e-government form and then evaluate their experience based on the five UX scales utilized in this study. Participation in the study was entirely voluntary, and respondents had the option to quit the survey at any point without saving their responses. It is important to acknowledge the potential influence of social desirability bias, which may lead participants to provide less sincere answers if they feel uncomfortable disclosing unfavorable opinions. To mitigate this effect, the survey included a confidentiality clause assuring participants that all their answers would remain completely confidential. Ultimately, a total of 200 valid surveys constituted the final sample size for this study.

4 RESULTS

4.1 Demographic Data

The demographic distributions of the survey participants are presented in Table 1. In terms of gender, the participants showed almost equal participation between males and females, with 53% males and 47% females. Regarding the age factor, most of the participants are below 50 years old. Around 29% of participants are from 18–30 years old while almost half of the participants are from 31–40 years old (46%), followed by 41–50 years old group (17%). The age group from 51–60 years old has only 7% of participants, and only 3% of participants are above 60 years old. The most common educational level of the US participants was graduate degree (31%) followed by undergraduate degree (28%), then associate degree (21%). Around 19% of participants have a High school degree or less while only 2% do not get a formal education at school.

4.2 User Experience Analysis

In evaluating the User Experience Questionnaire (UEQ), we utilized UEQ data analysis tools provided by (Hinderks et al., 2018). These tools were developed in the form of a Microsoft Excel file, streamlining the necessary calculations for the analysis. The tools not only calculate scale values but also generate relevant bar charts based on the entered data, visually

Table 2: Mean and confidence interval per each measurement item.

Mean and Confidence Interval per Item									
Scale	**Item Left**	**Item Right**	**Mean**	**Variance**	**Std.dev.**	**N**	**Confidence**	**Confidence Intervall**	
Efficiency	slow	fast	1.81	1.00	1.00	200	0.14	1.67	1.94
	inefficient	efficient	1.64	1.34	1.15	200	0.16	1.48	1.80
	impractical	practical	1.76	1.17	1.08	200	0.15	1.61	1.91
	cluttered	organized	1.73	1.21	1.10	200	0.15	1.58	1.88
Trust	insecure	secure	1.75	1.32	1.14	200	0.16	1.59	1.90
	untrustworthy	trustworthy	1.70	1.40	1.18	200	0.16	1.53	1.86
	unreliable	reliable	1.69	1.50	1.22	200	0.17	1.52	1.86
	non-transparent	transparent	1.52	1.68	1.29	200	0.18	1.34	1.70
Trustworthiness of Content	useless	useful	1.80	1.16	1.07	200	0.15	1.65	1.94
	implausible	plausible	1.73	1.21	1.10	200	0.15	1.57	1.88
	untrustworthy	trustworthy	1.70	1.24	1.11	200	0.15	1.55	1.85
	inaccurate	accurate	1.72	1.23	1.11	200	0.15	1.57	1.87
Quality of Content	obsolete	up-to-date	1.80	1.25	1.11	200	0.15	1.65	1.95
	not interesting	interesting	1.75	1.30	1.14	200	0.16	1.59	1.91
	poorly prepared	well prepared	1.72	1.31	1.14	200	0.16	1.56	1.87
	incomprehensible	comprehensible	1.84	1.15	1.07	200	0.15	1.69	1.99
Clarity	poorly grouped	well grouped	1.77	1.13	1.06	200	0.15	1.62	1.91
	unstructured	structured	1.81	1.23	1.11	200	0.15	1.65	1.96
	disordered	ordered	1.73	1.30	1.14	200	0.16	1.57	1.89
	disorganized	organized	1.75	1.13	1.06	200	0.15	1.60	1.89

presenting the results. Additionally, basic statistical indicators essential for data interpretation are computed by the analysis tool. The advantage of using this analysis tool is that it simplifies the experimenter's work, requiring only the insertion of the collected user experience data. The analysis tool automatically generates several figures to visually represent the output of the entered data.

The analysis results are presented in a ten-column table (Table 2). The first column, labeled as "scale," corresponds to the five selected scales in this study. The "item left" column indicates the leftmost items in the UEQ, such as "slow," "inefficient," "insecure," "obsolete," and so on. On the other hand, the "Item right" column represents the rightmost items in the UEQ, including terms like "fast," "efficient," "accurate," "interesting," and more. The fourth, fifth, and sixth columns of the table display basic statistical results, such as the mean, variance, and standard deviation of the entered data. The seventh column represents the number of participants involved in the study, with a total of 200 participants. The eighth and ninth columns indicate the confidence level and confidence interval for each measurement item, providing additional insights into the analysis.

During the analysis of the UEQ+ data, the UEQ+ analysis tool generates results displayed in a mean values table. The range of values measured in the UEQ spans from -3 to +3. A rating of -3 corresponds to a significantly negative or "horribly bad" response, while 0 represents a neutral or average rating, and +3 indicates an extremely positive or "most positive" response (Hinderks et al., 2018). In the context of the UEQ table, negative values indicate the leftmost items, which occur when participants rate the measured items as 1 to 3. The neutral or average value is calculated when participants choose to rate the items as 4. Positive values, on the other hand, indicate the rightmost items in the UEQ table, which occur when participants rate the items as 5 to 7.

Table 2 presents the comprehensive results of the UX assessment using the UEQ+. Among the items, the highest mean value is observed for the "incomprehensible/comprehensible" item, with a mean of 1.84 (SD = 1.07). This indicates that the majority of participants provided positive ratings, perceiving the item as comprehensible. As the "incomprehensible/comprehensible" items are categorized under the quality of content scale, it can be inferred that the tested prototype is deemed attractive by the participants in terms of content quality.

On the other hand, the lowest mean value is 1.52 (SD = 1.29) for the "transparent/non-transparent" item. This indicates that the majority of participants chose the leftmost item, indicating a perception of non-transparency in the e-government form. As the "transparent/non-transparent" items fall under the trust scale, it can be concluded that the tested prototype is generally perceived as trusted by the participants, given the positive mean value. However, the lower mean value suggests some trust issues regarding the transparency of the e-government form design, which should be taken into consideration for further improvement. These highest and lowest mean values indirectly provide evidence that the tested prototype was generally accepted by the participants. It also allows us to identify areas for further improvement in order to enhance the quality of the prototype. Addi-

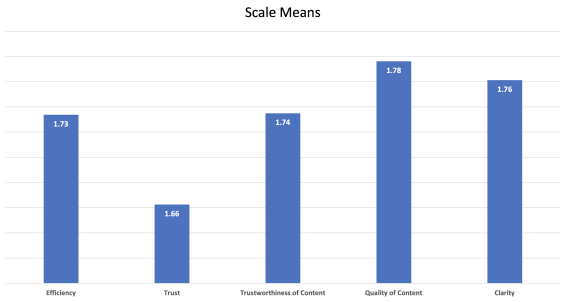

Figure 1: Overall mean values of each selected UEQ scale.

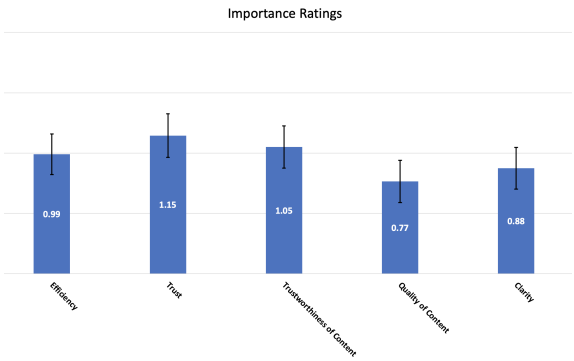

Figure 2: Importance rating of each selected UEQ scale.

tionally, increasing the mean values would strengthen the reliability and robustness of the results for future reference.

In addition to the detailed results, the UEQ+ data analysis tool also generates an overview of the selected UEQ+ scales as displayed in Figure 1 and Figure 2. These figures provide a visual representation of the mean values and importance ratings for the selected scales. The results show that the means were transformed from -3 to +3 and the results were all positive. Figure 1 displays the mean value of each scale used in this study, where the mean value on the efficiency scale is 1.73; trust is 1.66; the trustworthiness of content is 1.74; quality of content is 1.78; clarity is 1.76. The mean values of all the scales were above 1, which shows an excellent result and a good experience for the e-government form. The UEQ+ scale also provides the mean importance ratings and shows the importance of a scale based on the value, as seen in Figure 2. The mean importance rating value for the e-government form indicates that all of the scales are important, where the average importance rate of the efficiency scale is 0.99; trust is 1.15; Trustworthiness of content is 1.05; quality of content is 0.77; clarity is 0.88.

Based on the results, it is evident that the participant's experiences with the prototype were generally positive, as indicated by the positive mean values for all the measurement items. This suggests that the majority of participants perceived the prototype to be satisfactory in terms of the UX. However, it is important to note the differences in the mean values across the various items and scales. The presence of lower mean values for certain items or scales indicates areas where the prototype could be further improved to provide a more engaging and satisfying UX. By focusing on these specific areas, future iterations of the prototype can be tailored to address the shortcomings and enhance the overall UX.

5 DISCUSSION AND CONCLUSION

The quality of government service delivery relies on the effectiveness of forms, which serve as crucial interfaces for information exchange between the government and citizens. However, forms often pose challenges due to their complexity. To address this, governments must ensure that communication channels with citizens are user-friendly and easy to understand. To gain insights into citizens' experiences with e-government forms, we developed a web prototype and conducted a user experience evaluation. The evaluation was based on the principles of the US Web Design System (USWDS), which provides guidelines for designing online government services and user interfaces. Quantitative analysis was employed, utilizing a web-based questionnaire that incorporated the User Experience Questionnaire (UEQ+) with five key UX scales: efficiency, trust, the trustworthiness of content, quality of content, and clarity. Participants, who were US citizens or legal residents, were asked to evaluate the e-government form prototype based on these scales. Additionally, participants provided ratings on the importance of each scale for the given form. A total of 200 participants were recruited to contribute their evaluations, allowing for a comprehensive assessment of the e-government form's user experience based on the selected UEQ+ scales.

The results indicate that the UX of the designed e-government form is generally positive across all five adopted scales. However, it is noteworthy that the scale of trust has the lowest mean value (1.66) compared to the other scales (Figure 1). This suggests that there is room for improvement in enhancing the trustworthiness of the e-government form. Interestingly, the scale of trust also has the highest mean importance value (1.15) among all the scales, as shown in Figure 2. This highlights the significance partic-

ipants place on trust in the context of e-government services. It reinforces the notion that trust is a critical factor for the success of e-government initiatives. While the feedback from participants regarding the trust scale is positive, it is expected that this scale would have a higher mean value compared to the other scales. This discrepancy suggests that there may be specific areas or aspects within the e-government form where trustworthiness needs to be further emphasized and strengthened. By addressing any shortcomings and focusing on enhancing trust in the e-government forms, it is possible to elevate the overall UX and promote greater confidence among users.

Trust in e-government services is a critical factor that significantly influences the adoption and success of such initiatives. It refers to citizens' belief in the reliability and security of the offered e-government services (Lallmahomed et al., 2017). The importance of trust in e-government has been widely recognized worldwide, as citizens are concerned about the use and security of their personal information. Numerous studies have emphasized the significance of trust in driving citizens' adoption behavior toward e-government services. Researchers have found that when users trust the government agency to safeguard their data, it increases their likelihood of adopting and using e-government services (Alharbi, 2015; Chohan and Hu, 2020). Trust has been identified as a direct determinant of adoption behavior in various studies. For instance, (Chatzoglou et al., 2015) developed a framework to identify critical factors influencing the adoption of e-government services. They highlighted that trust in the government's ability to secure citizens' data plays a crucial role in promoting adoption. Similarly, (Lee et al., 2019) investigated the factors influencing citizens' intention to use e-government services and found that trust in e-government is a significant determinant of adoption behavior.

To enhance citizens' trust and promote adoption, it is essential for e-government agencies to implement secure systems and ensure accurate and trustworthy interactions with users. The graphical user interface (GUI) of e-government services plays a crucial role in establishing citizens' trust. The design and presentation of information within these services have a significant impact on the level of trust users place in the services and ultimately enhance their overall experience. By utilizing the UEQ+ questionnaire, it becomes possible to gain insights into users' initial experiences with the designed interface of e-government forms. The findings, particularly in relation to the trust scale, raise important considerations for future research. Specifically, it highlights the need for further investigation into the trustworthiness of the design interface of e-government services in the US, particularly when applying the USWDS guidelines.

Future studies should delve deeper into the impact of the USWDS guidelines on the trust factor and explore how adherence to these guidelines influences users' trust in e-government services. By conducting more extensive investigations, researchers can uncover valuable insights that will inform the development of trustworthy and user-centric e-government interfaces, ultimately enhancing citizens' experiences and fostering greater trust in the services provided.

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