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LOCALIZATION MODULE IN USER EXPERIENCE QUESTIONNAIRE FOR CROSS-CULTURAL WEBSITE DESIGN

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ABSTRACT

The importance of User Interface (UI) and User Experience (UX) in ensuring the practicality and usability of websites for users is well-recognized. The User Experience Questionnaire (UEQ) is widely employed to evaluate these aspects of a product, ensuring linguistic and cultural appropriateness for its target locale based on country, region, or language. However, the UEQ lacks a module specifically designed to assess the localization properties of a product. This research aims to extend the UEQ by introducing a localization module that adheres to cross-cultural design principles. The study involved a systematic literature review to identify potential items for the localization module, followed by a brainstorming session with experienced IT experts to discuss and refine these items. The final list of items was statistically analyzed using SPSS software, resulting in a consolidated localization module. This module's correlation with task completion time was examined through convenience sampling and internal consistency analysis. Reliability was further assessed using Cronbach's Alpha coefficient per scale method. The outcome is an additional module, named Localization in UEQ, which can be utilized alongside UEQ+ to evaluate a product's cultural and linguistic adaptability, enhancing its overall usability assessment.

Keywords: *Cronbach's Alpha, Cross-Cultural Design, Internal Consistency Analysis, Localization, Usability Assessment, User Experience Questionnaire (UEQ)*

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1. Introduction

All in the realm of website design, user experience (UX) has emerged as a crucial element that significantly influences user satisfaction and the overall success of digital platforms. As the digital landscape becomes increasingly globalized, the necessity for websites to cater to diverse cultural and linguistic audiences has intensified. User experience is an important subject since it impacts every user's motivation and engagement that contribute to their learning experience (Mäkinen et al., 2020). This research focuses on integrating a localization module into the User Experience Questionnaire (UEQ) to enhance cross-cultural UX evaluation for websites.

The concept of user experience (UX) encompasses all aspects of the end-user's interaction with a company, its services, and its products. It is a multi-faceted phenomenon that includes usability, accessibility, performance, and aesthetic elements, all of which contribute to how users perceive and engage with digital products. According to Hinderks et

al. (2019), a good UX can be obtained when a product is easy to learn, efficient to use or well-controlled with other criteria such as joy-of-use, aesthetics, novelty, attractiveness and others. Despite the growing recognition of UX's importance, there remains a gap in the ability to adequately assess it across different cultural contexts.

Localization in UX refers to the adaptation of a product to meet the language, cultural norms, and expectations of a specific target market (Gutiérrez-Artacho & Olvera-Lobo, 2017). It is more than mere translation; it involves a comprehensive adjustment of the content, design, and functionality to ensure cultural appropriateness and relevance. Effective localization enhances user satisfaction and engagement, leading to better user retention and higher conversion rates.

According to Tcha-Tokey et al. (2016), UX can be measured in two methods which are subjective or objective method (Somrak et al., 2021) or even through a combination of both methods. In a different study by Maia and Furtado (2016), it is also has been concluded that a questionnaire is the most favoured result over other evaluation methods such as interviews, observations, surveys and so on, in which it is easy to be administered and fairly accurate (Chopra, et al., 2020). While various tools and scales exist to measure UX, such as the System Usability Scale (SUS) and the original UEQ, they often fall short of accounting for cultural nuances. These tools were primarily developed within specific cultural contexts and may not fully capture the unique expectations and preferences of users from diverse backgrounds. This limitation poses a significant challenge for global companies striving to create universally appealing digital products.

This study focuses on the localization module, which is integral to ensuring that software and applications are adapted to meet the linguistic, cultural, and functional requirements of diverse user populations. To address this focus, the study aims to explore three primary aspects: identifying the items within the localization module, constructing these items effectively, and evaluating their performance. The following research questions are designed to provide a structured approach to this exploration:

- What are the items in the localization module?
- How to construct the items based on the localization module?
- How to evaluate the items in the localization module?

The result of this study is expected to contribute significantly to the field of UX design and evaluation by providing a robust tool that accounts for cultural diversity. The development of a localization module will enable more accurate and meaningful UX assessments, helping designers and developers create more inclusive and user-friendly digital products (Al-Batineh & Alawneh, 2022). Additionally, this study will highlight the importance of cultural considerations in UX design, encouraging further research and innovation in this area.

2. Methodology

The methodology outlines the approach and procedures used to conduct this study. It covers the entire research design, detailing the flow of the study from its inception to the final design of the research process. Each stage of the research framework is described and defined, providing a clearer view of the study as a whole. The research design presents an overview of the study's structure. The research framework consists of five phases: preliminary study, literature analysis, questionnaire item pooling and validation, questionnaire design and implementation, and findings.

2.1 Preliminary Study Phase

The preliminary phase is crucial for gathering foundational information and establishing a strong basis for the research. It involves identifying the research motivation, objectives, scope, and significance. Key areas of focus include user experience, usability measures, the

UEQ, localization, and usability evaluation methods. This phase aims to meet the first objective: identifying items for the localization module.

2.2 Analysis of Literature

The literature analysis phase involves examining the structure and components of the UEQ, focusing on scales and semantic differential words. According to Tullis & Albert (2013), the semantic differential scale is a technique that presents pairs of bipolar, or opposite adjectives. This phase also includes identifying verbs related to localization from previous research papers and reviewing relevant evaluation methods and tools. The goal is to compile a comprehensive list of potential items for the localization scale.

2.2.1 Search Strategy

The systematic literature review was conducted comprehensively using relevant digital libraries, including ACM, Elsevier (Science Direct), IEEE, and Springer. The review was divided into two parts: (1) localization study on user experience and (2) localization study on websites.

To identify relevant literature, search terms were combined using Boolean expressions. The primary search terms included "localization" paired with either "user experience" or "website." However, due to the low association of these terms, the term "localization" was often replaced with "cultural." This substitution was based on the definition of localization, which involves adapting a product to be linguistically and culturally appropriate for a specific locale (Riippa, 2016).

- Inclusion Criteria: The inclusion criteria were defined to ensure the relevance and quality of the selected studies. Specifically, the review included scientific materials such as journals, proceeding papers, technical reports, and short papers. All selected papers had to be written in English and include the search terms "localization," "cultural," "user experience," or "website.".
- Exclusion Criteria: The exclusion criteria filtered out papers that did not mention localization, cultural aspects, user experience, or websites in their abstracts. Additionally, studies focusing on localization or cross-cultural issues not related to user experience or websites were excluded. Papers that were inaccessible through the digital libraries were also excluded to maintain a comprehensive review.

2.2.2 Quality Assessment

The initial search yielded 4,479 papers. To ensure the relevance and currency of the research, the timeframe was limited to publications from January 2016 to June 2023, resulting in a reduced set of 2,074 papers. After eliminating redundant papers across different databases, 1,471 unique papers remained. These were further filtered through a manual abstract skimming process, using keywords such as "localization," "cultural," "user experience," "website," "interface," and "multilingual," which resulted in the selection of 26 relevant papers.

From these 26 selected papers (see Table 1), various terms were identified based on the focus of each research study. Adapting the original User Experience Questionnaire (UEQ) (Laugwitz et al., 2008), items occurring less than twice were excluded. The seven items removed were "categorize," "comprehensive," "credible," "friendly," "operable," "personalize," and "robust." Consequently, 38 out of 45 items were retained for further analysis. These 38 items undergo further validation and analysis to generate appropriate adjectives in a semantic differential form. Following the original UEQ construction and validation methodology these items will be scrutinized and selected by experts to finalize a localization module with only four items, forming a new module in the UEQ.

Table 1(a). Possible Items for Localization Module

*	Items	Papers																									
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**
1.	Accept				X		X	X		X	X			X	X				X		X	X					
2.	Access		X	X	X		X		X		X	X					X		X					X			
3.	Adapt	X	X	X	X		X	X			X	X	X		X				X	X	X	X				X	X
4.	Adjust		X																			X					X
5.	Advantage		X								X					X								X			X
6.	Appropriate			X						X	X			X			X		X		X		X				X
7.	Attract				X						X	X						X	X				X				
8.	Categorize											X															
9.	Change	X	X						X	X	X		X						X	X							
10.	Competitive										X													X			
11.	Comprehensive					X																					
12.	Consume			X	X																						
13.	Credible	X																									
14.	Customize		X	X																							
15.	Different	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X		X	X	X
16.	Ease of Use							X					X										X				
17.	Effective				X		X		X		X						X	X	X							X	
18.	Engage	X			X								X	X			X	X	X								
19.	Familiar	X		X	X						X	X			X		X										
20.	Friendly				X																						
21.	Influence			X	X	X	X	X		X	X	X	X	X	X	X			X	X		X	X		X		X
22.	Interact					X		X	X	X	X				X			X				X					
23.	Interpret		X			X						X															
24.	Match				X			X						X								X					
25.	Meaningful												X					X					X				
26.	Navigate					X				X																	
27.	Operable									X																	
28.	Personalize		X																								
29.	Prefer	X			X	X		X	X	X	X		X		X	X	X		X			X	X	X	X		
30.	Recognize													X						X							

Table 1(b). Possible Items for Localization Module

*	Items	Papers																								
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**
31.	Relevant			X		X	X				X											X		X		X	
32.	Restrict		X																				X				
33.	Robust									X																	
34.	Success	X											X				X						X				
35.	Sufficient		X				X																				
36.	Sustain																	X								X	
37.	Target	X	X	X	X		X		X		X	X							X		X	X		X			X
38.	Translate		X	X		X	X				X		X				X					X		X			X
39.	Understand			X	X		X	X	X	X	X			X			X	X	X	X			X		X		
40.	Unique																	X								X	
41.	Usability						X	X	X		X	X				X						X					
42.	Usable	X						X						X	X	X			X								
43.	Useful												X										X		X		
44.	Utilize		X						X								X										
45.	Value			X	X						X		X	X		X		X	X			X		X			

2.3 Questionnaire Item Pooling

In this phase, the process of pooling or gathering items for the localization module is executed. This phase commences with a collaborative brainstorming session involving a panel of at least 6 selected SAP experts, chosen based on carefully curated criteria to ensure a comprehensive exploration of UI/UX (Laugwitz et al., 2008). The selected experts bring extensive backgrounds in Computer Science and Information Technology, with 5 to 15 years of experience in roles such as Software Engineers, IT Technical Engineers, and Analysts. This diverse expertise aims to provide multifaceted insights into UI/UX intricacies, enriching the study for a robust and relevant analysis.

Building upon the list of items gathered in the previous phase, these items are presented to the experts for their initial analysis. The experts collaborate to identify and eliminate redundant items that convey similar meanings. Subsequently, they work towards confirming and agreeing on a consolidated list of items to be integrated into the localization module.

The brainstorming session continues with a selected number of experts ranking the refined list of items. During this ranking process, experts have the opportunity to mark terms they find inappropriate with a "veto," signifying an unlimited number of vetoes per expert. Items that receive multiple vetoes from the consolidated list are then removed from further consideration.

As the questionnaire structure employs a semantic differential scale, each item in the list is assigned to the most fitting adjective or adjective pair. The sequence of these item pairs and the polarity of each pair are determined randomly to mitigate bias and ensure impartial evaluation.

2.4 Questionnaire Validation

Usability has been perceived as the key factor in successful technology adoption (Vlachogianni & Tselios, 2021). This phase of the research focuses on achieving the third objective, which is to evaluate the items within the localization module through a usability questionnaire. Once the item pool has been successfully generated, the listed items undergo examination and testing to ensure their validity. A validity study is conducted to confirm the reliability and effectiveness of the questionnaire in assessing user experience (Laugwitz et al., 2008; Manap et al., 2020).

A crucial component of the validity study is the recruitment of qualified participants. A group of respondents will be selected based on their high level of experience using computers and familiarity with web applications. These participants are essential for providing valuable insights into the usability and effectiveness of the localization module items.

In this phase, a convenience sampling procedure is employed to recruit participants for the usability testing session. Websites used in the task sessions are carefully selected to ensure relevance and variety in tasks. Participants will be guided through a series of typical tasks relevant to the module, following a scenario described in a step-by-step instructional document.

Each task is contextualized with a short narrative that provides background information and explains the purpose of the tasks being performed. This approach ensures that participants understand the context and significance of their actions during the usability testing session. The procedures for each task session are adapted from the original study on UEQ construction and validation (Laugwitz et al., 2008), ensuring consistency and reliability in the testing methodology.

3. Results and Discussions

In this phase, factor analysis was employed to refine and select a subset of items associated with the localization module. Initially, a systematic literature review identified 38 relevant items, which were subjected to expert analysis through a structured brainstorming session involving 6 experts selected based on specific criteria pertinent to the research area.

During the brainstorming session, the 38 items were carefully reviewed and analyzed by the experts. Through iterative discussions and evaluations, 22 unique items were identified and finalized for further analysis. These items were considered to be the most relevant and representative of the localization module's scope and objectives.

3.1 Factor Analysis Process

Factor analysis is a statistical technique used to identify underlying relationships between variables (items) within a dataset. The primary objective of this process was to distill the 22 items into a smaller, more manageable set that captures the essential dimensions or factors influencing user experience within the localization module (Shrestha, 2021).

The selected statistical tool was applied to the dataset of 22 items to uncover any underlying patterns or groupings. This involved examining correlations between items and determining which items form coherent clusters or factors that are relatively independent of each other.

Following the factor analysis process, the goal was to identify and retain the most significant factors that align with the original structure outlined in the User Experience Questionnaire (UEQ) research framework. According to the UEQ framework, each module, including localization, is ideally represented by a concise set of 4 unique items that collectively capture the user experience dimensions specific to that module.

3.2 Extraction and Rotation Method

The extraction and rotation methods employed in this study aimed to refine the set of 22 initial items associated with the localization module through exploratory factor analysis (EFA). This process utilized SPSS software and followed a systematic approach to identify and interpret underlying factors that influence user experience dimensions.

Principle component extraction was utilized as a method of data exploration and analysis (Kherif & Latypova, 2020). This initial phase of EFA examined communalities and total variance explained by the 22 items. Three cycles of factor analysis were conducted to iteratively refine the factor structure. For the rotated component matrix, a varimax rotation with Kaiser normalization was applied. This rotation method is designed to maximize the variance of squared loadings among variables across factors, simplifying the interpretation of factor loadings (Kherif & Latypova, 2020).

The factor analysis was conducted in iterative cycles to eliminate redundancy in item component loading scores. Items exhibiting redundant loading scores for specific components in the rotated matrix were sequentially removed in each cycle to refine the factor structure and improve interpretability.

From the extraction method of principal component analysis, five components were initially extracted as indicated by the scree plot. However, to represent the localization factor in the questionnaire effectively, the top four items with the highest loadings were selected for inclusion in the finalized localization module. These components were identified as Consumable, Meaningful, Competitive, and Sustainable, based on their loading scores.

3.3 Communalities and Total Variance

Communalities, which represent the proportion of variance in each variable explained by the extracted components, were evaluated. High communalities (expected to have a value of 1.0 in principle components extraction) indicated that the extracted components effectively represented the variables.

The total variance explained encompassed initial eigenvalues, extraction sums of squared loadings, and rotation sums of squared loadings. This analysis demonstrated that nearly 98% of the variability in the variables was accounted for in the third cycle, with a minor loss of information (2%).

3.4 Scree Plot Determination

To determine the optimal number of components, eigenvalues from the initial solution were plotted on a scree plot. The scree plot illustrated a steep slope after the third cycle, suggesting that the first five components should be retained. Thus, a total of four components (Component 1, Component 2, Component 3, and Component 4) were selected for further analysis and interpretation (see Table 2).

Table 2. Localization Module Items

Localization	
Items	**Best-Fitting Adjective**
Consumable	Unconsumable
Meaningful	Meaningless
Sustainable	Not Sustainable
Competitive	Not Competitive

3.5 Evaluation of Localization Module

To establish the validity of the questionnaire, the primary goal was to minimize the time taken for users to complete the questionnaire. The validation study involved 45 respondents with IT backgrounds, a good understanding of website usability, and extensive experience using computers.

Participants were guided through a scenario designed to simulate a typical e-commerce browsing experience, specifically on the globally recognized website https://zara.com. This website was chosen due to its global presence, popularity, diverse user base, and comprehensive e-commerce features. Notably, Zara.com exhibited significant monthly traffic fluctuations between 2020 and 2022, peaking at approximately 111 million visits in January 2021 and decreasing to around 70 million visits in January 2022 (Statista Research Department, 2023). Additionally, Zara.com achieved an estimated six billion dollars in net e-commerce sales in 2022, highlighting its relevance for studying evolving trends and user behaviors in e-commerce.

3.6 Sampling Method

Convenience sampling was employed, wherein participants meeting the study criteria were invited to enroll (Wall, 2021). The test session comprised a series of steps to ensure participants understood and completed the tasks efficiently.

The scenario involved participants spending 4 to 5 minutes browsing the website, starting from the main page. They were tasked with finding a crossbody bag priced above RM200 in yellow color. Upon completing this task, participants were required to fill out the questionnaire. The time taken to complete the task varied between 7 to 44 seconds.

3.7 Reliability Study

To assess the reliability of the finalized four items in the questionnaire, Cronbach's Alpha was utilized. Table 3 demonstrates that Cronbach's Alpha coefficient was 0.85, indicating strong internal consistency among the four items. This suggests that the items reliably measure a consistent concept or aspect of the localization module.

Table 3. Reliability Study Result

Reliability Statistics	
Cronbach's Alpha	**N of Items**
0.85	4

3.8 Correlation Study

A correlation study was conducted to examine the relationship between the observed values of the localization module and the task completion times obtained through convenience sampling. The study aimed to identify a statistically significant correlation, with the expectation that a good correlation would have a r value ranging from +1 to -1, while an r value of 0 indicates no linear correlation. A significant p value was defined as $p < 0.05$.

The results, presented in Table 4, show a statistically significant correlation with a p value of 0.021 ($p < 0.05$). This indicates a meaningful relationship between the localization module's observed values and the task completion times, supporting the validity of the questionnaire.

Table 4. Correlation Study Result

Correlation with Observed Task Completion Times			
	Localization		**Time Taken to Finish Task (in seconds)**
Localization Module	Pearson Correlation	1	-.344*
	Sig. (2-tailed)		.021
	N	45	45
Time Taken to Finish Task (in seconds)	-.344*		1
	.021		
	45		45

3.9 Validation Study Result

The validation study confirmed that the questionnaire effectively measures the intended aspects of the localization module. The strong internal consistency (Cronbach's Alpha = 0.85) and the statistically significant correlation between the localization module and task completion times ($p = 0.021$) demonstrate the reliability and validity of the questionnaire. These findings support its use for assessing user experience in localized web application environments (see Table 5).

Table 5. Significant Study Result

UEQ Module	**Correlation with task completion time (r)**	**Significant (p)**	**Cronbach's Alpha**
Localization	-0.344	0.021	0.85

4. Conclusions

This study successfully answered the questions defined at the onset of the research journey. The primary goals were to identify items for the localization module, design an extended module of the User Experience Questionnaire (UEQ) based on the localization module, and evaluate the localization module.

Through a systematic literature review, we identified 45 possible items related to the localization module. Expert discussions and opinions were then solicited to refine and select the most representative items. This process led to the finalization of 36 items after filtering out items that appeared less than twice. Then, we further refined the list of items through expert selection, reducing it to 22 items. These items were then subjected to statistical analysis using SPSS, specifically through the rotated component matrix method. This analysis identified the top four items with the highest loading factors to be included in the final localization module. Lastly, the evaluation of the localization module, which was achieved using various statistical methods within SPSS. The correlation measure method and the reliability test via Cronbach's Alpha were employed to validate the finalized items. These methods demonstrated a significant correlation and confirmed the reliability of the items, thereby validating the localization module.

This study has made several significant contributions to the field of user experience evaluation, particularly through the introduction and construction of a new module named localization. This module is designed to evaluate the localization properties of a website alongside existing User Experience Questionnaire (UEQ) modules. Its development provides web developers with rapid feedback on how localized their website is, facilitating iterative improvements. Additionally, the study has provided a clear, step-by-step procedure for developing new UEQ modules, which can serve as a

valuable guide for future researchers. The identification of 45 items through a systematic literature review stands as a substantial contribution to localization studies, offering relevant data that can be utilized in other research endeavors focused on localization.

Despite its contributions, the study encountered certain limitations. The data collection process relied on video conference sessions, which introduced the possibility of participants interpreting and recording task completion times differently. Variations in recording times—whether starting or ending too early or too late—could lead to slight discrepancies in the data. Moreover, the use of remote interactions instead of face-to-face sessions might affect the consistency of time perception and recording. Another limitation pertains to the generalizability of the findings. Although the sample size was increased, the study may still have focused on a specific group or context. If participants shared characteristics such as age, profession, or cultural background, the findings might not be universally applicable to a broader population or different contexts.

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Author Contribution

Author1 proposed the methodology, conducted the data collection, and finalized the output. Author2 supervised the whole project and conceptualized the structure of the article writing.

Conflict of Interest

The authors have no conflict of interest to declare.

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