

A Comprehensive Review of Problem-Solving Approaches in User Experience Design

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ABSTRACT

The UX design process aims to improve the user's experience with the product. UX's aim is to attract visitors to a desired site and make their path from the home page to purchase easy and fun, as well as enhance a product's user experience. The user experience design process is divided into four major phases: user research, design, testing, and implementation. At the same time, it is crucial to remember that UX is an iterative process. A positive user experience boosts product uptake. A systematic review of UX case studies with a process-based approach will provide a better understanding for researchers to comprehend the UX Design process and utilize research analysis to meet the goals and requirements of existing research activities. This review will benefit and influence numerous stakeholders in the field of User Experience and research. UEQs, user surveys, ethnographic research, and interviews have been done to explore and examine the existing UX problems and their solutions. The UX process entails empathising, defining, ideating, prototyping, and testing the final results to produce solutions that meet the needs of a broader range of user views. The ambiguous use of interviews and surveys will help UX practitioners expand their ideas into a new primary research area. This review will benefit and influence numerous stakeholders in the field of User Experience and research.

Keywords -Experience design process; User surveys; UEQ; Reviews.

1. Introduction

Main text UX is essential since it strives to meet the user's demands. Its goal is to offer good experiences that keep customers loyal to the product or brand. A meaningful user experience also enables us to establish client journeys on our website that are most conducive to commercial success. [33].

A systematic review will give the researchers an idea of how to understand the UX Design process and use the research analysis to satisfy the needs and requirements of the existing research processes. This study aims to identify the critical aspects that support or are appropriate for modelling the User Experience process for researchers' current difficulties. This framework will help designers create more successful products in the future and make it easier for academics to evaluate their thesis with the appropriate framework. According to an examination of past User Experience Models, many components contributed to the process. There are a number of stakeholders in user experience and research that will benefit from this review. UX practitioners learn from the ambiguous use of interviews and surveys that uncover new primary domains for investigation.

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The user experience is a person's sensation when engaging with a system. This covers any human/device interaction, such as a website, smartphone application, desktop program, etc. The User Experience design process has been widely and extensively used to solve existing problems. Everyone's user experience is unique. The most essential thing to remember while creating a product is that even if we develop it, we may not be a prospective consumer who will utilise it. As a result, we cannot presume what a user wants or how they require it. Research to give the community a User Interface (UI) and User Experience (UX) learning solution so that excellent quality learning information may be correctly transmitted to the public. The research in the five phases contributes to developing the online course platform, which is a helpful and stable means to explore courses and guides. An efficient UI and extensive research can help solve technical educational problems. [40]

Regarding the Internet, the importance of User Experience (UX) cannot be emphasised since a website that is difficult to use, sluggish, or poorly planned out will lead visitors to quit while diminishing the associated brand's status. On a broader scale, (UX) is critical since its purpose is to completely meet the user's demands, striving to offer consistent, pleasant experiences that keep a user loyal to the product or brand. Research to make educational games more attractive focuses on giving players an immersive user experience (UX) via an emotional context. Educational game development should consider emotional and usability approaches while decentralizing the stigma created by gaming. Interviews taken from prominent game designers have helped to evolve the game strategically. [14] Awareness has to be made among teachers and students to use a gaming approach while learning and developing subsequent emotional quotients.

User experience aims to provide users with a meaningful product, service, or system by increasing their pleasure and perception of the value of the product, service, or system. To accomplish this aim, user experience designers must comprehend many disciplines, such as cognitive, psychological, and emotional elements and a traditional design technique, to develop a user experience that results in user pleasure. A competency model was developed for UX designers to meet their industry needs and demands. The Human-Computer Interaction and literature review done to examine all aspects of UXD helped to obtain well-rounded skillsets for designers. [9]. The UXD competence model showed all aspects of the well-rounded skills required for UX designers in the digital era.

The user experience (UX) process involves understanding, identifying, creating ideas, prototyping, and testing in order to find answers that meet a wide range of user needs. The objective of this paper is to review different research results in relation to User Experience Design. This review will help researchers, industry people, students, and teachers understand the process, method, and solutions, which will eventually help develop an interdisciplinary approach to the design process. A study regarding the comprehension and production capabilities of the interface regarding the internet, operating system, contents, and devices was published, and it was found that UI/UX professionals should be nurtured with professional

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course structure and methodical curriculum to build UI/UX comprehension and content creation capacity. [27]

2.Literature Review

The concept of User Experience (UX) has risen to the forefront of the user interaction with online products. Whether a person is working on an application, a web site, a medical device, or an educational resource, the experience in general will predetermine whether or not he or she will trust it, like it, and will return to it. In the literature, UX is considered not only as a technical process, but it is a humanistic practice consisting of psychology, design, emotions, and technology.

2.1 Foundations of UX

The researchers have always concurred that UX transcends usability. It concerns the emotions people experience when they use a product, whether they consider it useful, pleasant, intuitive and meaningful. According to the initial underlying researches, UX designers require a combination of talents, including mastering the human mind, in addition to designing interfaces. The process of UX, empathy, ideation, prototyping, and testing, is a roadmap of the development of solutions which really consider the needs of the users as opposed to the assumptions of the designer.

2.2 UX in Education

There is a lot of research dedicated to the learning platforms and educational apps. Numerous studies indicate that when children or students tend to work with tools that look clear, emotional, and user-friendly, the results of their learning are better. In VR-based anatomy courses, as well as in simple mobile learning apps, UX is an important element that contributes to keeping learners motivated and informed.

2.3 UX of Health and Assistive Systems.

There is another significant literature that deploys the UX concept in the field of healthcare-telemedicine, a tool to assist visually impaired individuals, smart health tools, and training simulators in the medical field. The evidence is that intuitive design is able to minimize stress, enhance the accuracy of prescribing treatments, and benefit patients and physicians. As an example, surgical training with VR allows perceiving complex procedures in a simplified way and practicing them. In the same fashion, the visually impaired may use context-based navigation.

2.4 UX in Autonomous Vehicles and Transportation.

Research on autonomous vehicles investigates the experience of safety, trust, comfort, and control of people in their interaction with self-driving systems. Even though most consumers say that they feel safe, researchers also observe potential biases since members do not necessarily have long-term exposure. Nevertheless, the general theme is evident; UX impacts significantly the way people embrace new mobility technologies within society.

2.5 UX in VR/AR and Immersive Interfaces.

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The use of immersive technologies relies on the comfort and realism. Studies of VR sports, medical simulation and learning in AR environments reveal that users respond favorably to virtual environments that are natural and responsive. Nevertheless, factors such as movement unease or eye-sight obstacles promote the cautious consideration of UX.

2.6 UX in Web sites, Applications and Web Systems.

The relevance of visual communication, emotional appeal, personalization, and the clarity of navigation is emphasized in the studies which address apps, websites, and search engines. Such tools as UEQ and SUPR-Q are used to gauge the attractiveness, efficiency, stimulation, and ease of use perceptions of a user. It has been demonstrated that even such minor changes as organizing buttons in a more convenient way or decreasing the level of cognitive load considerably improve user engagement.

2.7 UX to Behaviour Change and Sustainability.

Positive behaviours are being affected using UX. Eco-feedback and gamified surveys, as well as apps to calculate carbon, can be based on UX to motivate individuals to have a healthier or more sustainable lifestyle. Individualised rewards, positive response and clear visuals can keep users determined.

2.8 Summary of Gaps

- There are some gaps that reoccur in all spheres:
- There is no single framework of UX evaluation.
- Several researches are based on short-term or subjective measurements.
- Emotional, cultural, and contextual issues should be included more.
- There is still little long-term and large-scale UX research.

3. Methodology

In order to learn about the application of UX methods in various disciplines, this study has conducted a systematic review of research works. The idea was not complicated: examine how various UX methods, such as surveys, interviews, prototyping, UEQ, and usability testing, can be used to resolve real-life problems.

All the studies were analyzed in accordance with three major questions:

- Why did the research have to be done?
- Which UX methods were used?
- What were the findings and observations?

The results were collected into Table 1.1 that clearly represents a picture of UX cases in the fields of education, health care, transport, VR, mobile apps, etc.

The process of review was carried out through reading and analysing research papers, deriving the methodological decisions in them, comparing the results and drawing patterns. This methodology was useful in demonstrating where various approaches are more effective, and where they fail and how they could be used to create one more comprehensive UX evaluation model.

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Table 1.1. UX cases and their reviews

Purpose	Methods (Under UX process)	Result and observation
This study examines the distribution of data pertaining to various user activities and evaluates the waiting time and success rate of various user actions in various situations.	Review of Literature and interviews	Interviews and literature review has been done to study and understand the UX for social networking and its dimensions. Socially the experience has to embody human emotions and behaviors.[5] From an economical perspective the user base and its efficiency have to be taken into consideration.
This study analyses user experiences of autonomous public transportation in Baltic nations, with the ultimate objective of getting a better understanding of public requirements.	Between 2018 and 2019, surveys were collected to assess user experience along pilot projects constructing a public transportation route utilizing an autonomous electric minibus. To ensure enough data diversity, pilot projects were undertaken in a number of cities around the Baltic Sea Region.	The study to assess the User Experience of the public transport in the Baltic relic is done.[3] A survey has been conducted and analyzed which showed that passengers felt safe while commuting on self-driving cars as they felt safe and protected. Although the polls conducted have been proved bias towards the passengers going for AV's.
To assess the UX of Eden Farm application	Usability Questionnaire Method	The research was conducted to assess the UX of the Eden Fram application based on some effective criteria. Some of the criteria's being the satisfaction level, ease of using the application and ease of learning. [34] The Usability questionnaire method was used and the results were effective. The usability findings can be used to draw results for further researches that are going.
The creation of a customized tele guidance-based navigation aid system for the blind and visually impaired is described in this article.	The results of a usability and user experience research with 11 blind and visually impaired people and a sighted carer are presented. Participants used a smartphone camera connected to their chest to send a live video feed of their field of view to the remote caretaker's terminal.	Findings reveal that VIPs are pleased with the system's navigation aid, although they have different preferences [8]. Furthermore, the smartphone camera offered an acceptable field of vision for remote navigation aid; nevertheless, camera location and angle must be considered in future development.
To devise a method to compare user expectations and actual user experience	Card sorting method	More research is needed to have a better understanding of the method's capabilities and limits. [37] Furthermore, it must be examined whether UX practitioners find the results easy to comprehend and, more importantly, easy to convey in order to develop a shared understanding of the relevance of various UX components in project teams.

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Redesign of Chalmers' Student portal	The new design was developed in the web-based prototyping tool Figma	The design does provide a good experience for the users. When doing user testing, the use of emotional charts has proven quite useful in determining if the participants' opinion of the prototype was good or negative [18]
Evaluation of Learning Management Systems	Polled instructors about their perceived functionality, ease of use, and degree of happiness with LMS systems, and evaluated their subjective satisfaction with four LMSs, Canvas, Moodle, and Blackboard.	For a better understanding of how instructors engage with LMSs, future researches should explore evaluating objective outcomes like efficiency and effectiveness through pre-defined activities, as well as think-aloud sessions and interviews. [19]
This study investigates the link between the process of architectural storytelling and the creation of interactive experiences based on modern technologies.	Interviews and literature review	The results of the studies given seek to provide insight into how the built environment may be used as a stimulus to alter and improve human perception and experience of it. [17]
This article assesses the capacity of existing LCA tools to adapt to the early-stage PD environment by having users utilize the tools in practice and examining their experiences.	Literature review, interviews, and qualitative analysis	To expand on the outcomes of this study in order to make LCA and sustainable design more accessible to product designers [12]
The purpose of this article is to introduce the EduMobile UX model, a user experience paradigm that designers may utilize when creating educational applications for children.	To select the dimensions for the model, significant research was conducted. Semi-structured interviews and observation respondents from a public school in Tronoh, Perak were used to identify the elements for each dimension of the model.	Mobile application designers may use the Edu Mobile UX paradigm to create education mobile applications for school-aged children utilizing UX concepts.[29]
Affordable virtual reality (VR) surgical training	Eleven surgical trainees rotating through the gynecologic oncology section at the University Teaching Hospital in Lusaka were selected sequentially to participate in research assessing a VR radical abdominal hysterectomy training designed to simulate the experience in a Zambian hospital. Following the training, six people took part in semistructured interviews. Open and axial coding were used to examine the interviews, which were guided by grounded theory.	The VR simulator supplemented anatomical and clinical insights gained from other modalities. When mentored learning opportunities are few, VR enhanced learning may be very useful. [7]
The goal is to put physical realism, psychological fidelity, and construct validity of a VR golf putting simulation to the test.	To examine psychological and physical fidelity, self-report measures of task load and presence in the simulation were obtained following actual and simulated golf putting. The performance of novice and expert golfers in the simulation was also compared as an early test of construct validity.	Greater self-visualization fidelity may contribute to increased embodiment and presence in the simulation and may impact the development of sports abilities. [21]
The goal of this study is to characterize the user experiences of neurosurgeons and advanced practice providers (APP) in the care of elective neurosurgical patients, with an emphasis on the perceived value and obstacles of telemedicine.	An online survey was distributed to physicians participating in neurosurgical treatment utilizing telemedicine, with questions concentrating on the frequency of use, duration of patient interactions, advantages of telemedicine, and hurdles to existing types of remote patient visits. The poll results were divided into two categories: clinical position (neurosurgeon vs. APP)	Telemedicine was widely used throughout the COVID-19 period to ensure the continuation of perioperative treatment for patients with elective neurosurgical disorders. [44]. Despite the fact that doctors identified several hurdles to existing telemedicine platforms, the use of telemedicine is expected to continue since it provides distinct benefits to patients, clinicians, and institutions.

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	and subspecialty emphasis (cranial vs. spinal neurosurgery).	
To look into the impact of content, usability, functionality, and branding on user experiences using tourism-related search engines and metasearch engines.	The methodology used in this study took a hybrid approach in order to fulfill the proposed dual perspective, which was to collect data from websites and evaluate user experience.	Further research could test the proposed model in other tourist sectors and continue to identify new elements, such as collaborative customer relationship management (CRM) and new communication models linking supply and demand, which could help improve the model's representativeness for explaining user experiences.[50]
To improve the user experience of the blind people	UX process combined with design thinking	This study's findings show that a semantically richer, context-aware, and simplified user interface design combining several devices, such as a smartphone and a wristwatch, adds to a satisfying response.[30]
This paper describes a technique for developing mHealth apps and evaluating user experience design (UX) that provides a full list of stakeholder users and recognizes UX obstacles.	Literature review and Interviews	UX studies may be used to study and explain the embodied requirements and goals of every stakeholder-users of a mHealth app in order to provide the patient with an excellent healthcare experience. [31]
This study addresses the topic of volume dataset representation as a significant element of data storage and processing in a variety of disciplines such as science, research and development, health, and industry.	Literature review and data collection	In the future, we will concentrate on the structure and encoding of volume dataset segmentation metadata. Using lossless compression, the constant but relatively large ratio of metadata size to data block size may be considerably reduced. [35]. Hierarchical data structures can also be employed, however, their potential has yet to be explored.
The objective is to educate the user about their behaviors and encourage them to adopt more sustainable habits.	The study was carried out as a case study, and the data collected to learn about the many elements of using SUSLA was obtained through interviews with test users from all around Finland.	It is worth noting that the study only takes into account one CFC. O [45]. Overall, additional study is required, particularly when it comes to assessing UXs in various sorts of EFTs.
In utilizing mobile portable gadgets, the design approach is guided by user data.	An experiment to discover relationships between control gestures and musical characteristics including pitch, duration, and amplitude was done.	Although the results reveal some apparent tendencies, more testing is needed to further solidify these findings and investigate the parts where this experiment failed to produce definitive conclusions. [15]
The purpose of this study is to look at how users react to augmented reality-based learning media meant to help them learn cranial anatomy.	The User Experience Questionnaire (UEQ) is used in this study to assess user experience. The trial comprises 33 first- year foreign program medical students from Gadjah Mada University.	If the value obtained on each scale is more than 0.8, it is said to be positive.[42] The beauty value, on the other hand, earned the lowest scale average value, with a value of 0.788. Users of MAR-based Media Learning for Cranium Anatomy praised the availability of such technology.
The purpose of this study is to have a better knowledge of the acceptability of tourism applications accessible for marketing and tourism destinations.	The Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) was adopted to study the drivers of users' behavioral	The findings lead to a better understanding of user demands when deciding whether or not to download a

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	intentions for mobile tourism applications based on the quality and user experience of tourism apps.	mobile tourism app and utilize it at their location.[39]
The goal of this thesis is to develop prototypes that give a more intuitive and pleasant user experience when doing transanal irrigation.	Literature review and Interviews	The final prototype employs a combination of physical buttons that guarantee the user feels in control while conducting the treatment and a resistive touchscreen that allows for simple interaction with the interface[28].
The significance of the User Interface (UI), User Experience (UX), and Gameplay Experience (GX) in a video game has been demonstrated.	In order to determine the impact of users on video games in the form of UI, UX, and GX, a fast survey was conducted using Google Form for 60 participants, with only 52 respondents answering yes in question number 1, with 36 and 16 respondents being male and female, respectively. The 52 respondents are divided into four age groups, with 16, 24, 8, and 4 respondents being between the ages of 13 and 20, 21-30, 31-40, and over 41.	There is a potential that for the future project, each UI, UX, and GX should be measured in order to determine which video games have the greatest UI, UX, and GX scores. [32] Some Artificial Intelligence techniques, such as data mining, machine learning, deep learning, and so on, may be used to rank UI, UX, and GX for the top fantastic video games.
To find The Overlaps and Boundaries Between Service Design and User Experience Design	197 UXD and SD practitioners and academics were polled on their perceptions of the overlaps and limits between the two design approaches.	Our data indicate various competing perspectives on the breadth of UXD and SD labor, the subsumptive relationship between UXD and SD, and the theoretical underpinnings and methodologies on which each relies.[43]
The goal of this study was to evaluate the user experience (UX) (including usability) of a self-testing kit to identify COVID-19 antibodies used in automobiles by a representative sample of the general population in Northern Ireland, which comprised 1544 participants.	To conduct the testing, the participants followed the instructions (in Supplementary file): (a) Only warm water was used to clean the hands; (b) the blood sample was taken from the ring or middle finger of the non- dominant hand using the lancet; (c) the blood was collected using the blood collector; (d) blood was added to the test sample hole, and the test solution was then applied to the sample hole; (e) After 20 minutes, if C-line appears (indicating a successful test), the test findings were assessed by gazing via the viewing window.	The overall findings give insight into the potential for refining the design of SARS- CoV-2 antibody testing kits for wide public usage and hence guide procedures for future user experience studies of point-of-care diagnostics.[26]
User experience and perceived usability related to our automated vehicle and its driving system	The survey, interview, and literature review have been done.	Although participants indicated a reasonably high degree of desire to travel in our AV again in both situations (normal vs. fault), they reported a moderately pleasant experience and perceived usefulness.[34]
To test the impact that various interface designs and users' educational backgrounds have in task performance and subjective appraisal of the mobile terminal customization system	A structured interview revealed that the participants' general opinion of the interfaces was favorable, and they could all finish the modification work individually.	The combination of educational background and interface style may influence users' perceptions of system usability. [50]
Because older individuals are said to be increasingly spiritually oriented as they age, this study focused on spiritual user experience for older adult users.	A single case study with 11 participants was done to investigate the spirituality user experience aspects among elderly persons.	This model might serve as a reference for spiritual model creation applications among developers and as a resource for HCI academics.[1]

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To develop a theoretical model of user experience evaluation of micro-course.	Carried out research approaches, such as literature research, expert consultation, questionnaire surveys, the analytic hierarchy process, and others.	Based on the theoretical concept of micro-course assessment, we will build a micro-course evaluation index system and calculate the weight of the evaluation index. [49]
This study investigates the impact of a reusable mobile survey application that employs personalized gamification on user experience.	The Hexad Player Type Framework is utilized in an A/B research scenario with 28 participants to determine the user's player type and personalize the survey appropriately. [11]	Future research should look at the impact of more elaborate game components on a broader population.
To improve the user experience and naturalness of DialoGPT by smoothing the transition between related and meta conversation	A two-week trial involving 15 participants was carried out. Following the two weeks, the participants completed a questionnaire, and six of them were interviewed.[2]	Coherence is a critical characteristic in chatbots since without it, consumers would not engage with the chatbot.
This study suggests a more educated way to make that decision, particularly for road safety initiatives.	Contemporary research and interviews	The suggested approach may aid future research on the efficacy of technology by saving stakeholders time in deciding which technology to acquire and test.[52]
To research on UX	Literature review and research	Thus, UX in the sense of positive HCI would focus on how to generate exceptional quality experiences rather than just eliminating usability issues.[22]
To enhance Visual Communication through UX	Literature review, experiments, and research. [38]	Current research efforts to improve web design and user experience are being expanded.
This research is a multilateral analytical evaluation of the literature on UX and usability concerns in healthcare and medical device design.	88 scientific sources on the usability and user experience of medical-device design and healthcare were evaluated and systematized[8]	The amount of UX research in medical device design and healthcare technologies is insufficient.
This article presents a fresh angle on airport user experience as an area of research in order to maximize its potential as a foundation for strategic road mapping.	Literature review	The conceptual models presented, as well as the one provided in this study, demonstrate that there is considerable promise in a more in-depth and comprehensive examination of airport user experience [[50]
To offer to people in charge of a product a technique for developing a user experience key performance indicator (UX KPI) utilizing a UX questionnaire.	Six items were added to the UEQ to assess the significance of the UEQ scales. [23] We then created a User Experience Questionnaire KPI based on the UEQ scales and significance ratings (UEQ KPI). We generated and discussed the UEQ KPI in the first research with 882 people using Amazon and Skype.	The resultant UEQ KPI can be utilized as a key performance indicator for internal communication inside a company.
The goal of this article is to demonstrate the differences in user experience when completing an interactive activity in a simulation environment using GUI button arrangements based on Google Maps and OpenStreetMap.	Web map and GUI design, efficiency and eyeball movement data collecting, and data processing are among the study methodologies employed. We also showed the pool of participants and the experiment protocols.	Observing all of the corners (but not all of the buttons) to locate the suitable button leads us to propose grouping buttons with comparable interactive capabilities together (searching, routing). [16] Another suggestion is to place the buttons in the fewest amount of screen corners possible. Because the participant analyses all of the screen corners visually, the more corners a display employs, the more complicated the scanning route.

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To examine the factors impacting the EHR user experience	Literature review and research	There are several possibilities for regulators, lawmakers, EHR developers, payers, health system leadership, and users to work together to increase the usage and efficacy of EHRs.[51]
To measure the UX of the website	Five-year, three-part research including 4,000 user answers to encounters with over 100 websites yielded the Standardized User Experience Percentile Rank Evaluation, an eight-item questionnaire evaluating website quality (SUPR-Q).[48]	Finally, an initial distribution of scores across websites resulted in the creation of a database that was used to produce percentile ranks and make results more useful to researchers.

4. Result and discussion

After reviewing the research and studies on solutions produced by subsets of the UX design process, the result seems clear that the UX design process is fulfilling the needs and requirements of the solutions that need to be carried out. After all, we have a lesser probability of developing a successful UX product if we don't have a robust.

UX design process. On the other hand, a well-defined and well-executed UX process allows for the creation of outstanding user experiences. It's a methodical set of processes that helps us design, develop, and build a product - in our instance, an app. It enables us to be efficient, transparent and focused on producing the most excellent possible product. Sometimes, the whole process is not required to be structured, but some subsets of the process, when used dominantly, lead the problem statement to the solution. Process subsets have been used as separate methodologies, such as UEQs, reviews, interviews, surveys, and prototypes.

5. Conclusion and scope for future work

However, this review demonstrates that though the approaches to UX can differ, this can be interviews or surveys, prototypes or structured questionnaires, they all are significant in enhancing products and working out in solving actual user issues. Nevertheless, due to the general independent application of these methods in the research, the UX research remains disjointed.

In the future, there is a great necessity to develop a single UX framework that will integrate emotional, functional, social and contextual factors addressed in this review. A framework like that needs to be put to test by performing real life research, lifetime observation of users and cross industry experimentations in order to ascertain its universal applicability.

The other learning point is that the expectation of the users evolves with time. What is modern and intuitive today may be outdated in a couple of years. That is, UX models have to be adaptive and forward-thinking and capable of keeping up with the evolving trends and technologies.

In the end, an advanced UX framework will not only aid designers in developing more productive products but also assist researchers in the form of the reliable framework that gives them a clear idea on how to assess user experience in various fields and applications.

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