Research article

The use of User Experience Questionnaire Plus (UEQ+) for cross-cultural UX research: evaluating Zoom and Learn Quran Tajwid as online learning tools

Harry B. Santoso [a,*], Martin Schrepp [b], Lintang M. Hasani [a], Rian Fitriansyah [a], Arief Setyanto [c]

[a] Universitas Indonesia, Depok, Jawa Barat, Indonesia
[b] SAP SE, Walldorf, Germany
[c] Universitas AMIKOM, Yogyakarta, Indonesia

ABSTRACT

This paper aims to adapt and validate the User Experience Questionnaire Plus (UEQ+) in the Indonesian context. The UEQ+ is a modular extension of the User Experience Questionnaire (UEQ), which has been adapted to the Indonesian context and used in many studies. The UEQ+ was originally developed in German and English. As a modular extension, the UEQ+ has more user experience (UX) scales compared to the UEQ and can be used to evaluate products in special scenarios. Several steps were carried out to adapt and validate the UEQ+: translating the questionnaire into Bahasa by involving UX practitioners, evaluating the translation results by involving a UX expert and practitioners, and conducting face validity and reliability testing through two case studies (Zoom and Learn Quran Tajwid as online learning tools). The results showed that the findings from the open-ended questionnaire were consistent with the results of the six scales. Future work is needed to investigate whether the UEQ+ can capture some of the UX-related themes identified from the two case studies.

1. Introduction

Today's consumers can choose between a huge variety of products for nearly every aspect of their digital lives. In addition, most modern products are offered directly as cloud services, or can be easily installed using cloud delivery, and it is a simple matter to change to a competitor if a user is not happy with a product. Thus, it is crucial for the long-term success of a product in the digital market to reach a high level of user satisfaction or user experience and to maintain this level over the lifetime of the product.

But how can we find out if the user experience level of a product is sufficiently high and does not decrease over time? To answer these important questions, we need a method to measure user experience quantitatively. User experience, or UX, describes the subjective impression of users towards a product. Thus, it is a subjective measure and we need to ask users about their opinions to get an idea as to how good or bad a product is. Questionnaires are an adequate tool to measure UX and offer the possibility to capture feedback from larger target groups without great effort or cost, especially if they are realized as online questionnaires.

The UEQ+ is a modern UX questionnaire that follows a modular approach to UX measurement, i.e., it does not provide a fixed number of scales (which measure different aspects of user experience), but a larger

collection of scales from which researchers can pick those that are most relevant to the product under evaluation. To create interpretable and stable data, the questions or items in a UX questionnaire must be formulated in a way that is easy to understand for users of a product. If questions are misinterpreted by many respondents, it will create bias in the results. Thus, it is crucial that users can answer the questions in their natural language.

The original UEQ has already been successfully translated into the Indonesian language (Bahasa) and used in many evaluation projects. The development of the UEQ+ offers additional possibilities to measure UX, containing more scales than the UEQ and a different scale format. To make these new scales available for research activities in Indonesia and to help evaluate products in special scenarios, it is necessary to also provide a validated translation of UEQ+. Although UX research and studies are growing in Indonesia, the availability of UX measurement tools, including the development of the tools, are currently significantly limited in the Indonesian versions.

The aim of the current study is to adapt the UEQ+ into the Indonesian language and use it as a tool to assess the UX of a mobile application. The mobile application's features represent several aspects that can be evaluated using UEQ+ scales. The application has been used by millions of users across a number of countries, and the study is expected to be an example of cross-cultural research in the UX field.

---

2. Literature review

This section reviews works related to UX and its measurement, the UEQ+, and questionnaire adaptation.

2.1. UX and its measurement

User experience is a broad concept within the human-computer interaction domain. It refers to the thoughts, feeling, and perceptions of a user that are the results of the user's interaction with a product (Tullis and Albert, 2013). The notion of UX is sometimes mistakenly equated with usability. Norman and Nielsen (2006) suggest that UX refers to whole aspects related to the interactions between the end users, the company, and its products. On the other hand, usability refers to the quality aspects of the user interface of a product, such as its learnability, efficiency, memorability, error prevention ability, and the degree of user satisfaction towards the use (Nielsen, 2012). Therefore, the usability of a product is only one of the aspects that could influence a user's experience when interacting with the product.

Despite its wide scope, researchers have proposed various approaches to analyze UX qualitatively and quantitatively. Both approaches in UX studies can reveal certain patterns in users' behavior and perceptions that reflect the experience when using a product. However, qualitative approaches can give deeper narrative insights into "how" and "why" certain behaviors are exhibited by users when interacting with a product (Lazar et al., 2017; Rohrer, 2014). Such narratives can be further quantified to identify the recurring themes, which can provide further understanding of patterns in the data. An example of a qualitative UX study was conducted by Thach (2018), who quantified the identified themes from user reviews to evaluate five mental health apps. By quantifying the narratives, the study gained insights into patterns of user perceptions about features of the apps.

Quantitative UX studies, on the other hand, are directed at answering "how many" and "how much" types of questions (Rohrer, 2014). Tullis and Albert (2013) explained that the notion of UX could be measured quantitatively using several observable metrics encompassing various aspects such as efficiency, effectiveness, and user satisfaction that reflect the user's personal experience with a product. UX metrics consist of: (1) performance metrics; (2) self-reported metrics; (3) issue-based metrics; and (4) behavioral and psychological metrics. The performance metrics described by Tullis and Albert (2013) also measure the usability of a product, such as a task success rate, time on task, error frequency, and learnability. This demonstrates that usability is only one of the aspects that affects UX.

Several instruments have been developed to measure UX via surveys, which allow collection of data from larger target groups especially if realized as online surveys. The UEQ is one of these instruments and was developed to measure six UX and usability-related factors: (1) attractiveness; (2) perspicuity; (3) efficiency; (4) dependability; (5) stimulation; and (6) novelty (Laugwitz et al., 2008). It consists of 26 items that measure both classical usability factors as well as user experience factors. The UEQ has been developed further into UEQ-S (Schrepp et al., 2017), which is a shorter version of the original questionnaire containing just eight items, and UEQ+, which is a further extension of the original instrument to a modular approach.

The short version, UEQ-S, was developed for research scenarios in which the 26-item version requires too much time to be filled out. For example, assume a user just submitted their order in an online store. Triggered by the system, a questionnaire concerning the UX of the buying experience is launched. In such situations, the questionnaire must be short or the response rate will be low. Scenarios which require a short questionnaire and are thus typical application scenarios for the UEQ-S are described by Schrepp et al. (2017). The UEQ-S only measures two meta-factors, namely hedonic quality and pragmatic quality, which describe overall UX in contrast to the six detailed factors included in the original UEQ.

A problem in many practical applications is that the six existing UEQ scales may not cover all the UX factors relevant for the investigated product. For example, for a product used for daily work purposes (a programming environment, say, or a business application), efficiency is a key factor highly relevant for the overall perception of the UX; on the other hand, given the product's productivity-related applications, users will not object to expending some effort learning how to use it. Intuitive use will thus not be expected by users and is not an important aspect for the overall UX impression. For a product used to order goods over the web, the situation is different; no user will expect to spend significant time learning how to submit an order. In this case, intuitive use is expected and is a key factor in the success of the application; efficiency is not so central since the task is not done as frequently. Thus, how important a certain UX scale is for the evaluation of a product depends on the type of product and the usage scenario. A study by Santoso et al. (2016) showed that the importance of UX factors varied significantly for different types of products, but was quite consistent between different cultures.

Thus, which UX factors are relevant depends on the type of product, and this is the basic idea behind the extension of the UEQ to the UEQ+. The UEQ+ (Schrepp & Thomaschewski, 2019) is, in fact, not a questionnaire but a framework to build UX questionnaires adapted to the needs of a research question. It consists of a set of UX scales that can be combined to form a concrete questionnaire. Currently, the UEQ+ contains 20 scales (see ueqplus.ueq-research.org for the available scales and additional information and materials). The six UEQ scales are, of course, included in this collection but the scale format differs from the UEQ in some details since it is required that a researcher can combine a selection of available scales in any order.

All items of a scale are therefore grouped, and a sentence added to provide context for the correct interpretation of the terms. The importance of a scale in the overall judgment of the UX of the evaluated application is added below. The importance ratings are used to weigh responses to a scale and calculate a key performance indicator (KPI) over all items and scales (which is not available in the UEQ). Schrepp and Thomaschewski (2019a,b) provided details about the calculation of the KPI. Thus, a scale in the UEQ+ has a certain format (as an example, we present the scale Efficiency in Table 1).

The UEQ+ measures UX based on 20 factors, including the six factors in the UEQ. The other 14 factors were included based on the results of several studies. Figure 1 illustrates the different scope of UX measurements among the UEQ, UEQ-S, and UEQ+, as well as the relevant studies that developed the items included in the questionnaires.

As shown in Figure 1, the UEQ-S, UEQ, and UEQ+ measure the notion of user experience with a different scope of scales. The UEQ-S measures just the two meta-scales Pragmatic and Hedonic Quality; the UEQ gives a fine granular measurement on six scales, while the UEQ+ is a modular extension that allows selection from 20 scales (the recommendation is to select no more than five or six scales per study).

2.2. Use of UEQs

Studies have shown how UEQs can be used to measure UX in several fields. In this paper, we show examples in the areas of online learning, e-government, e-health, and e-commerce.

Table 1. A sample of scale Efficiency.

To achieve my goals, I consider the product as								
Slow	o	o	o	O	o	o	o	Fast
Inefficient	o	o	o	O	o	o	o	Efficient
Impractical	o	o	o	O	o	o	o	Practical
Cluttered	o	o	o	O	o	o	o	Organized
I consider the product property described by these terms as								
Completely irrelevant	o	o	o	O	o	o	O	Very important
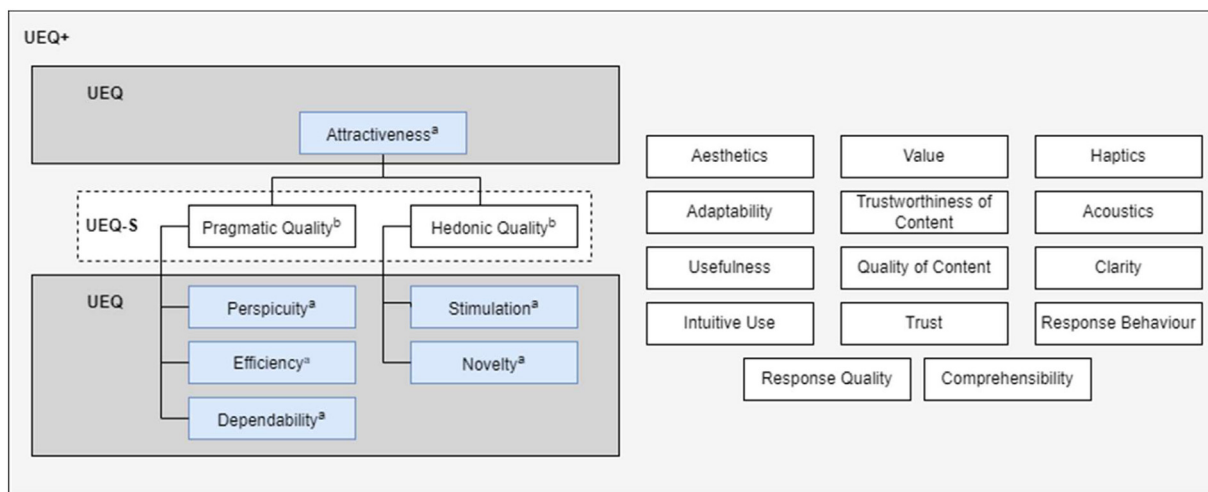
Notes: [a] the scales included in the UEQ; [b] the meta-scales of the UEQ-S

Figure 1. Illustration describing the scales measured by the UEQ-S, UEQ, and UEQ+.

In online learning, the UEQ has been used in a student-centered e-learning environment at the Faculty of Computer Science, Universitas Indonesia (Santoso et al., 2016) to develop an adapted version of the questionnaire and evaluate the university's learning management system. Another study by Syahrir and Sfenrianto (2019) investigated an online learning environment at an anonymous university using the UEQ as a quantitative method and Heuristics Evaluation as a qualitative method with the same purposes as the previous study. The only difference is that the previous study used the direct interview as the qualitative method.

For an example from the field of e-government, a study identifying UX with e-government online services at Indonesia's Ministry of Religious Affairs used the UEQ as its instrumentation (Prakoso and Subriadi, 2018). Within the e-health context, Guldager et al. (2020) identified Danish adolescents' experience of Virtual Alcohol Prevention Simulation using the UEQ as the quantitative method and focus group interviews as the qualitative method. Febrianto, Putra, and Perdanakusuma (2019) investigated the information system of a health center in Sidoarjo Regency, Indonesia, using the UEQ and usability testing to see and review users' experience of the system. From the e-commerce field, studies by Intanny et al. (2018) and Lukita et al. (2018) used the UEQ as a framework to measure e-commerce UX.

Updating the UEQ as the UX framework is important due to technology becoming more advanced over time. More technology would be applied and, thus, more UX attributes would be added to the UEQ. This study adapts the UEQ from an Indonesian perspective for cross-cultural UX research.

For more information concerning the UEQ and UEQ-S, see www.ueq-online.org. For an overview of typical application areas of the UEQ, a Google Scholar search for the Laugwitz et al. (2008) paper currently lists more than 1,000 citations, many describing concrete applications of the questionnaire in different domains. More information concerning the UEQ+ can be found at www.ueqplus.ueq-research.org.

2.3. Questionnaire adaptation for cross-cultural UX research

Cultural background plays an important role in UX on both the developer and user sides. Cross-cultural research was carried out by Rajanen et al. (2017) among UX professionals. They collected perceptions of usability and UX concepts from 400 UX professionals in Turkey, Finland, Denmark, France, and Malaysia and reported significant disagreement about UX concepts under different socio-cultural backgrounds.

On the user side, researchers agree that cultural background plays an important role in user perception towards the software-user interface, and some research has focused on the influence of cultural background on user behavior (Aladwani, 2013; Cheng et al., 2019; Lachner et al., 2018; Mazaheri et al., 2011; Richard and Habibi, 2016). A comparison of user perceptions towards e-government interfaces between British and Kuwaiti citizens was carried out by Aladwani (2013), who reported significant variations between the respondents in terms of perceived performance of quality attributes. Lachner et al. (2018) reported the effect of cultural differences between Germany and Vietnam toward user interface design preferences. On an e-commerce site, Chinese and Canadian users were observed to behave differently (Mazaheri et al., 2011). Richard and Habibi (2016) observed different online customer behavior between three major cultures: North American, Chinese, and Middle Eastern. Cheng et al. (2019) focus on color preferences between Taiwanese and German e-commerce users, finding that the Taiwanese sample showed more favorable responses for red than blue while German customers responded the opposite.

Questionnaire adaptation, therefore, needs to take into account cultural differences in order to understand UX accurately and avoid cultural bias. The UEQ has been adapted in many languages and the transformation process consists of some general tasks: forward translation, synthesis, back-translation, and the final synthesis or agreement (Cota et al., 2014; Rauschenberger et al., 2013). Cota et al. (2014) adapt the UEQ in a Portuguese version, while Rauschenberger et al. (2013) work with the Spanish language. Adaptation of the UEQ in the Indonesian language was reported by Santoso et al. (2016).

3. Method

3.1. Study phases

Several steps were carried out to adapt and validate the UEQ+: translating the questionnaire into Bahasa (forward translation) by involving UX practitioners; evaluating the translation results by involving a UX expert and practitioners conducting face validity and readability testing; and conducting two case studies to test the reliability of the instrument. Figure 2 illustrates the UEQ+ adaptation and validation steps.

During the forward translation step, three UX practitioners conducted forward translation of the original UEQ+ by Schrepp and Thomaschewski (2019a,b). Three initial versions of the UEQ+ in Bahasa were

obtained, and were discussed by a panel of three UX experts and practitioners in order to formulate one translated UEQ+ version. The version was then used in a readability test conducted through an online survey involving 23 participants. The survey consisted of open questions regarding the accuracy and readability of the translated items. The issues revealed by the survey were discussed again by the UX expert panel to decide on the final translated items. The final items were used in two case studies aimed at testing the reliability of the instrument. The case studies are described in the following sections.

3.2. Participants and context of the study

The study involved UX evaluations of two applications, namely Learn Quran Tajwid (LQ Tajwid) and Zoom, as two case studies for validating the UEQ+. The users of both applications were asked to fill in the UEQ+ online questionnaire. A number of LQ Tajwid users from different regions in Indonesia were invited to participate in the study. They had downloaded and used the app to practice the articulation of reciting the Quran. Moreover, 123 Zoom users were invited to fill in the UEQ+ online questionnaire. The Zoom users were university students who had used the platform for distance learning.

3.3. Instrumentation and case studies

The UEQ+ was developed by Schrepp and Thomaschewski (2019a,b) and consists of 20 scales: Attractiveness, Efficiency, Perspicuity, Dependability, Stimulation, Novelty, Trust, Haptics, Acoustics, Personalization, Usefulness, Value, Visual Aesthetics, Intuitive Use, Trustworthiness of Content, Quality of Content, Clarity, Response Behavior, Response Quality, and Comprehensibility. It is recommended that researchers delete any scales not required for their UX measurement. Each scale has four pairs of terms with opposite meanings that span a semantic dimension. For example, the Quality of Content scale has four contrasting descriptions: obsolete/up to date; not interesting/interesting; poorly prepared/well prepared; and incomprehensible/comprehensible. Table 2 shows the UEQ+ scales and their explanation.

Some of the scales can only be applied to certain types of products. For example, Response Behavior, Response Quality, and Comprehensibility are designed to measure the quality of voice systems. Another example is Haptics, which only makes sense for products that are held when operated. Other scales, for example Efficiency or Usefulness, are universally applicable.

This study employed six UEQ+ scales (Attractiveness, Novelty, Acoustics, Value, Trustworthiness of Content, and Quality of Content) to validate the adapted version of the UEQ+. The six scales were used to measure the UX of Zoom and LQ Tajwid in separate case studies. We present a brief description of the two applications.

3.3.1. Application for case study 1: Learn Quran Tajwid

The pronunciation of the Arabic language used in the Quran differs from contemporary standard Arabic, and teaching such a pronunciation requires a specific approach especially for non-Arabic speakers. LQ Tajwid is an m-learning application developed for teaching Quran recitation techniques that offers lessons in English and several other languages. LQ Tajwid has been downloaded more than 1.6 million times by users from many countries.

LQ Tajwid offers several main features for learning Quranic recitation: voice-over recording, recitation recording, Latin transliteration of Arabic texts, Quranic words, placement test, test result, and bookmark. For the voice-over recording, the application provides high-quality recordings of Quranic recitation from renowned Quran reciters and Hafiz (those who have memorized the Quran). Moreover, the transliteration used in the application is verified by notable Quran scholars. LQ Tajwid also aims at delivering an excellent learning experience by offering a simplified user interface. Based on these features, several scales suitable to be investigated were selected: Attractiveness, Novelty, Acoustics, Value, Quality of Content, and Trustworthiness of Content (described in Table 3).

There are three main scenarios for using LQ Tajwid: (a) understanding concepts and know-how, (b) practicing, and (c) doing assessments. Figure 3 illustrates these learning scenarios. For understanding the concepts and know-how of Quranic recitation, the application offers detailed
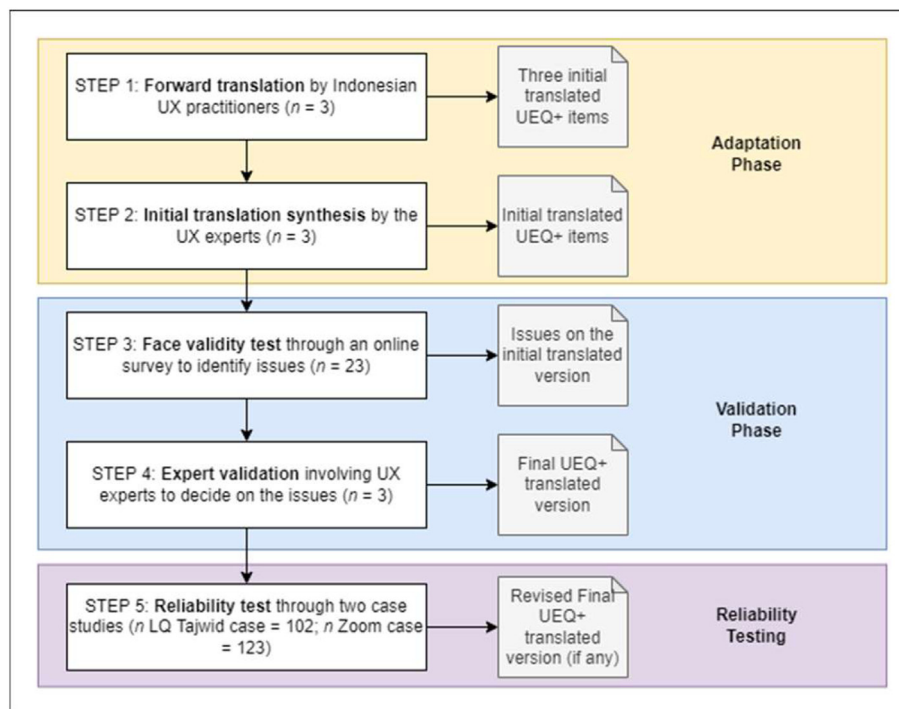

Figure 2. UEQ+ adaptation and validation steps.

Table 2. UEQ+ scales and explanation.

Scale	Explanation
Attractiveness	Overall impression of the product. Do users like or dislike it?
Efficiency	Can users solve their tasks without unnecessary effort? Does it react quickly?
Perspicuity	Is it easy to get familiar with the product and to learn how to use it?
Dependability	Does the user feel in control of the interaction? Is it secure and predictable?
Stimulation	Is it exciting and motivating to use the product? Is it fun to use?
Novelty	Is the design of the product creative? Does it catch the interest of users?
Trust	Are users' data in safe hands and not misused to harm them?
Haptics	Feelings that result from touching the product.
Acoustics	Impact of product sound or operating noise on the user experience.
Adaptability	Can the product be adapted to personal preferences or personal working styles?
Usefulness	Does using the product bring advantages?
Value	Is the product design professional looking and of high quality?
Visual Aesthetics	Does the product look beautiful and appealing?
Intuitive Use	Can the product be used immediately without any training or help?
Trustworthiness of Content	Is the information provided by the product of good quality and reliable?
Quality of Content	Is the information provided by the product actual and well prepared?
Clarity	Impression about the order, structure, and visual complexity of a graphical user interface.
Response Behavior	Does a voice assistant behave respectfully, politely, and in a trustworthy manner?
Response Quality	Do the responses of a voice assistant cover the users' information needs?
Comprehensibility	Does a voice assistant correctly understand the users' instructions and questions using natural language?

explanations, voice-over recordings, figures, animated video, and practical video. After learners have familiarized themselves with the technique, they can move to the next learning scenario: learning by practice.

Regarding practice, the application shows examples of Quranic words to be recited by the learners. LQ Tajwid provides correct examples for each Quranic word, thus enabling the learners to correct their recitation independently. After some practice, the learners can assess their learning outcomes by taking the test.

As for the assessment, the application offers two types of test: (a) a quiz with multiple choices, true or false, and multiple answer questions, and (b) a live recitation test attended by a teacher. These tests assess the users' learning outcomes.

3.3.2. Application for case study 2: zoom

Zoom is a meeting and webinar tool widely used in working and learning activities, among other similar commercial tools such as Google Meet and Cisco Webex. There are also open-source meeting tools such as Big Blue Button (https://bigbluebutton.org/) and Jitsi Meet (https://jitsi.org/). However, Zoom is currently one of the most popular video-conferencing tools.

In general, Zoom allows synchronous audio-video communication among users and has many important features to enable online teaching. It works on Windows, Linux, Android, and Mac operating systems. Users in a Zoom meeting are divided into three types: host, co-host, and participants. Host and co-host control the meeting; they control who can join the meeting, access certain features such as presenting, participate in collaborative screen control, open microphone, camera, etc.

Besides its basic feature, Zoom allows its users to share presentations and collaborate in real time using a shared screen. It allows the instructor or host of the meeting to share interactive quizzes in order to improve participants' engagement. Moreover, Zoom provides a whiteboard where presenters can share their handwriting and draw interactively. This feature is extremely useful when discussing mathematical formulas or giving drawing lessons. To handle more-focused discussions, Zoom allows the host to divide participants into smaller groups using breakout rooms. In terms of connectivity, Zoom allows broadcasting the meeting synchronously through YouTube.com, Facebook, and other broadcasting software services. Video archives are provided in local storage as well as in cloud facilities.

3.4. Data collection procedures

Data were collected from the UEQ+ through an online survey from November 2020 to December 2020. Respondents are categorized into two groups: LQ Tajwid users and Zoom users. Before filling in the questionnaire and open-ended questions, respondents were asked to reflect on the application they used (i.e., LQ Tajwid or Zoom) by recalling their general experience. Over the survey period, 102 LQ Tajwid users and 123 Zoom users participated in the study.

3.5. Data analysis

The collected data were analyzed using descriptive statistics and qualitative content analysis. Data included respondents' answers to the UEQ+ questionnaire and open-ended questions related to respondents' experiences while using LQ Tajwid and Zoom. An Excel-based calculation tool was used to analyze UEQ+ data. In addition, MAXQDA software was used to analyze qualitative data, i.e., the respondents' answers to open-ended questions.

The data analysis tool contains the following worksheets: Data_Items (observed data for the items in each scale); Data_Importance (observed data concerning the importance ratings of the scales); Means (means, standard deviation, confidence intervals for the scales, importance ratings, and single items); Consistency (Cronbach's alpha value and correlation of all items in each scale); KPI (an overall KPI calculated from the items and importance ratings); and Texts (contains the texts for the scale names and items).

Table 3. Selected UEQ+ scales to evaluate the LQ Tajwid

| Scale	Explanation
Daya Tarik (Attractiveness)	LQ Tajwid developed in a mobile application has a certain appeal compared to web-based applications.
Kebaruan (Novelty)	LQ Tajwid is an application with a new approach for those who are learning or improving the quality of how to read the Koran.
Akustik (Acoustics)	LQ Tajwid provides audio and video recitation for users to learn how to correctly recite the verse or example given by the app.
Nilai (Value)	LQ Tajwid has been assured by a quality assurance engineer to ensure high-quality application and has been designed by a professional user interface designer to make it look more elegant.
Kualitas konten (Quality of Content)	The application's contents are advised by four expert Quran scholars, and it has been certified by the chief of the Quran Correction Committee, Indonesian Ministry of Religious Affairs, and former rector of Institut Ilmu Al-Qur'an.
Tingkat Kepercayaan Terhadap Konten (Trustworthiness of Content)	LQ Tajwid provides a page that explains that the content has been verified by four expert Quran scholars. The application received 4.8 out of 5 stars on Android reviewed by 26,447 users and 4.7 out of 5 stars on iOS reviewed by 1,300 users on February 21, 2021.
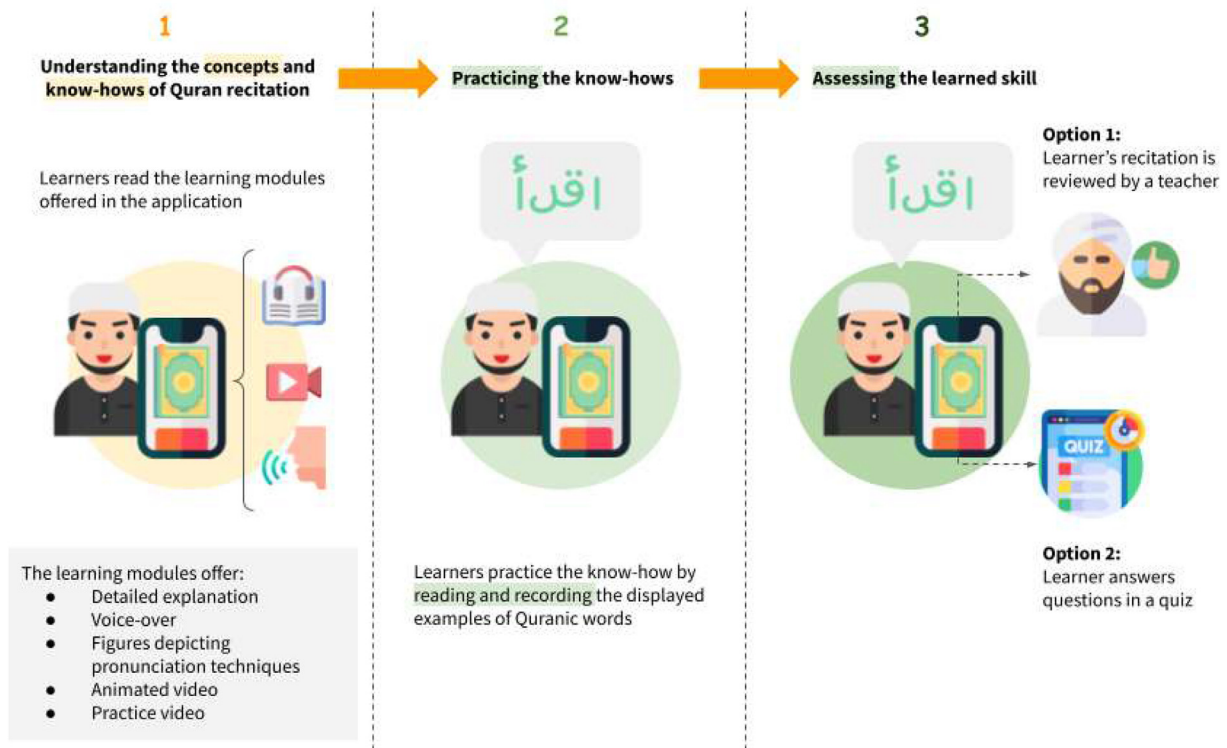
Figure 3. Learning scenarios for LQ Tajwid. *Note:* This figure has been designed using resources from Flaticon.com.

Table 4. Mean and confidence interval per scale for LQ Tajwid

Scale	Mean	Variance	Std.dev.	N	Confidence	Confidence Interval
Attractiveness	2.47	0.94	0.97	102	0.19	2.28–2.66
Novelty	2.25	1.32	1.15	102	0.22	2.03–2.47
Acoustics	1.66	2.47	1.57	102	0.30	1.35–1.96
Value	2.37	0.95	0.97	102	0.19	2.18–2.56
Trustworthiness of Content	2.63	0.45	0.67	102	0.13	2.50–2.76
Quality of Content	2.49	0.65	0.81	102	0.16	2.33–2.64

Table 5. Mean importance ratings for LQ Tajwid

Scale	Mean	Variance	Std.dev.	N	Confidence	Confidence Interval
Attractiveness	2.42	0.86	0.92	102	0.18	2.24–2.60
Novelty	2.47	0.67	0.81	102	0.16	2.31–2.63
Acoustics	2.38	0.81	0.90	102	0.17	2.21–2.56
Value	2.48	0.67	0.81	102	0.16	2.32–2.64
Trustworthiness of Content	2.63	0.55	0.74	102	0.14	2.48–2.77
Quality of Content	2.56	0.49	0.69	102	0.13	2.42–2.69

4. Findings and discussion

This section elaborates on the findings in addressing our research objective.

4.1. Findings related to LQ Tajwid user experience

This section presents the LQ Tajwid UX of the six scales of the UEQ+, namely Attractiveness, Novelty, Acoustics, Value, Trustworthiness of Content, and Quality of Content. The results are presented in Table 4.

Table 6. Scale consistency of the UEQ+ from the LQ Tajwid case study.

Scale	Cronbach's alpha
Attractiveness	0.94
Novelty	0.96
Acoustics	0.75
Value	0.91
Trustworthiness of Content	0.95
Quality of Content	0.90

The results show that the means were transformed from -3 to +3 and the results were all positive. The mean values of all the scales were >1, which shows an excellent result for Learn Quran apps. Furthermore, the confidence interval in which values were all >1 shows a good confidence level for the results. The UEQ+ scale also provides the mean importance ratings and shows the importance of a scale based on the value, as can be seen in Table 5.

The mean importance rating value for LQ Tajwid shows that all of the scales are important. The means and confidence intervals were >2 in all scales and indicate that users consider all of the scales to be relevant to
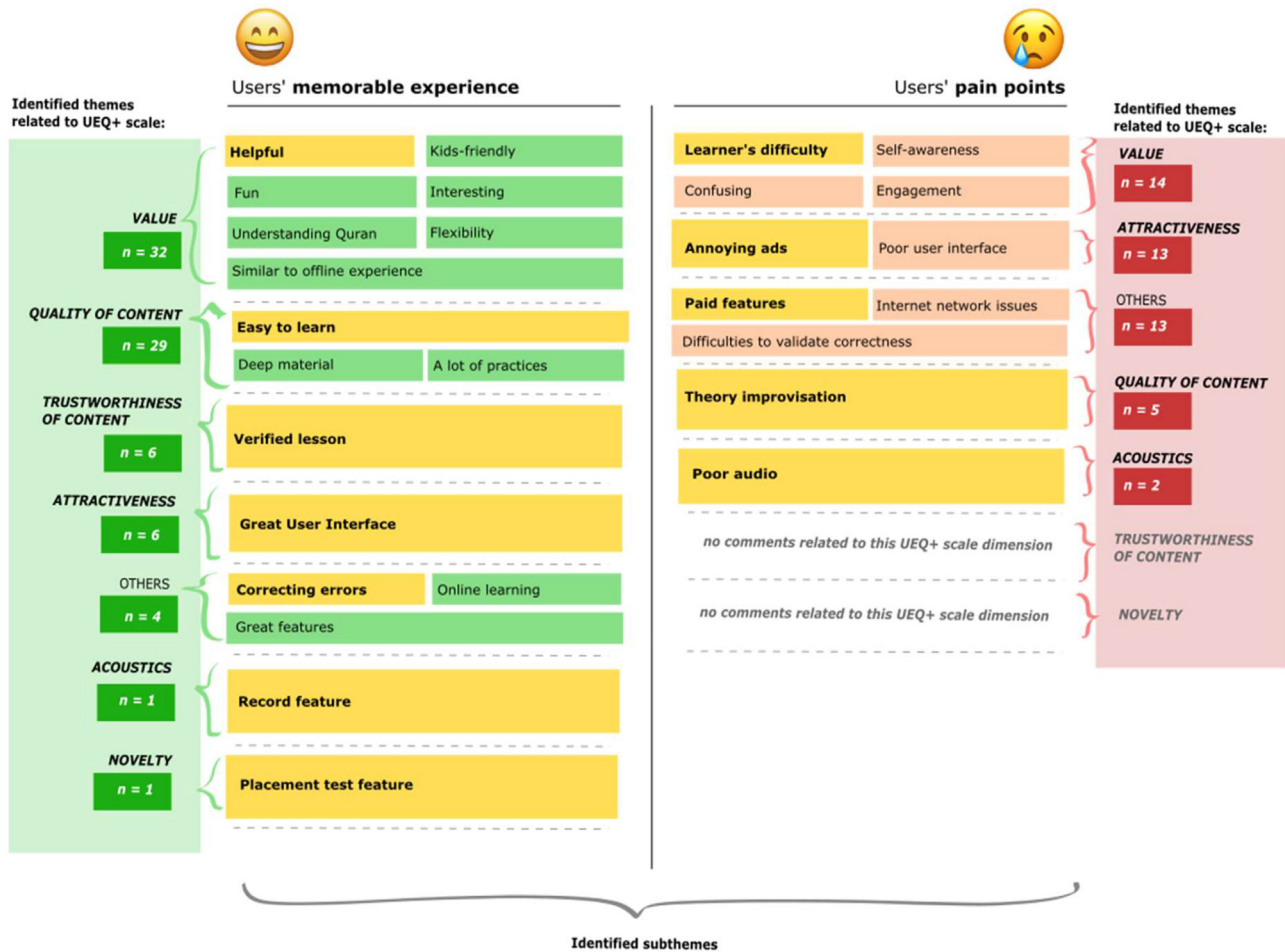
Figure 4. Users' memorable experiences and pain points when using LQ Tajwid

Table 7. Mean and confidence interval per scale for Zoom.

Scale	Mean	Variance	Std.dev.	N	Confidence	Confidence Interval
Attractiveness	1.60	1.42	1.19	123	0.21	1.39–1.81
Novelty	1.59	1.46	1.21	123	0.21	1.37–1.80
Acoustics	0.96	1.94	1.39	123	0.25	0.71–1.21
Value	1.67	1.34	1.15	123	0.20	1.47–1.88
Trustworthiness of Content	1.60	1.44	1.20	123	0.21	1.39–1.81
Quality of Content	1.70	1.32	1.15	123	0.20	1.49–1.90

Table 8. Mean importance ratings for Zoom.

Scale	Mean	Variance	Std.dev.	N	Confidence	Confidence Interval
Attractiveness	1.57	0.98	0.99	123	0.17	1.39–1.74
Novelty	1.68	0.99	0.99	123	0.18	1.51–1.86
Acoustics	1.38	1.55	1.24	123	0.22	1.16–1.60
Value	1.59	1.19	1.09	123	0.19	1.40–1.79
Trustworthiness of Content	1.67	1.29	1.13	123	0.20	1.47–1.87
Quality of Content	1.63	1.20	1.09	123	0.19	1.44–1.83

Table 9. Scale consistency of the adapted UEQ+ from Zoom case study.

Scale	Cronbach's alpha
Attractiveness	0.87
Novelty	0.87
Acoustics	0.88
Value	0.90
Trustworthiness of Content	0.90
Quality of Content	0.89

the LQ Tajwid apps. The UEQ+ also calculates Cronbach's alpha showing the consistency value across the user's opinion in all of the scales, and can be seen in Table 6.

All the scales have a Cronbach's alpha value > 0.7, showing all scales were consistent. However, Acoustics was near 0.7 in value meaning that the scale has some different perspectives across users. The details of the perspectives can be seen in the qualitative analysis.

Figure 4 illustrates the identified subthemes within the LQ Tajwid app. We divided it based on users' responses to open-ended Question 1 (memorable experience) and open-ended Question 2 (pain points). The subthemes were extracted from the LQ Tajwid selected UEQ+ scale. The

Note: Contrasting users' views are highlighted in yellow text boxes.

Figure 5. Users' memorable experiences and pain points when using Zoom.

Others scale means there were other issues that need to be captured in future.

In memorable experiences, the significant issues were in the Value scale ($n = 32$). Most users thought the LQ Tajwid app was helpful to them but, on the other hand, the most significant issues in pain points were also in the Value scale ($n = 14$). It points out that there are significant issues in learners' difficulty. This shows that the app is helpful, but the learner still needs the teacher's guidance with the app. The second most memorable experience was in the Quality of Content scale ($n = 29$). Most users thought the content easy to learn but, based on the user's pain points perspective in the Quality of Content scale ($n = 5$), it could still be improved especially in the theory part of the app.

Other memorable experiences were not as significant as the top two scales, like Trustworthiness of Content ($n = 6$), Attractiveness ($n = 6$), Acoustics ($n = 1$), and Novelty ($n = 1$). Even though the Trustworthiness of Content and Novelty were not significant, the users had no pain points on the related scales.

As for the pain points, the top three of the scales (Value, Attractiveness, and Others) were affecting users. LQ Tajwid users were still not attracted to the application due to annoying ads. Most of the users were free users, so they were subjected to ads while using LQ Tajwid. Moreover, there are a number of issues not covered by the current scale (e.g., paid features, internet network issues, and difficulties to validate correctness). These issues should be captured in future work to easily group and analyze them despite the users' experience. On the Others scale in memorable experiences, LQ Tajwid could correct user errors. While some of the issues were conflicting (e.g., easy to learn vs. learner's difficulty or great user interface vs. poor user interface), it shows that each user had different experiences and knowledge while using the LQ Tajwid app.

4.2. Findings related to zoom user experience

Identical to LQ Tajwid, this study also measured Zoom UX using six scales of the UEQ+, namely Attractiveness, Novelty, Acoustics, Value, Trustworthiness of Content, and Quality of Content. The results of the six scales are presented in Table 7.

The means shown in the table were transformed values in a range from -3 to +3. All scales' means were positive. However, the scale of Acoustics has a lower mean in comparison to other scales. It also has a coefficient of variance (CV) ≥ 1, which indicates that a relatively high variance was observed. Thus, there was a possible UX issue regarding Zoom's acoustic qualities.

Apart from providing the mean of each UX scale, the UEQ+ also provided the mean importance rating for each scale. The means for Zoom are presented in Table 8.

The table shows that all scales have a positive mean importance rating and indicates that the users considered all scales used in the measurement were relevant to the UX of Zoom. Moreover, all scales have Cronbach's alpha value ≥ 0.80 which indicates that the adapted version of the UEQ+ used in measuring Zoom UX had excellent consistency. Cronbach's alpha with a value ≥ 0.80 is considered fairly high and adequate (Taber, 2016), and the value for each scale is shown in Table 9.

Apart from analyzing the quantitative results, this study also retrieved open-ended responses which reflected the users' experience with Zoom. The open-ended responses include the users' memorable experiences, pain points, and suggestions for improvement. The themes of users' memorable experiences and pain points were mapped to the scale of the UEQ+ to aid in the interpretation of results. A summary of the results of users' memorable experiences and pain points is given in Appendix 2 and, for convenience, the results are illustrated in Figure 5.

The figure shows the subthemes identified from Zoom users' responses to open-ended Question 1 (memorable experience when using Zoom) and open-ended Question 2 (pain points when using Zoom). The subthemes were grouped into the six UEQ+ scales or qualities that were used to measure the user experience. Figure 5 provides several groups of subthemes that explain users' views on Zoom based on UEQ+ qualities of Value,

Attractiveness, Quality of Content, and Acoustics. The results confirm that the qualities were captured well by the adapted UEQ+ instrument.

Subthemes that were unrelated to those qualities were grouped in the Others theme. A significant number of users who expressed different issues classified as Others reflects a need to include more scales to capture these aspects.

Regarding users' memorable experience, the majority tended to emphasize the Value of using Zoom (e.g., provides useful features, supports various activities, etc.) instead of focusing on the Trustworthiness of Content and Novelty. Regarding users' pain points, the majority ($n = 98$) tended to report other issues unrelated to the used UEQ+ scales (e.g., internet network issues, time limit, etc.). Furthermore, a significant majority ($n = 22$) emphasize issues related to the Value of using Zoom (e.g., troubles in using features, being a heavy load application, etc.).

As shown in Figure 5, there are conflicting identified subthemes regarding certain issues (e.g., Zoom is more interactive vs. Zoom has limited interactivity) which are highlighted in yellow text boxes. Despite this contrasting difference, the quantitative results, as shown in Table 9, indicate adequate scale consistency which implies that the adapted UEQ+ instrument is reliable in measuring the six UEQ+ scales. These findings reflect that different groups of users had different experiences when using Zoom and had different views on such experiences. The qualities of Trustworthiness of Content and Novelty were not reflected in the responses to both open-ended questions, indicating that users did not consider these qualities as having a significant impact on their overall Zoom experience. Nevertheless, both qualities have a positive mean of importance rating, as shown in Table 8, thus making both qualities relevant for inclusion in the measurement.

5. Conclusion and further work

The UEQ+ scales are new in terms of tools for validating product experiences with larger scales than UEQ, especially in the Indonesian context. Our research shows that these scales can be used effectively for validating LQ Tajwid and Zoom experience by using suitable scales for each product and appropriately translating the UEQ+ scales into Indonesian language.

For LQ Tajwid, our research concludes that the app is excellent in all of the scales that were measured (Value, Novelty, Attractiveness, Trustworthiness of Content, Quality of Content, and Acoustics). All the scales were identified as important by users and, thus, the results corresponded to the importance ratings of the scale. Our research also shows that the values scattered along the scale were consistent, indicating that users' opinions were directed into positives rather than negatives. LQ Tajwid is considered to be excellent in its type of app but users still have pain points, especially in learning difficulty, annoying ads, and other issues not captured within current scales.

Further work could be directed at investigating whether the UEQ+ can be widely used, and not limited to LQ Tajwid and Zoom applications. Moreover, it also can identify different user behavior resulting from the use of other products, which may be different from LQ Tajwid and Zoom cases.

According to the findings from the LQ Tajwid case study, further research could be undertaken based on other pain points that were not captured in the current scale. Furthermore, the findings from the Zoom case study showed that further work could be conducted on investigating whether other UX qualities included in Figures 4 and 5 as a separate theme labeled Others can be captured by other UEQ+ scales.

Declarations

Author contribution statement

Harry B. Santoso: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Martin Schrepp: Conceived and designed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Lintang M. Hasani & Rian Fitriansyah: Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Arief Setyanto: Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Data availability statement

The data that has been used is confidential.

Declaration of interest's statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

Appendix 1

Indonesian adapted version of UEQ+ (only scales used in the paper).

	1	2	3	4	5	6	7	
Daya Tarik (Attractiveness)								
Menurut saya, secara umum produk ini								
menyebalkan	○	○	○	○	○	○	○	menyenangkan
jelek	○	○	○	○	○	○	○	bagus
tidak nyaman	○	○	○	○	○	○	○	nyaman
tidak ramah	○	○	○	○	○	○	○	ramah
Saya pikir ciri produk yang dijelaskan di atas sebagai								
Sama sekali tidak relevan	○	○	○	○	○	○	○	Sangat penting
Kebaruan (Novelty)								
Menurut saya, ide dan desain produk ini								
tidak kreatif	○	○	○	○	○	○	○	kreatif
konvensional	○	○	○	○	○	○	○	orisinal
biasa	○	○	○	○	○	○	○	unggul
konservatif	○	○	○	○	○	○	○	inovatif
Saya pikir ciri produk yang dijelaskan di atas sebagai								
Sama sekali tidak relevan	○	○	○	○	○	○	○	Sangat penting
Akustik (Acoustics)								
Bunyi yang dihasilkan produk ini								
keras	○	○	○	○	○	○	○	tenang
sumbang	○	○	○	○	○	○	○	merdu
nyaring	○	○	○	○	○	○	○	tidak nyaring
tajam	○	○	○	○	○	○	○	lembut
Saya pikir ciri produk yang dijelaskan di atas sebagai								
Sama sekali tidak relevan	○	○	○	○	○	○	○	Sangat penting
	1	2	3	4	5	6	7	
Nilai (Value)								
Secara umum, saya pikir desain produk ini								
tidak berharga	○	○	○	○	○	○	○	berharga
tidak rapi	○	○	○	○	○	○	○	rapi
tidak nyaman dilihat	○	○	○	○	○	○	○	nyaman dilihat
tidak elegan	○	○	○	○	○	○	○	elegan
Saya pikir ciri produk yang dijelaskan di atas sebagai								
Sama sekali tidak relevan	○	○	○	○	○	○	○	Sangat penting
Tingkat Kepercayaan Terhadap Konten (Trustworthiness of Content)								
Menurut saya, informasi dan data pada produk ini								
tidak berguna	○	○	○	○	○	○	○	berguna
tidak masuk akal	○	○	○	○	○	○	○	masuk akal
tidak dapat dipercaya	○	○	○	○	○	○	○	terpercaya
tidak akurat	○	○	○	○	○	○	○	akurat
Saya pikir ciri produk yang dijelaskan di atas sebagai								
Sama sekali tidak relevan	○	○	○	○	○	○	○	Sangat penting

(continued)

	1	2	3	4	5	6	7	
Kualitas konten (Quality of Content)								
Menurut saya, informasi dan data pada produk ini								
usang	○	○	○	○	○	○	○	terbaru
tidak menarik	○	○	○	○	○	○	○	menarik
tidak dipersiapkan dengan baik	○	○	○	○	○	○	○	dipersiapkan dengan baik
tidak dapat dipahami	○	○	○	○	○	○	○	dapat dipahami
Saya pikir ciri produk yang dijelaskan di atas sebagai								
Sama sekali tidak relevan	○	○	○	○	○	○	○	Sangat penting

Appendix 2

Users' memorable experience when using Zoom.

Theme	F	Sample User Comment
Value		
Provides useful features (41); Supports various activities (27); Flexible (15); Supports large meetings (7); Provides comfortable experience (4); More interactivity (2); Provides different experience (1); User-friendly design (1); Free apps (1)	99	"I think that Zoom is very excellent for, especially, a big online event because it has large participant capacity, supports sharing screen, and enables us to annotate so that both the presenter and the audiences can interact well."
Attractiveness		
Excellent apps (12); Fun apps (1); Excellent user interface (4)	17	"(Zoom) has features that 'wowed' me, and no other platforms have those features."
Others		
Easy to use (7); Easy to access (3); Good learnability (3); Excellent user control (1); Familiar (1); Ability to be synchronized with 3rd party apps (1)	16	"(Zoom) is better than other products because its images are stable (not chaotic) and it is easy to use."
Quality of content		
Good video quality (4); Good share screen quality (1); No lagging (1)	6	"Zoom can facilitate a number of participants at one time with excellent images. Moreover, it can be an alternative for online meetings."
Acoustics		
Good audio (3); Noise cancellation feature (1)	4	"During a seminar using Zoom, the sound quality was soft and not rough. Moreover, Zoom supports audio sharing."
Trustworthiness of content		
–	0	–
Novelty		
–	0	–

Notes: F denotes the sum of theme frequencies; the numbers inside brackets denote the frequency of an individual theme.

Users' pain points when using Zoom.

Theme	F	Sample User Comment
Others		
Internet network issues (54); Time limit (11); Unfamiliar features (7); Annoying experience (5); Security issues (2); Distractions (2); participant limit (2); Need to download the application before use (2); Annoying application behavior (2); Hi-specs device requirement (2); Difficulties in accessing meeting (2); Not easy to use (2); Hard to understand (1); No straightforward entry (1); Waiting time (1); Hard to sync with 3rd party apps (1); Confusing (1)	98	"I think that Zoom requires much more bandwidth when we use video in comparison to other similar products. Furthermore, I do not really prefer Zoom due to a previous case of the breaches (of its user data)."
Value		
Troubles in using features (8); Heavy loads app (3); Complex user interface (2); Limited features (2); Bugs (2); Limited interactivity (2); Profile not integrated (1); No parallel meeting support (1); Difficulties using smartphone (1)	22	"I do not have any problems as I become used to (Zoom). However, during my first time using it, I was very confused. I needed to set my computer audio when I pressed the share screen menu (button)."
Acoustics		
Poor audio (4); Annoying background sound (2); Voice cannot be heard (1); No audio experience (1)	8	"Sometimes, the lecturers' voice is broken when the signal is bad."
Attractiveness		
Poor user interface (1)	1	"The user interface was not really good and heavier than the other (products)."

(continued on next page)

(continued)

Theme	F	Sample User Comment
Quality of content		
Text/figures not clear (1)	1	"My problem when using Zoom is that I cannot zoom in on my own by controlling its ratio, so, sometimes, I have difficulties in seeing tiny texts or images on the screen."
Trustworthiness of content		
–	0	–
Novelty		
–	0	–

Notes: F denotes the sum of theme frequencies; the numbers inside brackets denote the frequency of an individual theme.

References

Aladwani, A.M., 2013. A cross-cultural comparison of Kuwaiti and British citizens' views of e-government interface quality. Govern. Inf. Q. 30 (1), 74–86.

Cheng, F.F., Wu, C.S., Leiner, B., 2019. The influence of user interface design on consumer perceptions: a cross-cultural comparison. Comput. Hum. Behav. 101 (181), 394–401.

Cota, M.P., Thomaschewski, J., Schrepp, M., Gonçalves, R., 2014. Efficient measurement of the user experience. A Portuguese version. Procedia Comput. Sci. 27 (34), 491–498.

Febrianto, W.A., Putra, W.H.N., Perdanakusuma, A.R., 2019. Analisis pengalaman pengguna aplikasi sistem informasi puskesmas paperless menggunakan metode usability testing dan user experience questionnaire (UEQ) (Studi Kasus: Puskesmas Tarik Kabupaten Sidoarjo). J. Pengembangan Teknol. Inf. Ilmu Komput. 3 (6), 6099–6106.

Guldager, J., Kjær, S., Lyk, P., Dietrich, T., Rundle-Thiele, S., Majgaard, G., Stock, C., 2020. User experiences with a virtual alcohol prevention simulation for Danish adolescents. Int. J. Environ. Res. Publ. Health 17, 1–14.

Intanny, V.A., Widiyastuti, I., Perdani, M.D.K., 2018. Measuring usability and user experience of the marketplace of Jogjaplaza.id using UEQ and USE questionnaire. J. Pekommas 3 (2), 117–126.

Lachner, F., Nguyen, M.A., Butz, A., 2018. Culturally sensitive user interface design: a case study with German and Vietnamese users. ACM Int. Conf. Proc. Ser. 1–12.

Laugwitz, B., Schrepp, M., Held, T., 2008. Construction and evaluation of a user experience questionnaire. In: Holzinger, A. (Ed.), USAB 2008, LNCS 5298, pp. 63–76.

Lazar, J., Feng, J.H., Hochheiser, H., 2017. Research Methods in Human-Computer Interaction, second ed. Morgan Kauffman, Cambridge, United States.

Lukita, K.A., Galinium, M., Purnama, J., 2018. User experience analysis of an e-commerce website using user experience questionnaire (UEQ) framework. Pros. Sem. Nas. Pakar 1, 347–355.

Mazaheri, E., Richard, M.O., Laroche, M., 2011. Online consumer behavior: comparing Canadian and Chinese website visitors. J. Bus. Res. 64 (9), 958–965.

Nielsen, J., 2012. Usability 101: Introduction to Usability. Retrieved from. https://www.nngroup.com/articles/usability-101-introduction-to-usability/.

Norman, D., Nielsen, J., 2006. The definition of user experience (UX). Retrieved from. https://www.nngroup.com/articles/definition-user-experience/.

Prakoso, B.S., Subriadi, A.P., 2018. User experience on e-Government online services: a case study on the SIMPATIKA service application at the Ministry of Religious Affairs of Indonesia. J. Inf. Technol. Comput. Sci. 3 (1), 67–76.

Rajanen, D., Clemmensen, T., Iivari, N., Inal, Y., Rızvanoğlu, K., Sivaji, A., Roche, A., 2017. UX professionals' definitions of usability and UX – a comparison between Turkey, Finland, Denmark, France and Malaysia. In: Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics). 10516 LNCS, pp. 218–239.

Rauschenberger, M., Schrepp, M., Perez-Cota, M., Olschner, S., Thomaschewski, J., 2013. Efficient measurement of the user experience of interactive products. How to use the User Experience Questionnaire (UEQ). Example: Spanish language version. Int. J. Interact. Multimedia Artif. Intell. 2 (1), 39.

Richard, M.O., Habibi, M.R., 2016. Advanced modeling of online consumer behavior: the moderating roles of hedonism and culture. J. Bus. Res. 69 (3), 1103–1119.

Rohrer, C., 2014. When to Use Which User-Experience Research Methods. Retrieved from. https://www.nngroup.com/articles/which-ux-research-methods/.

Santoso, H.B., Schrepp, M., Isal, R.Y.K., Utomo, A.Y., Priyogi, B., 2016. Measuring user experience of the student-centered E-learning environment. J. Educ. Online 13 (1), 1–79.

Schrepp, M., Hinderks, A., Thomaschewski, J., 2017. Design and evaluation of a short version of the user experience questionnaire (UEQ-S). Int. J. Interact. Multimedia Artif. Intell. 4 (6), 103. Retrieved from. https://www.ijimai.org/journal/bibcite/reference/2634.

Schrepp, M., Thomaschewski, J., 2019a. Eine modulare Erweiterung des User Experience Questionnaire. In: Fischer, H., Hess, S., Hrsg (Eds.), Mensch und Computer 2019 - Usability Professionals. Gesellschaft für Informatik e.V. Und German UPA e.V, Bonn.

Schrepp, M., Thomaschewski, J., 2019b. Design and validation of a framework for the creation of user experience questionnaires. Int. J. Interact. Multimedia Artif. Intell. 5, 88–95.

Syahrir, S.N., Sfenrianto, 2019. User experience questioner and heuristics in online learning environment. J. Theor. Appl. Inf. Technol. 97 (4), 1071–1081.

Taber, K.S., 2016. The use of Cronbach's alpha when developing and reporting research instruments in science education. Res. Sci. Educ. 48, 1273–1296.

Thach, K.S., 2018. User's Perception on Mental Health Applications: A Qualitative Analysis of User Reviews. In: 5th NAFOSTED Conference on Information and Computer Science (NICS), Ho Chi Minh City, pp. 47–52.

Tullis, T., Albert, B., 2013. Measuring the User Experience: Collecting, Analyzing, and Presenting Usability Metrics, second ed. Morgan Kaufmann, Cambridge, United States.