Investigating Users' Experiences and Attitudes Towards Mobile Apps' Reviews

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Abstract. One of the daily routines of the smartphone users is using the mobile applications. Individuals explore the app stores and select a potential app. The selection procedure is affected by the information that the app stores display for each app. Reviews of the apps are an important factor in making decisions to select an app. Likewise, Users experiences and attitudes are affected by the information that they read and see on the interface of apps' reviews. In our study, we aim to investigate the users' experiences and attitudes towards mobile apps' reviews. To achieve our goal, we constructed a survey consists of statements divided into five categories to collect a variety of data about the users' experience and attitude. The questionnaire's categories were designed to generate data regarding users' experiences and attitudes when selecting apps. Likewise, to investigate the criteria that users set to evaluate the apps' quality. Moreover, participants were asked about their experiences with the comments section in the apps' reviews. Also, investigating if there are complaints regarding the reviews' comments. Furthermore, we investigated what users can know from the interface of the mobile apps reviews in the app stores. We had 102 participants in our survey. Our results showed that free apps, especially if there is a need for the app, have the most chance to be installed even with a lower rate. We also found that, besides the apps' rating and download statistics, users tend to adapt self-judgment for determining the apps' quality. Regarding the reviews' comments, users wish there is a way to limit the length of the reviews. Users like the reviews that are short and specific. We found that the current interface design of the review needs revisions to help users to be aware of critical apps-related issues such as apps' permissions.

Keywords: Apps' reviews · Users' experiences · Users' attitudes
Mobile apps · Reviews' interface

1 Introduction

Adam loves photography. Recently he bought a new smartphone that has a very powerful camera. Adam wanted to take pictures and post them on his Instagram account to show his talent to his followers. He needed to have a powerful app to do some photo editing before posting the images to his account. He searched for an app in the app store; he found multiple apps that look very useful. However, He was confused which app he should install. He found that the first five of them has a very high rating and so many positive comments, but still, he needs to decide and install one of the apps

he found. The problem is that he does not want to try them all. He wanted to find an easy way to know which app is better. He has concerns regarding the privacy, permissions required, and the battery consumption but he could not find a usable way to compare the apps and know which one is the best for his need. He tried to read the reviews, but there is a vast amount of reviews listed for each app. He could not find another way to read the reviews quickly and decide which one may help him. Adam ended up with installing the apps one after another until he found a mid-rated app that he liked the most.

A numerous portion of mobile apps' users has experienced Adam's experience at least once while they want to install an app. There is a huge increase in the apps developments. Every day we have new apps posted to the app stores. The number of apps that users can access on apps stores is very huge. As of March 2017, a recent statistical data shows that Google play has 2.8 million apps and Apple's App Store has 2.2 million apps [1]. In addition to that, many of the companies and developers try their best to have their apps ranked with a higher rating. Either by producing very good apps or by manipulating the reviews. In addition to that, there is a numerous number of reviews added every day. A study reported that the popular apps, like Facebook, receives on average more than 4000 reviews per day [2]. Thus, it is a hard job for users to read all reviews.

In our study, we aim to investigate the users' experiences and their attitudes towards mobile apps' review. When we mention mobile apps' reviews, we mean the whole interface design that illustrates information about an app. In another way, we mean all elements that app's info page contains such as the star rating, the comments, the number of downloads, versions history, permissions, etc.

In this paper, in order to get better understating, we investigate the users' experiences and their attitudes towards mobile apps' reviews in several dimensions. To achieve our goal we address the following research questions.

- RQ1: What are users' experiences and attitudes when selecting mobile apps?
- RQ2: What criteria do users set to evaluate apps' quality?
- RQ3: What are the users' experiences and attitudes towards the comments of mobile apps' reviews?
- RQ4: What are the users' complaints regarding the apps' reviews?
- RQ5: What can users know from the interface design of apps' reviews?

This paper is organized as follows. In Sect. 2, we illustrate the current and relevant research on mobile apps' reviews. In Sect. 3, we describe the methodology and how it was constructed. In Sect. 4, we report our research findings. In Sect. 5, we discuss our findings. Then we conclude this paper with our final thoughts and future directions.

2 Literature Review

2.1 The Importance of the Apps' Rating

Apps rating plays crucial roles to determine the apps successful in apps' stores [3, 4]. There is a strong correlation between apps rating and the number of downloads [5]. Moreover, the rating is a key role when users decide to purchase an app [6] or make an

online purchase [7]. For many developers, the revenue will be tied with the star rating that their apps achieved [6]. Apps with better reviews will achieve better ranking which could result in better sales [8].

A research study found a relationship between the quantity of feedback that an app got and the app's overall rating and its price [9]. They reported that users tend to provide more feedback for lower rated apps. Moreover, reviews are 12 times more trusted than the description provided by the app's developer [9].

2.2   The Challenges in the Apps' Reviews

Increasing the number of reviews could limit the benefit for users because they will not be able to read all reviews. Iacob et al. [9] stated that the ability to read the reviews become limited when the app has a massive quantity of reviews. Moreover, quantity and length of reviews make spotting the weak points of product harder for people.

Reviews are very challenging and hard to be analyzed. On average, Apps receive 23 reviews per day, and the popular apps like Facebook receive on average more than 4000 reviews per day [2]. Since apps receive this huge amount of reviews, there are associated issues that make dealing with apps reviews difficult. Reviews are unstructured, vary in the quality, and hard to identify the useful ones [2, 10]. While users leave reviews in varying length, these reviews are not free of informal expression, using abbreviations, and misspelling [11]. Moreover, online reviews are not trusted every time. As stated in [12], the online products' reviews may provide misleading information and do not always revealing the products' real quality.

2.3   What Can We Get Out of Apps' Reviews?

Tian et al. [13] conducted a study to understand differences between high rated and low rated apps. They found that "high-rated apps have larger sizes, more complex code, more requirements on users, more marketing efforts, more dependence on libraries, and adopt higher quality Android APIs."

Reviews are not only beneficial for users but also developers can get valuable feedback. Apps' reviews could help developers with determining users' requirements, improvement suggestions, requesting desired features, expressing users experiences [2, 5, 14]. In addition to that, some users report issues related to the app's GUI, app's speed, or provide a comparative review with other apps [9].

One way to distinguish good apps from bad apps is their ratings. However, the rating is not always reflecting the reality of an app. Users might be unsatisfied with an app even if the app has a decent rating. A study suggested that app's trust should be built on several criteria not only on the app's rating. Apps' rating is not a reliable metric [15].

2.4   Users' Behavior with Exploring and Experiencing Apps

Apps' Selection
There are several ways for discovering a new app in the apps stores. Recommendations from known individuals, and browsing the apps' stores are the most discovery means

for apps installation [16, 17]. Approximately 25% of the reviews have recommendations for using the app to other users [9]. Moreover, Chin et al. [16] claimed that the price of an app and the app's popularity are considered aspects of app selection and installation.

Hoon et al. [18] analyzed 8.7 million reviews from 17,330 apps; their results showed users tend to leave short reviews for mobile apps. Additionally, the category of the app has an impact on the length of the review. The reviews are higher rated and longer in some apps categories than other. Moreover, as stated in [12], usually users provide a review when they are either extremely happy or extremely unhappy with the product.

Apps' Updates

In a study of the user's attitude and behavior towards applications' updates, about half of smartphone users set their phones to be automatically updated because they want their apps to be always up-to-date [19]. In addition, the study found that there are users who do not update apps due to privacy and permissions concerns. Another research found that users tend to install apps that are recently updated but not requesting frequent updates [20]. A recent study analyzed 10,713 mobile apps in 30 categories of apps found out that 14% of the mobile apps are frequently updated [21]. Moreover, they found that 45% of the frequently updated apps do not inform the users about the reasons behind the updates. As reported in [20], users have mixed feeling regarding apps update. Users often desire new updates for the apps. However, they are afraid of facing update-related issues. Nayebi et al. [20] found that both device and apps crashes are the frequently reported issues emerging after the updates. Trusting the app's developer, the type of the apps' reviews either negative or positive, and the type of permissions requested are factors that influence users' decision when they chose to update an app [16, 19].

Privacy and Permissions

To understand to what extent users value their information on their smartphones Chin et al. [16] found that users are more concerns about privacy in their phones than other devices like a laptop. Surprisingly, while users tend to see and read the permissions on the screen, research revealed that users have limited knowledge about privacy and security, and they do not understand permissions [22, 23]. Kelley et al. [22] found that people are unaware of the security risks associated with apps. Users believe that all apps on the app store are already tested and should be trusted. As claimed in [22], users are not prepared to make decisions regarding privacy and security. Moreover, not all users are unaware of privacy. There are users know that mobile apps violated their privacy unethically, but they still use these apps [24]. In fact, most users ignore permissions completely [25, 26].

Many of smartphone users are willing to share data with developers in the right way specifically when the data used for the agreed purpose. Research reported that users were surprised and felt violated when they found out that apps in their mobiles are accessing data without their knowledge [25, 27]. A recent study examined 10000 android apps and had found a relationship between permission popularity and the number of times it was misused [28].

One of unethical and misuse for the permissions is collecting users data. There are apps that are interested in collecting data from users phones [26].

Battery Consumption

An issue that might happen to some apps' users is when the app drains the cellphone's battery. Nagappan and Shihab [29] claimed that not all developers know how to program an energy efficient app. Thus, there is a need to make developers aware of the good habits to program an energy efficient apps. The apps may have access to multiple resources of the users' devices. Users might not be able to recognize which resource in the app is draining out their devices' batteries. Since resources vary in consuming the power of the device, Li et al. [30] studied 405 apps to investigate energy consumption. One of their findings is that networking is the component that consumes much energy.

Users' Complaints

In the body of literature, many studies have done text mining to investigate the complaints that users reported in the apps' reviews. Examples of the users' complaints were reported in [31, 32]. In [32] a categorization of 12 types of users' complaints have been identified. The identified complaints are

> *"App Crashing, Compatibility, Feature Removal, Feature Request, Functional Error, Hidden Cost, Interface Design, Network Problem, Privacy and Ethics, Resource Heavy, Uninteresting Content, and Unresponsive App (Pg.74)"*

To determine which complaint is reported the most, studies found that more than 50% of the users' complaints fall into three categories; reporting functional errors, requests for specific features, and reporting app crashes [31, 32]. From the 12 types of complaints, the most negatively perceived complaints were privacy and ethics, hidden cost, and feature removal [31]. Some apps got a low rating because the users have experienced some of these complaints. Although some apps are free to download, users need to pay monthly subscription fees to have the full membership privilege. Some users do not perceive that before installing the app. That led them to give a lower rating for the app. As reported in [31], more than half of low rating for Hulu plus was due to the hidden-cost, which is the monthly subscription fees. As claimed in [31], there is a correlation between users' complaints and the apps updates. They also found that users report their complaints after a recent update.

2.5   The Need to Redesign the Reviews' Interface

Users may have some issues with the design of the interface of the apps' reviews. A study showed that 13%–49% of the sentences of online reviews have feedback related to usability or user experience [33]. Some users may have difficulty to figure out why specific resource of their phone is being accessed. Liu et al. [34] suggested that app stores should design a simple interface especially when it comes to permissions and privacy information illustration. They claimed that simple interface would help users to make better decisions when it comes to granting permissions and control the resources of their devices. There should not be a trade where users give up the control for the sake of usability [34]. A Research claimed that users have limited knowledge about the security risks that are associated with app selection. Thus they suggested that apps

stores should consider redesigning privacy communicating icons [23]. Also, they encourage apps' stores to display these icons at the beginning of the installation cycle so users can make decisions in the earlier stages. In [23], Rajivan and Camp recommended that privacy communication icons should fit the user mental models of security. Hence, users need visual cues that are simple, and easy to comprehend to reduce risks and concerns that are associated with app choices. In [23], Rajivan and Camp stated "privacy communicating icons should align with user mental models of security." As suggested in [27], users need to be informed about the reason of why each resource is being used because that could help to ease the users' privacy concerns. Due to the numerous amount of reviews in apps stores, users need a clear interface to be able to make decisions about apps quality [14].

It is worth to mention that none of the previous research has study the user experience with the interface of the apps' reviews, which is one of this research goals. We think that the users' experiences with the apps' reviews would be differ if the design is different. The number of the complaints would be reduced, and the users' awareness regarding some of the apps related technical issues would be increased.

3   Methodology

The goal of this study is to investigate users' experiences and their attitudes towards mobile apps reviews. Thus, we used an online questionnaire as a method for collecting our data. As stated in [35], it is appropriate to use questionnaires to explore people's attitudes and beliefs. In [36], Müller et al. stated that

> *"Surveys can gather insights about people's attitudes, perceptions, intents, habits, awarenesses, experiences, and characteristics, at significant moments both in time and over time."*

3.1   Subjects

The total number of completed responses is 102. Majority of the participants were students at Iowa State University and representing well-educated population. The primary recruitment method was via sending a mass email. We sent the link of the survey to the email list of the graduate students in computer science program and to the email list of Virtual Reality Application Center (VRAC). We also adopt snow bowling method in recruiting the participants by inquiring people who may participate to forward the study link to other people who might be interested in participating as well. While the snow bowling was helpful to recruit more respondents, it made the majority of the participants are individuals who are well educated.

Out of 102 respondents, 60 (58.82%) were male, and 42 (41.18%) were female. Regarding the operating system of participants' smartphones, 57 (55.88%) were using IOS, 43 (42.16%) were using Android, and 2 (1.96%) were using Windows phone system. Regarding the age range; 29 (28.43%) aged between (20–24), 30 (29.41%) participants aged between (25–29), 36 (35.29%) aged between (30–34), and 7 (6.86%) were older than 35 years of age. In term of the highest degree that the participants have received, 12 (11.76%) participants have high school, 3 (2.94%) have associate degree,

34 (33.33%) have Bachelor's degree, 45 (44.12%) have Master's degree and 8 (7.84%) participants have Doctorate degree.

3.2   Instrument

The questionnaire consists of six sections. The first one contains demographic data about the participants. The following five sections were divided to collect data regarding users' experiences attitudes towards mobile apps reviews. The statements in each group were designed as a 5 points Likert scale questions. Following each set of statements, there was an open-ended question to give the participants the opportunity to add additional thoughts. The statements were grouped according to their thematic similarities into five groups. The first group contains seven statements about the user experiences and attitudes regarding the mobile apps' selections. The second group has four statements to measure participants' attitudes regarding some of the criteria for evaluating the apps' quality. The third group has seven statements designed to reveal data about users' experiences and attitudes with the comment section on the apps reviews on the apps store. The fourth group contains six statements asking participants about their experiences and attitudes regarding frequent mobile apps issues. The fifth group consists of eight statements to determine participants' awareness regarding some of the app's issues as well as some elements of the reviews' interface.

A pilot study and review by three university professors helped the authors to modify the elements of the questionnaire. Modifications in the questionnaire included eliminating some of the statements as well as rephrasing other statements. For the internal consistency, the instrument's Cronbach's Alpha was ($\propto = .765$).

3.3   Procedure

To make the survey available online we used Qualtrics platform (www.qualtrics.com), a very well-known online platform for survey administration. The survey was made available for a month. Participants completed the survey on a duration ranged between 5 to 10 min. The survey questions were illustrated in separate pages. The first page had the demographic questions. The following pages were illustrated in groups of statements from group 1 to group 5. Each group has statements that are providing information regarding one aspect of the study. Following each group of statements, there was an open-ended question to give the participant the opportunity to provide the personal thought.

After completing the questionnaire, the participants were given a chance to enter a drawing to win a gift card. We had four gift cards each one valued $25. To ensure anonymity, and to separate the drawing data from the survey data, participants information and participants who wished to enroll in the drawing were required to click on a link that opens a new web page. Then they can add their email information.

To provide a degree of agreement for each statement, we have used five points Likert scale statements that were ranked 1–5, with 1 = "strongly disagree", 2 = "disagree", 3 = "neutral", 4 = "agree", and 5 = "strongly agree".

4   Results

This study has two types of data, quantitative and qualitative data. The quantitative data generated by analyzing the results of the Likert scale items. While the qualitative results generated by analyzing the open-ended questions that followed each group of statements in our scale. Following is our findings categorized according to our research elements.

4.1   Users' Experiences and Attitudes with Selecting Mobile Apps

The experience of picking an app differs from user to another. Table 1 summarizes results for participants' responses when they were asked to indicate their agreements regarding each statement in this part of our questionnaire. Results show that participants mostly tend to agree with all the statements. Preferring to install free apps was the highest among other statements in this group (M = 4.54, SD = .88). For installing applications with a lower rating, participants' answers tend to be, on average, "agree" (M = 3.45, SD = 1.03). Interestingly, when participants were asked about downloading trendy apps, the results were the lowest among other statements. The participants tend to answer, on average, "agree" (M = 3.04, SD = 1.07).

Table 1. Users' experiences and attitudes with selecting mobile apps

Statement	N	M	SD
1. I choose apps upon the ranking given to them	102	3.73	0.98
2. I prefer to install free apps more than paid apps	102	4.54	0.88
3. I do not install apps with lower rating	102	3.45	1.03
4. I install apps that I need even if they have a lower rating	101	3.49	0.99
5. I install apps that my friends suggested to me	102	3.80	0.82
6. I often install trendy apps	102	3.04	1.07
7. I trust apps reviews	102	3.68	0.75

As a part of investigating the users' attitudes and experience with selecting mobile apps. We had an open-ended question to ask participants to share their approaches of selecting apps to install. Results of this question revealed several patterns for the participants' experiences when they pick an app to install. The frequent words in most of the users' inputs for this question included star rating, number of downloads, need, and free app. One of the participants has described his experience with picking apps as "I start off reviewing the free apps, then I look within the free apps and look for the ones with the highest ratings." Another participant said, "I search for something I need, then read reviews. Both in the apps store and online to find the best app for me. If they are free, I might download a couple to try them out and see which I like best."

Some users reported that they only install important apps. Others identify their way for searching for an app is by using keywords. Some participants reported that they download apps, specifically the free ones, then they try it out. If the app met their desires, then they keep it. Otherwise, they try out a different app. Participants responses

reveal several criteria to consider installing an app. Examples of these criteria include being rated above three stars, having positive comments, being a free app, having specific features, meet a specific need, specific brand, and having a nice interface design.

Installing an app is not always done purposefully, some participants reported that they install apps due to other factors. These factors include brand name, friends and relatives' suggestions, Advertisements, and social media.

Some users are not interested in installing apps unless they find themselves in situations that lead them to install the apps. On the other hand, some users like to browse the apps store from time to time to discover new apps. Also, they might browse the apps by their categories to compare the apps. We found participants who like to explore the apps by searching for a keyword. A participant in our study summarized his experience with exploring and choosing the apps as following

> "Search for a keyword. See the first 8–10 apps and compare them. if any of them were recommended by a close friend, then give them higher weightage. Second in line will be those recommended on the internet. One important point will be the app should have good review for the last few updates and negative comments mentioned should not be a big factor. If it is, then not go for the app. Else, do not worry. Also, one big factor is the specifications of my phone. If my phone could not handle the app even if it is best for the world I would not use it, e.g., Asphalt game for many users."

4.2 Users' Experiences and Attitudes with Perceiving and Evaluating Apps Quality

There are many ways to provide a judgment on apps quality. Our questionnaire focused on investigating three elements that are important factors to determine the attitudes towards the perception of apps' quality. These factors are number of downloads, number of the stars given to an app, and the amount of review comments in that the app page. Results showed that participants tended to answer, on average, "agree" for the all of the statements (M = 3.45, SD = 1.10; M = 4.09, SD = 0.78; M = 3.53, SD = 1.06) respectively. Results show that participants tended to answer, on average, "disagree" (M = 2.06, SD = 0.94) when they provided their responses to the statement there is no relationship between the app quality and its rating. Table 2 illustrates our findings in this category.

Table 2. Users' experiences and attitudes with perceiving and evaluating apps quality

Statement	N	M	SD
8. Number of downloads for an app is an indication of the app quality	102	3.45	1.10
9. Number of stars given to the app is an indication of the app quality	101	4.09	0.78
10. Number of reviews for an app is an indication of the app quality	102	3.53	1.06
11. I think there is no relationship between the app quality and the app rating	102	2.06	0.94

Participants were also asked to answer the open-ended question "Can you share how do you decide whether the app has good quality?" Answers to this question

contained valuable thoughts. As a summary of the participants' thoughts; many participants think that the number of downloads and the stars rating are very important factors to determine the quality of an app. Other participants may have different criteria such as friend's advice or self-judgment to decide the apps' quality. A participant summarized his approach to determining the app quality by stating "By the following criteria: First, by downloading it and use it by myself. Second, friends' advice. Third, reviews. Fourth, app advantages." Moreover, the quality judgment may depend on the app technical features, and how it works without issues. A participant stated that "Whether it is buggy, slows the phone down, has too many in-app purchases…whether it is easy to use, fast response, fast load time, completes the task necessary." Other participants consider ease of use and beautiful interface as a part of the app quality.

4.3   Users' Attitudes and Experiences with Comments Section in the Apps' Reviews

The comments section on app reviews is very useful for many users. Results showed that participants tended to answer, on average, "agree" when they were asked about the usefulness of the comments in app reviews (M = 3.94, SD = 0.78). On the other hand, participants disagreed with the statements that claimed reading all the detailed comments is wasting their time (M = 2.94, SD = 1.19). We also found that participants tend to use the comments of apps' reviews as a supportive tool when they want to compare two apps (M = 3.85, SD = 0.91). Table 3 summarizes all findings related to statements of the apps' review comments.

Table 3. Users' attitudes and experiences with comments section in the apps' reviews

Statement	N	M	SD
12. The comments in the app review are useful	102	3.94	0.78
13. If the app has an excellent rating, it is a waste of time to read all of the detailed comments in the comment section	102	2.94	1.19
14. I tend to read the comments in the review when I want to compare two different apps	102	3.85	0.91
15. Comments associated with the rating may affect my decision regarding installing an app	102	3.97	0.78
16. I trust reviews that are associated with a lower rating	102	3.34	0.80
17. I trust negative comments more than positive ones	102	3.07	0.87
18. I extensively read comments in the review section associated with lower-rated apps	102	3.19	1.12

To give the participants more flexibility to deliver their thoughts regarding apps reviews comments, they were asked to answer an open-ended question "Can you share how do you read comments in the review section?" Analyzing the results of this question revealed the participants' behaviors when they interact with the reviews section. In general, participants reported that they do not read all of the reviews listed in the comments section specifically the long reviews. Participants reported several

behaviors for reading apps reviews. Most users tend to scan reviews. When they need to read the reviews, they start with shorter, negative, and lower rating reviews. Some participants read both negative and positive reviews, which are associated with lower and higher rating to make a comparison when is needed. One of the participants described his behavior as following, "I tend to read comments when I want to compare two similar apps. If the apps are different, there is no need to compare apples to oranges." In addition, participants stated that they read the recent reviews because it reflects the current issues if there is any. One reason to read reviews was to investigate other users' experiences and make decisions according to what others have experienced with the app. While participants reported that apps reviews are fun to read, they also wish if there are a limited number of words for each review. Some participants claimed that they could distinguish fake reviews. They said those fake reviews usually consist of ridiculous qualities and many misspelling. A participant has shared his experience with the apps' review as following

> "*I know that just like news, product reviews, app reviews are also susceptible to being fake. The company can ask their acquaintances to write positive about them and their rivals can write negative too. It is hard to differentiate the genuine and fake ones, but I use the following observation for my sake. Do not go for one word, one-liner reviews (exception if the majority says the same thing). Do not go for super lengthy reviews, as they will be people criticizing the app like a bully. Go for reviews between the length of 2–6 lines or the ones that make sections of pros and cons.*
>
> *One more important thing is some people write comments just after a couple of days of use. We cannot verify this, but I prefer the ones that are written by users who used it for at least a month as sometimes system performance reduces with prolonged use of apps. Long ago we can view votes and comments from our friends but due to recent privacy changes it cannot be done now.*"

4.4   Users' Experiences and Attitudes with the Common Complaints

Having complaints about any product is normal. For the apps users, they always complain about several common issues. We had several statements that measure the users' attitudes and experiences with frequent apps complaints. Surprisingly, participants tend to answer, on average, "strongly agree" for all statements. Results indicated that removing a favorite feature from an app was the highest average among other statements (M = 4.43, SD = 0.67). It is known that apps ask for some permission upon installing them. Participants tend to answer, on average, "strongly agree" with the statement that stated "apps should indicate specific reasons for using some permissions" (M = 4.30, SD = 0.76). Table 4 indicates all findings about statements on this section.

Participants were asked to answer the open-ended question "Do you have any complaints about mobile apps reviews? Would you like to share your thought?" we have found insightful thoughts in participants' responses for this question. Results regarding this question were not only including the complaints about the mobile apps' review, but also there were comments that would benefits the development of the apps. Some responses were commenting on the hidden cost of mobile apps. They reported that they hated when an app asks for small transactions for every single feature that they want to use. In addition, they said there is no trial period; consequently, they

Table 4. Users' experiences and attitudes with the common complaints

Statement	N	M	SD
19. It bothers me when an app asks for permission that I think is not related to the app purpose	102	4.22	0.93
20. Apps should indicate specific reasons for using some permissions	102	4.30	0.76
21. I am not comfortable with ads included in some apps	102	4.08	1.05
22. I do not like when an app asks me to pay money to use specific features	102	4.21	0.97
23. It bothers me when an app's developer removes a favorite feature from the app after updates	102	4.43	0.67
24. I feel disappointed when an app is not compatible with my smartphone	102	4.16	0.84

cannot undo their purchases. Moreover, participants prefer to pay one price upfront for the app and its features instead of paying separately for each feature specifically games. Participants agreed to the importance of paying some money for apps developments, but they wanted to be clear about what they will pay.

The participants in our study raised another issue which is the comments in apps review. Participants mentioned that there are reviews that are helpful but very long. They wish if there is a way to limit the review's words count and provide a specific structure for the review. A participant reported, "It is better to make them short, specific and helpful. Some comments might be helpful but long which makes me skip them." In addition to that, participants suggested that users should not be able to provide high app rating without writing a comment. Participants claimed that this process would limit fake and misleading reviews. One of our participants stated "it is easier to rate 5 starts rater than 3 and write why." Another issue about the apps' review is the lack of the reviews number. Usually, apps' stores do not display reviews for new apps until they reach a specific number of reviews. A participant reported that he hated when he found an app without published reviews. On the other hand, results indicated not all participants read the reviews. A participant mentioned that he downloads apps that he comes across and when they are not good, he uninstalled them.

Our results indicated several complaints regarding apps in general. Participants were not comfortable with the number of unnecessary permissions that they need to provide to the app upon the installing process. In addition, there were some complaints regarding the Ads. Participants reported that some apps contain many ads. Some users reported complaints regarding apps that have low-quality graphics and ugly avatars.

4.5   What Can Users Know from the Interface Design of Apps' Review?

The screen of apps reviews has many elements that users are not aware of. Moreover, there are other elements that are very important to be parts of the apps reviews, but unfortunately, most apps' stores do not provide it. For example, information about the battery consumption is important information that users should know. Our results indicated that users tend to answer, on average, "strongly disagree" (M = 1.95, SD = 1.01) when answering the statement regarding the ability to locate information about apps battery consumption on apps review screen. In addition to that users tend to

answer, on average, "disagree" when they were asked to answer questions regarding the ability to find information about app's security, app's privacy, device compatibility, and app's ads. Table 5 summarizes our findings regarding the users' responses.

Table 5. What can users know from the interface design of apps' review?

Statement	N	M	SD
25. I think age rating is a necessary feature to classify apps	101	3.87	1.08
26. From the app review's screen, it is easy to determine if the app is suitable for my age	101	3.11	1.07
27. From the app review's screen, I can locate information about the app's battery consumption	101	1.95	1.01
28. From the app review's screen, I can tell whether the app is secure or not	101	2.04	1.02
29. From the app review's screen, I can find information about privacy	101	2.30	1.04
30. From the app review's screen, I can tell whether the app violates the privacy or not	100	2.15	1.02
31. From the app review's screen, I can tell if the app has ads or not	99	2.32	1.16
32. From the review's review screen, I can tell if the app is compatible with my smartphone	99	2.93	1.28

To give the participants more flexibility to deliver their thoughts regarding the interface of apps reviews, they were asked an open-ended question followed their responses for the statements in this section. The question was "Do you have any suggestion about the design of apps' reviews? Would you like to share your thought?" Responses to this question had valuable thoughts. We divided their answers into two categories. First complaints related to the interface design. Second, suggestions for a future design.

Participants reported that the current interface design for the mobile apps' reviews needs more simplicity in the design. The amount of information is very huge and bulky, which makes finding specific information sometimes a very hard task. Participants stated that the current design is not constant. There is information illustrated in the reviews of some apps while this information could not be found in other apps. In addition to that, users claimed that there were too many elements in the review info page. They needed more time to figure out relevant information to what they want to find.

Respondents have suggested some ideas for redesigning the interface of mobile apps' reviews. The suggestions included a specific request for some features like the apps battery consumption and illustration for the permissions required. A participant stated his ideas regarding redesigning the reviews interface as following "There should be a quick list where you can quickly see the most pertinent information about the app such as permissions, age range, ads or no, compatible OS, etc." Some participants suggested that reviews should contain some statistics about battery consumptions, and other technical factors. One of the participants suggested that there should be specific questions for the reviewers to be answered to enrich the reviews and to make them constant.

To conclude the study questionnaire, there was a final though question which asking the participants if they have any further input they would like to provide. There were very interesting responses that may improve the visualization and the interaction with the mobile apps reviews. A participant suggested that the reviewers should have credits for their reviews. He also suggested that apps store should consider gamification techniques to increase the interactivity with apps reviews. Many responses stated that apps should justify exactly why they use specific permission and how it would be used. There were suggestions to represent a portfolio for each developer and company to see all apps developed by them. Thus, users can have an idea about the quality of apps produced by those developers.

5   Discussion

The purpose of this study is to investigate the users' experiences and attitudes with the interface of mobile apps' reviews. Our results included rich data that could be helpful for both research and industry. In this part, we provide our rational towards the results that we got.

When we explored the users' attitudes and experiences with selecting an app, our results agree with what the previous research has done. Users have a variety of ways to select an app, and there are some factors affect his choices. In our study, we find that price of the app could be the most important factor in selecting an app. We think that because apps stores have free alternatives for most of the apps. Moreover, users consider uninstalling the app if they are not satisfied with it. In addition to that, developers might be interested in building apps that are similar to paid apps to gain quick revenue. Developers might get some income by using ads in their apps instead of selling their apps. However, this method is not comfortable for some of the users, who do not prefer ads in the selected apps. The problem is that installing an app then uninstall it does not go as what most users are expecting. If the app is malicious, during the period from installing the app until uninstalling it, the users' data might be at risk. So, we think there should be a way to represent the security level of the apps visually.

From our results, we infer that there is a portion of users who have the ability to set criteria for selecting an app. These criteria might not include the app rating specifically when the users are in need of using the app. Users might install an app even if they are not satisfied with its rating.

Regarding the apps' quality, our results indicated that participants tend to agree with all the statements there were asked. Participants consider the number of downloads, number of stars, and number of reviews as indications for the app quality. This is similar to what the previous studies have indicated [3–5, 9]. However, our findings infer that some users might consider self-judgment or friends' recommendations as factors in deciding the app quality. We think that is possible because one way to install an app is a referral from trusted people whom we know.

Our findings indicate that participants described the quality in another manner. The results indicate that there are participants who consider how the app works. Their perceived apps quality was not only limited to the visual communication icons that they see such as the number of stars or number of downloads but also they are seeking more

easy to comprehend details. We think this kind of input from the users may help to figure out a way to have icons on the mobile apps info screen that reflects the technical aspect of the app. These icons may illustrate crashes, slowing down the device, freezing. Unexpectedly, the results indicate that there are users who consider the aesthetic of an app as a part of the quality.

Different from what other researchers have done, our study considers the users' experiences and their attitudes towards apps review. Our results indicate that, in general, users think that mobile apps reviews are helpful. However, users do not read all the comments in apps reviews. They scan the reviews and prefer to start with the reviews that are shorter, negative, and lower rating. We think this happens because users do not want to spend much of their time to read all the comments posted. Thus, they might look for the bad ones and then build their decision. While our findings infer that participants have multiple types of behavior reading the reviews, we think it is necessary to have a better design for the interface of the apps' reviews. Users do not want to spend numerous time reading 2000 reviews. Instead, it is advisable to have a better way to summarize and illustrate the reviews. Additionally, it might be useful to limit the words count for the reviews. As indicated in the results some of the reasons for reading the reviews are to help in making a comparison between apps and to support users decision-making process. Making reviews easy to read and comprehensive will ensure better user experience.

Prior research has investigated what the mobile apps users' complaints are. They have characterized number of the frequent complaints like hidden-cost, violate the users' privacy, frequent updates, removing a favorite feature from the app, and other complaints [31, 32]. Our results indicate similar results to what have been found in the previous research. However, there are some additions to the complaints list. Most of the previous research has adapted using text analysis for the reviews while we directly ask the users to provide their feedback regarding their complaints. Thus, we were able to have more information tied to the users' experiences. We found many of our participants were complaining about the length of the review. This complaint was reported in multiple parts of our study which indicates that is a real problem that needs to be solved. The findings also reported users concerns regarding ads in most of the free apps. The literature contains two dimensions for using the ads in mobile apps, which are the revenue and the power consumptions. Ads' content is an important topic and not getting much attention in the body of the literature. We think there should be some regulations for using ads by the developers specifically the contents of apps. We think that not all ads are suitable for all ages. Moreover, it is not justified when an app designed for kids having ads that are targeting adults.

The interface of the mobile apps reviews is a very important aspect that we considered in our study. Our results indicated that there is a need to rethink about the interface design of the apps' info page. While the current design seems to be simple, it is failing to help users to be aware of many issues and knowledge that are relevant to mobile apps. The prior research claimed that users do not read permissions and if they read they do not understand them [22, 23]. We agree with this and can add another reason. We notice that the app store and google play do not provide proper explanations for the permissions that apps ask users to grant. In addition to that, the apps information layout should be redesign in a way without misleading the users by the

number of stars given to the app. We think that there should be an illustration for other necessary information in the top of the page. It is advisable to have information about the battery consumption, permissions, recent updates, security, and ads. Information like these should be illustrated on the top of the interface. That will help users to have easy access to these important aspects of the app.

Results of this study reveal the need of considering redesigning the interface of the mobile apps reviews. The new design should consider socializing the user experience with the apps and their selections. Moreover, considering techniques like gamification would increase the interaction between the users and the apps reviews. One important thing that users were not sure about was the developers' portfolio. Users reported that they do not have ideas about who made the apps. We think the most important thing to consider is making the interface as a tool to enhance the users' knowledge about apps related concerns. Examples of these concerns include an explanation for the required apps permissions, battery consumptions, ads, hidden cost, and any unique or specific features.

5.1   Limitations

One of the limitations of this study is that the majority of our participants were well-educated individuals. It is possible that results would contain additional output if there is a mixed of people who vary in their level of education. Moreover, it is possible that there would be additional points of view if the sample includes older adults and children.

6   Conclusion and Future Work

Previous research has done great work in extracting what users' complaints are. However, none of the previous research has investigated the users' attitudes and experience with the interface of the mobile apps review. We did a survey to measure the users' attitudes and reveal their experiences with the interface of the mobile apps reviews.

Our results indicated that users' complaints are not related only to how the apps work but also to the way that apps' stores illustrated the apps. In fact, users need to have awareness about the technical terms that are associated with reviewing an app. The way of illustrating the permissions and privacy-related issues should be considered when designing the interface. Information related to the ads, battery consumptions is also beneficial to be included in the interface of mobile apps' reviews. Our study found that users are frustrated from reading the reviews especially the lengthy reviews. There might be a way to summarize the reviews and help users to have better experience.

In the future, we would like to explore users' needs and desires for a suggested interface. An interview with apps' users could help to prioritize the elements of the visual design. Then we plan to have a suggested prototype that could enhance users' experiences and increase their awareness regarding apps- related issues. Users should be able to distinguish apps' risks and benefits easily.

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