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Investigating user Requirements for Mobile Educational App Impact of Requirements Gathering on Software Development

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***Abstract* – Requirements for mobile apps and their development process considerably differs from software developed for desktop computer or web applications. Beside many other reasons, lack of efforts for requirement gathering and inappropriate app development processes creates significant challenges for app developers and sometimes results in app failure. Extracting user requirement for an educational app was the main objective of this research. In the research we understand requirement of users and the environment in which they will use this app in the future. We collected data from teachers in three different languages using an online questionnaire and printed questionnaire. Analysis of the results reveals that most of the teachers have the same preferences for app functional features, user interface and usability requirements. From analyses and literature review, we identified challenges that an app developer can face, studied the implications of requirement gathering on software development and users' expectation of app quality.**

Keywords Requireme gathering; software engineering; educational app; app features; questionnaire; user interface; usability

I. INTRODUCTION

Eminent features of mobiles such as variable screen size, different platforms, input methods, communication capabilities and difference in programming languages required for platform specific app development draw attention to certain serious challenges for app developers during app development process. Previous studies [1] highlights that the commonly used development practices in mobile app development are rarely based on formal development processes and vary from native to web based apps. App development based on developer, how he handles app development frameworks, tools and technologies. In order to create high quality, secure, complex and critical app and the apps for some targeted users, it is very important to follow software engineering techniques. Issues and challenges in requirement gathering, design, implementation, testing and maintenance for mobile app development issue and challenges are very much different from desktop or web applications [2].

Most essential phases of a software development life cycle are requirement gathering [7], and for software engineering end user involvement is important for the development of useful and usable systems [9]. The requirements for commonly developed software that are used in mobile device and available in app stores are derived from strategic business goals or from market opportunities [3]. Therefore, developers have limited contact with end users and face many challenges. If the app does not meet the user requirement in terms of interface, features, pricing, app description, or user feedback it is failed [3]. Since the users from different countries, age group and gender have different behaviors and needs.

Integration of mobile devices in education enhances learning and enable teachers and student to use computing power any time anywhere [6]. Research [10] [11] [12] highlights a positive response of students towards educational apps and assessment shows their better performance in new active learning techniques. In [4] and [5] we discussed tools and techniques required for cross-platform app development and framework of a new mobile app for the university environment respectively. In this study, for our proposed framework [5] we explore end user requirements and involve users in app development process. The mobile educational apps are generally meant for teachers and students. Research [8] highlight a high percentage of smart phone consumers use their devices for the academic tasks in higher education. Through background studies, we found that in most of the app surveys either pre-study or post-study targeted users were students. Therefore, our targeted group is teachers. For the positive attitude of teachers towards the presentation and functionalities of an app that in future will help them with course related tasks and students' assessment, we have gathered requirements from teachers.

A. Contributions

Past research shows that an evaluation of effort extended on modern learning techniques depends on end user satisfaction from the featured tasks, during app usage. Therefore user responds with a confined mindset rather than proactive. Our present research provides support for what the user expects, and therefore in future we hope to get better user satisfaction in the app and it will reduce the challenges faced by software developers in future tasks.

We conducted investigations for requirements gathering with teachers as targeted users and cover different countries. Our questionnaire investigated user adoption of mobile platforms, their rationale for selecting or abandoning an app, their educational app needs, and, also their preferences for the user interface. We surveyed 64 participants from different countries, including Pakistan, Saudi Arabia, Tunisia, and

India. With no major variation in characteristics of focus group, an acceptable survey can be conducted with a limited number of participants [15]. Therefore a dataset of less than hundred forms a valuable resource for the requirement gathering of education app, and investigating its impact on mobile app development. We consider our analysis as a major contribution to our work. From the analysis of results that we obtain from mathematical measures such as percentages, graphs and statistical measures such as the Bivariate Pearson correlation coefficient, linear regression, and one sample t test, we identified requirements and evidence that there is no strong difference in respondents' preferences therefore in future an educational app can satisfy its users. Through analyses, we identified new challenges for software engineering in context of educational apps, and provide implications of requirement gathering on app development.

B. Motivation

Intense use of mobile phones among students is a great motivation. Mobile phones have become an integral part of both students and faculties. It motivates us to exploit this technology in education as learning resources. The main objective beyond this work is to demonstrate the prominent possibility of applying cellular phones in the classrooms at the Higher Education level and show its promising results by developing an app. App development follows software engineering principles. Software Engineering is a challenging field and a large part of the challenges come from, how requirements are gathered in software development. If app developers have limited contact with the end user, it is difficult to fulfill their needs.

The objective of this study is to analyze the teachers' response towards a mobile app that would be an effective teaching tool in future. Requirement gathering before software development would help us to provide content in such a way that teachers can understand the presented interface and we could clearly identify the required app features with their characteristics. Our aim is to interpret, conceptualize, and approximate statistical information based on users' responses so that in the future gets a better real-time feedback of mobile educational app.

The remaining paper is organized as follows. Section II provides background with research questions and the methodology we adopted during the study is explained in section III. The results discussed in section IV. In section V an analysis of the challenges of software engineering and impact of requirements in software development is provided, also the validity of our research discussed in this section and final section VI concludes our studies.

II. BACKGROUND

Since surveys are the best tool to learn about user preferences, interest and requirements [3]. Therefore, we have not focused on activity log even according to our objective activity log data and app store data are not required. Literature review of the importance of surveys, methods for conducting surveys, how they are used in existing research to get user needs, and their use in app evaluation according to user feedback is provided in this section. We summarize our discussion by formulating some research questions.

A. Survey and User Feedback

Surveys provide a high degree of accuracy is users' demographic information [3]. In the questionnaire of [3] close ended questions were used to examine app needs of users, their criteria for selection or abandonment of app and effect of country differences in user behavior. To evaluate students' performance in quiz on mobile app post experiment 7-point Likert scale was used in the questionnaire [10] with limited sample size. Overall performance of group was better than the control group in quiz. iRequire [9] is a web based tool launched for Samsung to explore end user context information, and allow the end user to blog their preferences and needs. A pre-study and post-study questionnaire with Yes/No, multiple choice and Likert style questions, used during evaluation of students' performance in mobile and podcast based learning experience [11]. In pre-study questionnaire 92 students provide personal information and respond to their podcast and mobile devices use. 36 students from the trial group fill a Likert scale post-study questionnaire to share their learning experience. An experiment [12] conducted with 25 students, 12 in the control group and 13 in the statistical mobile app group to evaluate how an educational app enhance students' performance. A post-experimental survey with 7 point Likert scale used to explore students' comfort level with educational app. Students who used app performed much better than the control group and show satisfaction in new active learning technique. In [14] 132 students participated in a survey to evaluate existing learning features and in the second session of the survey give their requirements for the features they want to be part of the app.

To summarize, existing research into apps and requirements analysis, our focus is on sample size, targeted users, and type of questions of the questionnaire used in surveys. Close ended questions are used in these surveys. Maximum sample size is targeted in [3], but for [10] and [12] sample size is very small. Although [3] has taken detailed demographic information, and broadly investigated country wise app user behavior, but users are not classified in terms of age group, education, or job category. This study is more general rather specific. In [10], [11], [12] and [14] targeted users are students. In these educational apps teachers are not considered in app evaluation and feedback and for first three students give feedback on existing apps, their preferences and needs are not considered during app development. iRequire [9] can only be used by the user who have this tool on their mobile.

B. Research Questions

Our research questions form a baseline in-order to gather user requirements for educational app and to discuss their implications during the complete software development process. The research questions are as follows.

a) Which method is better for gathering requirements that are prerequisite of software development?

b) What needs a teacher trying to meet from an educational app?

c) How to improve user's satisfaction for interface and achieve required non-functional requirements?

d) What will be the impact of requirements gathering on app development future tasks?

III. METHODOLOGY

Methods for collecting an initial set of requirements include questionnaire, interview and task analyses [7]. Further, this research reveals that each of them has pros and cons, and for the best possible outcome it's better to use a combination of different methods. Requirements gathering from graphical user interface provide more insight in procedural requirements and interface preferences. A questionnaire is the most suitable method to get functional insight, moreover task analysis, interviews and GRC, take more time and require software engineers and end user be in the same place. In [13] different methods are used for user requirements and questionnaire is starting point of this research to gather initial requirement and to understand the problem domain. According to research questions, collecting an initial phase of requirements is the main focus of our study and our targeted user are not at one place therefore we use questionnaire.

To investigate the research questions in this study, we use survey. For the survey, we constructed a questionnaire in order to collect quantitative data from teachers. To obtain a representative and generalized view of teachers about educational app, we targeted teachers from different area of specialization and countries. In our survey targeted countries were Saudi Arabia, Pakistan, Tunisia and India. Due to participants from different countries we used both online questionnaire and printed copy of the questionnaire, to make survey easily assessable for targeted users.

A. Questionnaire Construction

The objective of this questionnaire is to gain a better understanding of how users adapt to a mobile based education system in university, their app requirements and their motivation for selecting a mobile educational app. To achieve the objective, we formulated a questionnaire in which questions relate to our research questions mentioned in section II. For example, for b (needs teacher trying to meet from educational app), we asked the participants about features they want in app, how they want calculation and presentation of results, how much time they think appropriate for quiz and assignment, how teachers and students share data with each other and what they prefer for answer key, whether it should be presented to students or not. We assembled these questions and their options on the basis of our previous research [5]. For research question c (improve user satisfaction from the interface and to achieve non-functional requirements) we give questions about information presentation, their preference for design elements, navigation and orientation and usability features that should be considered in app. For formulating these questions we get idea from [6] and [13]. Except for two questions (number of days for an assignment and user problems solved by app) all other questions close ended with multiple choices. We used close-ended questions because open-ended questions require more effort [3], quantitative analysis of such questions is difficult and in some cases rather impossible.

We assembled a list of questions to collect general information about participants such as area of specialization, gender, age, years of experience and designation. The purpose of these questions is to strengthen our analyses and get a generalized view of requirements. In our previous research [4] we highlight importance of cross-platform app, therefore we included some questions that reveal participants mobile and app usage pattern. We asked close ended questions such as number of mobile platforms used, and preferred mobile platform to know about user distribution across mobile app platforms. In multiple options we mentioned a list of popular mobile platforms, including android, apple, windows, and blackberry. For knowing about participants seeking behaviour we inquire how they find an app, and reasons for abandoning an app. In options we mentioned the factors that influence the selection or rejection of apps such as size of app, app description, and app reviews. To collect more precise data and detailed information, wherever required in multiple options we mentioned "Others (please specify)".

Questionnaires were arranged in three sections. The first section of the questionnaire based on investigation related to user's seeking behaviour in terms of distribution of user across mobile app platform, methods used to search app, reasons for selecting or abandoning an app. Questions in section II focus on the functionality of app that an end user requires, and questions in section III will help to develop a usable, efficient, and a user friendly app with limited cognitive burden thus provide a usability guide according to end user requirements and motivation. Where ever required, users can select multiple options. We arranged the questions so as to keep the interest of participants properly engage them in surveys and get better quality results. We grouped the questions in sections according to their concept and arranged questions to have a natural progression, e.g., start from which mobile app platform they preferred, to what influences them in the selection or rejection of an app, the features they want in educational app, to which problems will be solved by this app, and how they want presentation of data, to how they will completely satisfied by the app. Demographic questions are generally considered boring, so they can be kept at end of questionnaire [15], but we kept them in first page, because in paper based survey sometime participants skip questions on the last page.

In-order to avoid misunderstanding in the questionnaire, we used very simple words. We used language that can be easily understood by participants specially those who filled it in English, but English is not their first language. For example, as "mobile platform" is not a common word, we gave examples of mobile platform such as Android, iOS, Windows, and Blackberry. An abbreviation used for short form followed by full form. For instance, for the SDL app, we mentioned its full form Saudi Digital Library. When asking users about their preference for usability features, we gave a short description of satisfaction, efficiency, and effectiveness and when we asked how frequently users visit the app store, we provided quantifiable options such as, "several times a day", "once a day" or "once a month", rather than using subjective terms such as "frequently" or "rarely" that represent extreme behaviour [15].

With close ended questions limited kind of questions can be asked and questions are related to each other, they are arranged in the form of a story [15]. It is very important to keep participant interest and reduces chances of response biases. To reduce response bias in the questions the order of

answer options is carefully handled and it reduces bias when the participant without reading all options, select the first one or their response based on their previous experience or prior knowledge, e.g. in the question how teachers and student share information we gave option email as the first option, and website with each user profile as a second option. Therefore, reader focus on both rather than only the first one. "Others" remain the last option wherever it is used.

To ensure that participants do not miss out any questions, the online questionnaire highlights missing answers and respondents cannot submit form until the missing answers are completed. We also make it flexible so that if a question (like for SDL) is not relevant, the respondent can skip that, similarly for an open ended question if respondent do not want to answer or have no time can skip that question. The reason behind this logic is, usually in a paper based survey people do not answer open ended question so we kept it optional in online. Finally, we tested our questionnaire on common browsers, Mozilla Firefox, and Google Chrome.

B. Questionnaire Translation

The teaching faculty in our university are from different countries and we made survey online so our survey targets individuals from a variety of countries, background, and area of specialization. The questionnaire was translated into different languages preferred by our focus group in order to avoid misunderstanding and increase the number and accuracy of responses. The questionnaire was translated from its English version[1] into two other languages, French and Arabic Most of the teachers were comfortable with English, but some of the teachers from Saudi Arabia, Jordan, Egypt and Sudan were not able to give an appropriate response in English and the people in Tunisia have their first language French. The translators are native speakers of the targeted language and are also proficient in English. The Third author of this paper translated in Arabic while the fourth one in French. The translator used words that were easily understood by participants even if they were not from the computer science field, and ensured that the translated questionnaire matches the English questionnaire.

C. Data Collection

For a better response rate two methods were used for data collection: online: web-based survey and hardcopy: paper survey. The survey was conducted for three weeks in the month of February 2015. In the first method we created a separate site for English, French and Arabic version using Google docs, then we invited individuals from the teaching field in our social networks to complete the survey, and then asked them to invite teachers in their social networks or whom they know in their workplace to complete the survey, and so on. The following methods were used for the invitation: emails to specific colleagues or friends, emails to mailing lists and sending messages to friends on Facebook. The data automatically saved in excel sheet was later combined in single sheet in English language for calculation of results and analysis.

[1]https://docs.google.com/forms/d/1NhMUDuR0tWnxPp9j9HJ_UEMqJKDHytiKiDWnpaB0bwU/viewform

The second method based on paper survey. We contacted our colleagues and distributed questionnaire on the basis of their preferred language. For paper based survey English and Arabic version are only used, since all the teachers are comfortable with either of the two languages. To avoid response bias, we contacted them individually and asked them to fill it according to their own experience and understanding. The data collected was then entered in excel for result and analysis. A focus group is a good tool to understand and determine peoples' needs, to know how people perceive a situation, and to get insight in their attitude and perception [15]. Therefore, our sample was a focused group not a generalized one, as it was good for our motivation, our findings and for our experience that we want to attain from users' requirements.

D. Data Analysis Technique

The results were calculated by using MS Excel 2010 and SPSS[19]. We analyzed general information of participants and section 1 by calculating percentages and graph representation where ever required, and used Pearson correlation, linear regression to see the relation between the number of mobile platforms selected by user and preferred platforms, for our assumption related to mobile platform one sample t test was conducted. In section II data analysis was performed through percentages, graphs, Pearson correlation, and one sample t test according question and data. While in section III number of times an option is selected was calculated to observe users' preferences in user interface and represented in the form of graphs for each question independently.

IV. RESULT AND ANALYSIS

The dataset collected from 64 participants using two different data collection techniques, was arranged in three excel sheets. First sheet data collected for user response demographic information and users' behavior towards mobile platforms and apps. A second sheet contains information about educational app functional requirement or app features and sheet three summarizes their preferences for user interface and non-functional requirements. All participants provided useful data, therefore nothing was excluded. The following sections summarize our results about different questions in questionnaire and provide analyses of dataset.

A. User Distribution

Dataset collected from 23 (35.93 %) male and 41 (64.06%) female based on participants from different areas of specialization such as computer science, biology, chemistry, English and Urdu language / literature, economics, accounting, management, physics, mathematics, statistics, commerce and Arabic language thus gave a broad spectrum of users' preferences. Focus group comprised of 60 from teaching profession (professor, associate and assistant professor = 17 (26.56%), lecturer = 43 (67.187%)) and 4 (6.25%) from non-teaching profession. The responses of participants from non-teaching profession were also appropriate so we consider in our analysis. Almost 64% were in the age group 30-40 while 25% were above 40, and 70.3% had more than 5 years working experience. Thus, participants had a strong background in teaching field. The mobile platform that was preferred by most of the participants was Android (51) as shown in fig 1, but some participants mentioned that they use more than one mobile platform (2 =

17 (26.56%), 3 = 4 (6.25 %) and more than 3 = 2 (3.125 %)). Participants behavior towards mobile apps indicates that more than half (57.8%) find app in app store followed by those who use search engine (25 %) and those who focus on app reviews were just 14%. Very few (almost 3%) use other methods. Frequency of the visiting app store shows that 43 % visit just once in a month, while only 23 % visit daily. This low percentage of visiting app store is probably one of the reasons that 71 % participants don't know about SDL mobile app, although most of them were from our university and they use SDL on their desktop computers.

The number of mobile platforms is significantly correlated with the preferred platform. Bivariate Pearson correlation proves our assumption with r = 0.987 and p = 0.013, therefore strong correlation. Linear regression reveals that 97.5 % responses for mobile platforms depends positively on preferred platforms with R^2 = 0.975 and p = 0.013. From personal experience, we supposed the likelihood of mentioning only one platform is more, one sample t test reveals mean depression score 1.48 ± 0.76, and p = 0.000 thus positively significant results. We thought that participants will not understand our question, but these results indicate that their response was according to our assumptions.

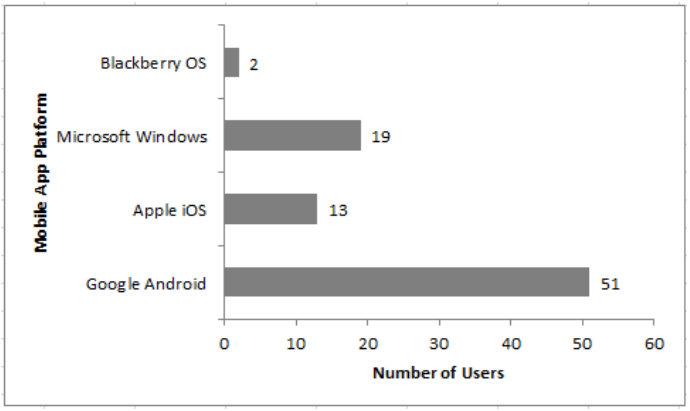

Fig. 1. Users' Distribution Along Mobile App Platforms

B. Required App features

For the main mobile app features quiz, assignment and feedback 71.8% preferred all three options, while 15.6 % want both quiz and assignment, only quiz is the choice of 4.6% and only assignment is selected by 7.8% . Therefore, both quiz and assignment should be part of app. In future app should be developed to be used in both campus and home as it was the choice of 87.5% and 79.68% participants want result calculated by the system. 84.37 % want to generate assignment or quizzes with answer key that 64.06% think to be disclosed to students after each quiz or assignment, while 31.25 said it should be displayed at the end of semester. The results presentation options with percentage is given in fig 2. It shows that more priority was given to tables than reports and graphs. Website with each user profile is considered as best choice for sharing data or information between users and teachers (51.62 %), even it is selected with other choices also as shown in fig 3. 5 to 30 minutes are enough for quiz, and 1-7 days are enough for the assignment, as stated by approx. 66 % and approx. 75 % participants respectively.

Participants who mentioned quiz time 5-30 minutes would likely mention assignment days between 1 to 7 days. Bivariate Pearson correlation provides a strong correlation between quiz time and assignment days with r = 0.994 and p = 0.069 that shows a moderate trend towards significance. One sample t test reveals a mean depression score for quiz time 36.64 ± 26.308, and for the assignment 8.06 ± 11.037. This difference in quiz time is because 18 mentioned more than 30 minutes and even 4 want more than 1 hour, maybe they consider midterm exam time or this variation could be due to difference in subjects. Similarly, in assignment 14 participants considered around two weeks require for the assignment, while one person from non-teaching profession mentioned three months he might assumed project. In case of assignments p = 0.444 shows that there is no significant difference is mentioned days, while p = 0.048 shows a significant difference is quiz time. In future in app development, we must consider mean depression score to satisfy app users.

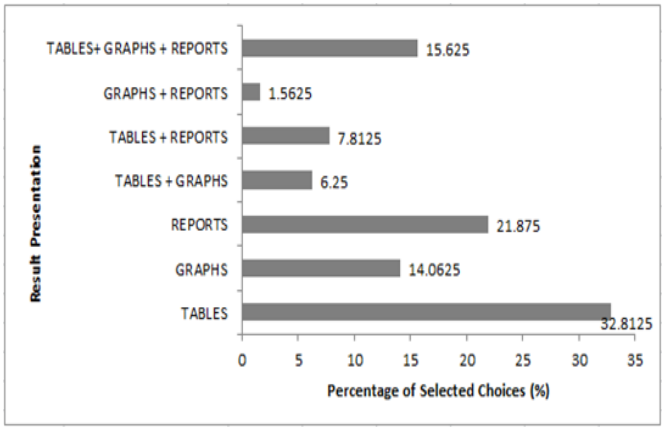

Fig. 2. Methods suitable for result presentation

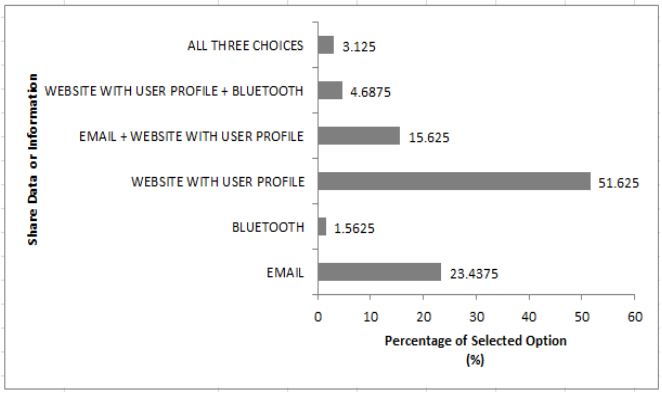

Fig. 3. Methods for sharing data or information

C. Preferences in User Interface

To effectively understand participants' preference in user interface and required usability features we analyzed results of different questions. 45 participants' selected light background with dark color of text and 19 mentioned information should be presented on multiple screens as shown in fig 4. Information presentation options were not answered as required, only 27 gave a response for arrangement options so the difference of 37, and 53 gave response to color combination so there is a difference of 11. For design elements and features for navigation and

orientation most of the participants selected multiple options, number of times each option is selected from these questions is given in fig 5 and fig 6 respectively. Analyses disclose that all usability measures are important as 49 participants selected all of them, while other selected either two of them or only one. Efficiency is considered important by 62 respondents, followed by satisfaction 57 and effectiveness 52.

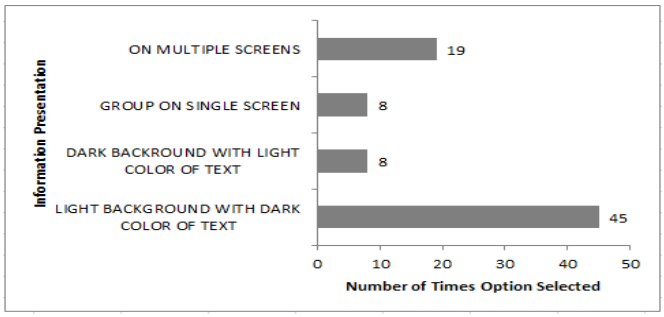

Fig. 4. Preferences in information presentation

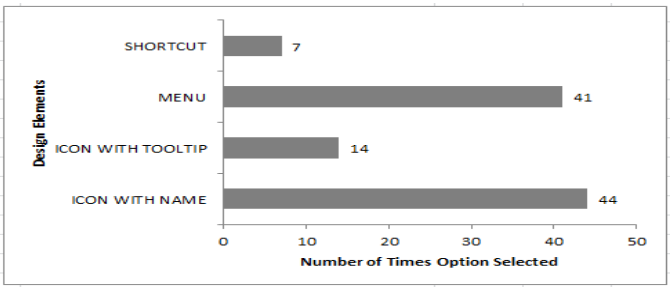

Fig. 5. Types Of Design Elements For User Interface

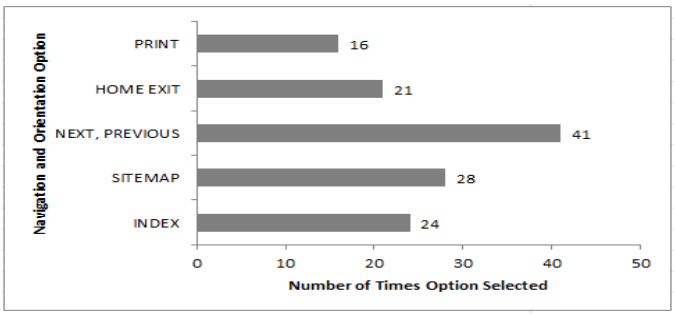

Fig. 6. Options for navigation and orientation in app

V. DISCUSSION

From the literature review in Section II-A it is quite obvious that app reviews got good feedback from participants, but previous research on mobile device usage in education [18] and use of mobile devices in educational context [19] highlights that percentage of mobile usage both by teachers and students for educational purpose is very low and they are not very much aware of the importance of using mobile technology in education. From this we assume that common mobile apps or even those which are specifically developed for education purpose are not according to end user needs and expectations, therefore this affect their interest. Therefore, in Section III we explain the questionnaire that we used to collect teachers' requirements and in Section IV analysis highlight common preferences in requirement and specific user behavior towards mobile apps. In this section we summarize our analysis in the context of literature in software engineering in order to identify challenges in app development, discuss how the requirements have an impact on software development and implications of this study on meeting high quality user expectations.

A. Challenges for Software Engineering

Analysis of the data collected through questionnaire suggests that the app-based software development brings new challenges for software engineering. In this section in the context of educational app and our results, we highlight the challenges listed in Table 1 [1, 2, 16, 17, 21, 22, 23] for software engineering suggested by previous research in app development.

Table 1: Summary of Challenges for Software Engineering in Context of Mobile Educational App Development

Challenges	
1.	Challenges in properly gathering and documenting requirements to avoid app failure.
2.	Difficult to gather non-functional requirements and satisfy end users.
3.	Documenting non-functional requirements is not easy as mobile environment depends on different kinds of network.
4.	Introducing usability features are difficult due to the stringent requirements of mobile software.
5.	Without good experience in mobile device and mobile operating system, requirement engineer cannot satisfy customers.
6.	Challenges in designing prototype for cross-platform due to diversity in platform user interface and user experience.
7.	User interaction varied on each device due to difference in interface style of different mobile platforms.
8.	Difficult to manage development constraints such programming language and physical constraint such as size of mobile device to achieve software quality.
9.	Completion of the development life cycle requires a physical manifestation of the device.
10.	To meet requirement of location based services, e.g. app can only be used in campus area is difficult but important in educational apps.
11.	Maintaining security and privacy in context aware mobile software is difficult.
12.	In flexible architecture a developer must keep balance between variability and concrete requirements without compromising evolution.
13.	Acquiring app according to external sources, e.g., running same features of an app with or without internet.
14.	Challenges in selection of common input method and widgets that satisfy users with different devices.
15.	Gathering information from the environment through physical sensors, Bluetooth or web services and managing varied data from different devices require profound expertise.
16.	Challenges in architecture for abstraction between end user app, variability, and detailed information.
17.	Cross-platform approaches such as cross-compiler, virtual machine, web based or hybrid all have major limitations that seriously effect services provided by the app and its quality.
18.	High cost of high quality and full performance, multi-platform native apps.
19.	Just emulator is not sufficient for testing, therefore different devices with varied use case for each device required for testing cross-platform app.
20.	Quality of SDK effect software developer satisfaction and thus loyalty to mobile platform.

B. Impact of Requirements Gathering on Software Development

To address the impact of requirement gathering on software development, we consider our analyses and challenges listed in table 1. The factors that affect user selection for an app are, app size, packaging of apps such as app title, and app description. This effect app reviews, and selection or abandoning of an app as we analyze for SDL app. Therefore, this thing must be kept in mind in order to motivate people for educational app. Documenting and managing features of educational app are challenging for developers as which features should be included and which features can be omitted. From analysis, we found Android is preferred platform, but others cannot be sidelined. This was just an initial set of requirements in the future during app development extensive user involvement is required. Creative requirement gathering techniques such as paper based prototypes or app prototypes for cross platform with different interface styles required to meet the requirement gathering, documentation and user satisfaction challenge.

For app features quiz and assignments, security, correctness, usability and many other non-functional requirements are required, but users cannot easily define these requirements. Another problem is in different types of networks such as wireless internet, wired internet and for Bluetooth the non-functional requirements and their priority changes. Therefore, for the functional requirement (such as data sharing between teachers and students), non-functional requirements need to be handled according to the mobile environment. Mobile devices fairly handle context aware apps [20] but using an educational app either in campus or home and making it available for students only in class reveals challenges especially for security and privacy of information.

Features related to result calculation, presentation, conduction of quizzes come across constantly changing data or information that might be kept for a certain period of time as given in framework [5], similarly all features are not available at home, and some of them can only be used in the campus area. The challenge here is to manage the balance between changing and concrete features. To address this challenge developers need to develop an effective evolutionary process for the design of app features. During app development process developer come across programming language constraints while implementing requirements, such as whether programming language support APIs for Bluetooth connectivity, and device constraint such as screen size and input methods. No doubt these constraints vary within programming language and within devices. Therefore, developers need extreme expertise and requirement engineering must be based on more effective techniques where such issue should be discussed with end user to produce a feasible requirement document.

C. Meeting High Quality Expectation

To meet high quality expectations of users from educational app, it is very important to encounter usability issues that generally people face in mobile apps. Usability is effected due to speed, size, memory required to save data (and mobile have memory issue), user interface and many others. Analyses show that the participants require efficiency, effectiveness and satisfaction from educational app. During requirement gathering usability features must be discussed and documented. The end user must be clear about usability features, e.g. how the user is satisfied by app. Without functional requirements app is useless, so they are included in the app, but from an end user perspective non-functional requirements define quality of apps. That's why non-functional requirements are considered more important than functional requirements [3]. Therefore, requirement gathering must be elaborated by prioritizing non-functional

requirement, and defining them properly in context of each functional requirement of educational app.

D. Validity of Research

We gave maximum care and attention to ensure the accuracy of results and to avoid response bias. But like any other research approach, it is not without limitations. Although we asked a simple questions, but one common issue in the responses was that we consider SDL app which is only available to Saudi university teachers, so there was a response bias in those questions. For "others" option, in online questionnaire respondents could not mention that what is other, this is where the difference in analysis come from those who responded online to those how gave response on printed questionnaire. We gave an open ended question that was very important, but very few people gave response even those were not very effective.

This study was conducted to gather user requirements for educational app. The dataset that we collected from this research provide a clear insight into user requirements, enabling future research to extend requirement gathering with different techniques and proper documentation of both functional and non-functional requirements for educational app development. It was unique as in literature we did not find any requirement gathering from teachers for educational app. In future this study could be extended by improvement in the questionnaire from our experience and including respondents from more countries especially where smartphone usage in mobile learning is high.

VI. CONCLUSION

Advances in mobile technology have resulted in the development of cross platform apps that resulted in innovated solutions for challenges faced by almost all walks of life. Developing an app with either not having proper experience of app development or without properly gathering user requirements, result in extensive challenges for software developers. As complexity of mobile apps and their requirements is significantly more than desktop software. Therefore, in this research we gathered requirements for an educational app from teacher using questionnaire based survey technique. We analyzed the importance of requirement gathering from literature review and demonstrated through the results user preferences in educational app. We concluded that most of the teachers mention almost same suggestions for app.

Through analysis of results and literature review, we identified new challenges for software engineering in context of educational app development. Our approach of app features and usability based requirement gathering will be useful in future in application development when dealing with software engineering issues. The research conducted by a team with distributed expertise, help to conduct in different languages and effective use of Software Engineering and Human Computer Interaction in generating questionnaire and analyses. Although we use this studies for educational app, its analysis and discussion can be used to enhance quality of other mobile apps.

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