

Usability Evaluation of M-Learning Apps in the Context of User Experience

Kamlesh Meshram¹ and Manimala Puri²

¹Department of MCA, JSPM's Jayawant Institute of Management Studies,
Pune, Maharashtra 411033, India

²JSPM Group of Institutes,
Pune, Maharashtra 411033, India

Abstract

Usage of M-learning applications has been increased tremendously in higher education domain in India. Previous studies shows that users doesn't bother to accept new technology if the products or services are useful. Usability is the main factor in terms of user will use this product or not. In mobile application development process, usability evaluation is a vital aspect. User Experience term have been used in this research study to evaluate usability of mobile learning applications in the context of Higher Education in India. The main objective of this research study is to evaluate usability of widely used mobile learning application by university students. This paper is focusing on two mobile learning applications namely "SoloLearn" and "Coursera". Usability evaluation test conducted with 302 participants who were selected using convenience sampling method from various management colleges affiliated to Savitribai Phule Pune University. The data was collected using System Usability Scale (SUS) questionnaire, to obtain students' and teachers' perception regarding two M-learning applications namely "SoloLearn" and "Coursera". The findings of this study show that both the applications are useful, easy to use, effective and efficient and the users were satisfied as the overall SUS score is 78.

Keywords: *M-learning, Higher Education, Usability evaluation, and User Experience.*

1. Introduction

Learning and educational content has widely available for anyone who having access or connected with internet and want to grab the knowledge from it. Knowledge content is available through online resources; free of charge, at any time any place and anywhere [20]. Easy access to communication, information, and knowledge has also resulted in social and cultural changes: for instance, people rarely manage a day without a mobile phone or access to the Internet [9], [10], [11]. This easy access

to knowledge creates additional and perhaps even surprising demands for the design of learning content and applications [13]. Mobile learning aims to overcome the constraints of traditional educational settings where learning and teaching happen in classrooms behind closed doors. M-learning has been around for almost two decades, but so far it has failed to draw serious attention of educational institutes in comparison with e-learning [16], [17]. Utilizing smart devices for educational purposes is associated with several challenges including the usage of a small device with many limitations on display, keypad, and memory. Mobile learning applications also compete with students' time regarding other applications in the used device, including games [14].

What is Usability Evaluation?

Usability evaluation is the process testing of system User Interface (UI) on how easy a design is to use and any potential usability issue are there or not. Put simply, usability evaluation assesses the extent to which an interactive system. Usability evaluation process involves examining system users as they try to complete tasks and can be done for different types of designs, from user interfaces to physical products. It is often conducted repeatedly, from initial development of system until a final product's release.

The major advantage and rationale of usability evaluation is to find out are there any usability issues with a system design as early as possible, so developers and designers could fixed before the design is implemented for users. As such, usability evaluation is often conducted on prototypes rather than finished products, with different levels of reliability (i.e., detail and finish) depending on the development phase. Prototypes tend to be more primitive, low-fidelity versions (e.g., paper sketches) during early development, and then take the form of

more detailed, high-fidelity versions (e.g., interactive digital mock-ups) closer to release.

In a typical usability evaluation, a test instructor gives a series of tasks to the potential end user that they must perform with the design. The tasks represent procedures that an end user would typically carry out with the finished product [25], [26]. During the evaluation, the instructor observes each participant's actions, often also recording the test session on video. After analyzing the results of a usability evaluation, the instructor reports on several points of interest that arose—these include issues such as the aspects of the design that caused problems and the severity of these problems, as well as places in the design that the participants particularly liked [27]. Recognizing this potential to highlight difficulties and strong points in a design's early versions is a vital part of a designer's thought process. The broader the testing and the greater the number of matters raised, the stronger the likelihood that designers can craft more successful products [12].

In order to produce usable products researchers suggest four principles: a) focus early and continuously on the users, b) integrate consideration of all aspects of usability, c) test versions with users early and continuously, and d) iterate the design. Usability inspection methods are continuously evolving, since traditional usability measures do not cover new contexts such as e-learning and m-learning [20]. Therefore, new methods and approaches are continuously being developed to promote the usability of systems and applications in the new applications' domain. Researchers, particularly those in the field of human-computer interaction (HCI), have developed comprehensive sets of usability guidelines to help designers produce usable systems [29].

Figure1: Mobile devices with a variety of physical forms, Raptis, D. (2015).



What is Mobile User Experience (UX) Design?
 Mobile user experience (UX) design can be defined as the expression of user in verbal or nonverbal

feedback regarding the positive experiences during the use of mobile devices, handhelds devices, and applications or services running on those devices. The mobile market, promotes the contextual use in which smartphones are being used by the users. Context of use aspect plays an important role on the design of the user experience. Mobile UX design focuses strongly on efficiency and discoverability regarding the context of use [19], [23], [24].

According to Nielsen a web portal, in India average spending time with smartphones is 3 to 4 hours. But if we talked about average spending time for mobile learning application is very less, mobile users engage with their devices at essential moments and only for very short periods. User experience need to be consistently positive, efficient and pleasant in order to keep them occupied and ensure their continued use of such items. Therefore, mobile UX design focuses on delivering devices and services that are streamlined to serve spontaneous user needs that change with the context the user finds himself or herself in, while keeping the interaction levels as low as possible [30]. For instance, a user may have two free hands and fewer distractions while standing in a coffee shop than she would if, five minutes later, she must grasp a pole or railing on a bus traveling on an uneven road.

According to Educational App Store a web portal, more than 5, 00,000 educational apps are available for android and iOS devices. So the next important challenge for mobile UX is discoverability (i.e., how easily potential users can find the service or app) due to the sheer size of app marketplaces. For the same reason, retention and engagement also pose significant challenges, since users are often able to find plentiful and free alternatives to suit their needs. For mobile UX designers, the careful shaping of the mobile user experience—from discovery to operation and co-operation with other devices or services—is a key goal in creating positive and personally meaningful experiences for users. Designing for mobile also involves appreciating the need for brand consistency and the users' expectations of content regarding their threshold for inferior versions of "full-fledged" designs they would find on computers at home or in the office [31].

M-Learning Application other than "SoloLearn" and "Coursera"

There are different mobile applications that are useful for teaching and learning apart from "SoloLearn" and "Coursera". These mobile apps are either pre-installed or need to download to use. Also, there are free and paid mobile apps. Some of the mobile apps and its uses are described below:

- **Smart Dot:** It's an iDevice-based laser pointer that functions as a remote control for PowerPoint and Keynote presentations.
- **Educreations:** Interactive Whiteboard: This is an easy-to-use app for drawing and diagramming in the classroom.
- **Attendance:** Attendance helps to keep track of attendance of students' in the classroom.
- **Grade Book for Professors:** Is a good app for organizing and tracking student grades. Both free and paid versions are available.
- **Percent Calculator:** Get grades done smarter, better, faster, and stronger using this quick and easy calculator just for figuring out percentages.
- **eClicker Polling System:** Available on the iPhone, the eClicker Suite lets teachers poll their students about anything and everything during class.
- **Edmodo:** Edmodo is a community learning platform for students, teachers, and schools. Edmodo can be used for communication, polling, assignments/quizzes etc. Maintaining and managing classes is much easier, and students can easily send teachers individual messages or materials.
- **iTalk Recorder:** This app helps keep an audio record of the classroom discussions using the iPhone!
- **Evernote:** Evernote is another app for teachers to organize the things. This application can be used for course planning, implementation lesson plan and taking feedback from the students after every class. Educator can take notes, capture photos, make to-do lists, record voice reminders and makes these notes completely searchable, whether you are at your Institute, at home, or on the move.
- **CourseSmart:** Subscribers to this digital textbook service enjoy unlimited access to thousands of digital reads on their phones and tablet devices.
- **Google Classroom:** Google Classroom can be use of by any eLearning professionals and online educators who have already created a Google Apps for Education account for free. In fact, Google Classroom is developed and designed to provide platform for online facilitators, content providers and educators. The major one of the objective of this app to bring change in education in terms of paperless education and consolidate their eLearning materials in one cloud-based location.

Limitations of Mobile Applications

One of the major challenges of mobile application is their platform dependability. Along with the interesting advantages mobile applications have some limitations as well and are given below:

Small screen size: In mobiles it is difficult to view text and graphics like in a desktop computer screen.

Navigation: Most of the smartphone enabled with touch screen user interface do not have mouse like pointer, so it has limited flexibility in navigation.

Acceptability of files: The mobile platform does not support all types of file format.

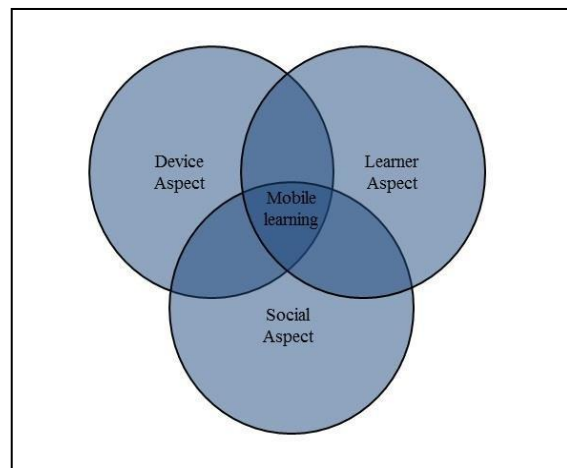
Speed: The speed of processing and connectivity of mobiles is low.

Size of messages or email: Many devices support limited number of characters in message or email.

The FRAME model

One of the prominent models used in usability evaluation is the FRAME model. The Framework for the Rational Analysis of Mobile Education (FRAME) model developed by Marguerite Koole in 2009 has been used in developing other mobile devices, learning content, and in designing teaching and learning strategies for mobile learning. Mobile learning as the interaction among learners, their devices and the social environment which requires new generation learning skills and modified roles of the teacher and their identities [22]. There are three elements in the model: device aspect, learner aspect and social aspect. In an attempt to define "usability", the criteria proposed by [22] for assessing usability served as a useful guideline for evaluating the mobile learning module (Figure 2).

Figure2: The FRAME model [22]



2. Literature Review

In this paper researchers has proposed and validated a framework on evaluating mobile learning applications particularly for Mathematics in the context of human computer interaction (HCI) [7]. To achieve this objective, researcher reviewed existing relevant frameworks on mobile learning. In this research expert view has been taken in to consideration, the results proved that the framework can be easily and effectively applied for evaluating mobile learning applications for Mathematics which

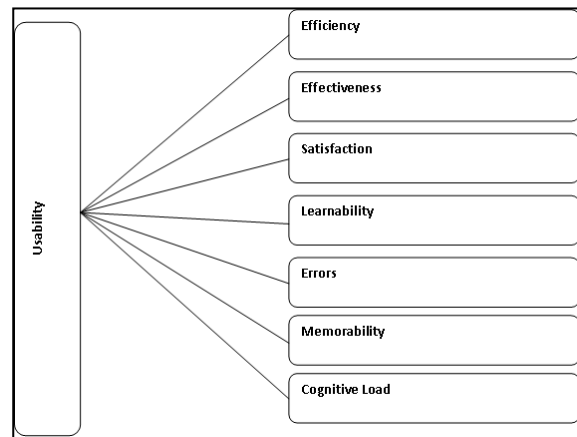
aimed for the use of developers, teachers, learners and administrators [11].

The research study stated by [21] has used two different groups one is experimental group (n=15) and other was control group (n = 26). A mobile learning pedagogy was used in experimental group, while the control group participated in classroom teaching-learning strategy was used. 57 items attitude scale was used and refined this scale gradually to measure the students' attitudes toward mobile learning, and 36 items academic achievement test was developed by researchers to check the effect of mobile learning applications on the students' achievement. In this research study exploratory analysis, interviews were conducted with student's pre and post test was done [3], [4]. The results show that there was significant difference before and after use of mobile learning applications in attitude and academic achievement. Both the groups had reported significantly high attitude scores toward mobile learning [5].

Researchers had collected usability data from 20 students in which 9 was males and 11 were female. The research was carried out in two different environments, one in a laboratory and other was field setting to investigate the usability of Grab car mobile application on the usability dimensions namely efficiency, effectiveness, and satisfaction. The results of this study showed that majority of respondents were satisfied usability dimensions i.e. ease of use, efficiency and satisfaction for the mobile application [1], [2], [15].

Usability evaluation framework consisted of two layers: usability formation and evaluation of usability [6], [7], [22]. The study for measuring the usability as a part of user-centered design process [8]. Rachel Harisson et al. define the PACMAD (people at the center of mobile application development) model of usability. This methodology brings different attributes of different usability factors together to develop a extraordinary comprehensive model [18]. The usability of the mobile applications can be measured by three criteria. They are efficiency, effectiveness and satisfaction. Some other attributes like cognitive load are overlooked, even though they are very prominent for the success or failure of a particular application. Cognitive load is the amount of cognitive processing needed by a particular user to see the applications [26]. In order to overcome with this difficulty, PACMAD (people at the center of mobile development application) was introduced. The PACMAD model [18] added four attributes other than ISO 9241-11 models' three attributes, i.e., learnability, errors, cognitive load and memorability. In order to overcome the existing model, PACMAD depends upon three factors. They are task, user and context of use [28].

Figure 3: PACMAD usability evaluation framework



3. Research Objectives

1. To study the applicability of M-learning applications in higher education in India.
2. To study User Experience (UX) aspects for “SoloLearn” and “Coursera” learning application.
3. To study comparison of “SoloLearn” and “Coursera” application on Usability dimensions.

4. Research Hypothesis

H1₀: SoloLearn and Coursera mobile learning applications do not significantly support perceived usefulness in higher Education.

H1₁: SoloLearn and Coursera mobile learning applications significantly support perceived usefulness in higher Education.

H2₀: SoloLearn and Coursera do not significantly effective in Higher Education.

H2₁: SoloLearn and Coursera significantly effective in Higher Education.

5. Research Question

1. Can usability evaluation of M-learning application being done using existing evaluation methods.
2. Are “SoloLearn” and “Coursera” effective learning application in the context of higher education?
3. What are major usability dimensions in the view of students and teachers concerning with the “SoloLearn” and “Coursera”?
4. Is User Experience (UX) really does matter while evaluating M-Learning applications?

6. Research Methodology

In this study, a questionnaire was made and used as a primary instrument for data collection purpose. The questionnaire was distributed to management institutes which run management courses like MBA and MCA affiliated to Savitribai Phule Pune University through online Google Form. The

questionnaire consists of three sections and of 22 close ended questions. Section-A focuses on the users' profile such as gender, age, course and role (Teacher or Student); Section-B covers seven questions which comprise of questions regarding mobile learning app namely "SoloLearn" and "Coursera". Questions comprises in Section-C investigates the Usability of these applications in their regular studies. The questionnaire was distributed to 467 students and Faculties of MBA and MCA courses running under Savitribai Phule Pune University, Pune. Convenience sampling method was adopted to collect data from 302 respondents with response rate of 64.66%.

Table 1: Respondents for SoloLearn Application

Particulars	Category	Number of Respondents	Percentage
Gender	Female	81	54.40%
	Male	68	45.60%
Age	20 To 30	119	79.80%
	31 To 40	28	18.70%
	Over 40	2	1.30%
Course	MCA	136	91.30%
	MBA	13	8.70%
Profile	Student	103	69.10%
	Teacher	46	30.90%

Table 2: Respondents for Coursera Application

Particulars	Category	Number of Respondents	Percentage
Gender	Female	75	49%
	Male	78	51%
Age	20 To 30	131	85.60%
	31 To 40	22	14.40%
	Over 40	0	0%
Course	MBA	135	87.70%
	MCA	18	11.70%
Profile	Student	107	69.50%
	Teacher	46	29.90%

7. Research Analysis

The total 467 online questionnaire were distributed out of which total 302 valid responses were collected. Valid responses then separated on the basis of their M-learning application used, as we have asked them to used only SoloLearn and Coursera. Table 1 represents demographic data of

those respondents used "SoloLearn" as their learning application. And Table 2 represents demographic data of those respondents used "Coursera" as their learning application. According to table 1, majority of the respondents were from MCA course whereas in table 2 majority respondents were from MBA course. The total 149 participants are distributed as per gender wise as given in Table 1, with 81 (54.4%) Females and 68 (45.6%) were Males. The majority of participants' ages were between 20 and 30 years, with 79.8%, ages between 31 and 40 were 18.7%., ages over 40 were 1.3%. The total 153 participants are distributed as per gender wise as given in Table 2, with 78 (51%) Males and 75 (49%) were Females. The majority of participants' ages were between 20 and 30 years, with 85.6%, ages between 31 and 40 were 14.4.

8. Results and Discussion

This study focuses on usability evaluation of m-Learning applications namely "SoloLearn" and "Coursera" with the help of series of questions that analyzes preferences, attitude and perception of the students towards mobile technology in education with reference to management courses MBA and MCA running under various colleges affiliated to Savitribai Phule Pune University. Questionnaires were divided mainly into three section user profile information, questions related to "SoloLearn" and "Coursera" UX experience and third section comprises System Usability Scale (SUS) [8] questions of these M-Learning applications. Four questions of these questions were about involved attitude related questions specifically indented to assess acceptance of M-Learning technology with reference to MBA and MCA course form the student and teacher community. This study conducted at colleges affiliated with Savitribai Phule Pune University with specific courses such as MBA and MCA.

8.1 Findings for SoloLearn Learning App

Figure 4: I use SoloLearn App daily

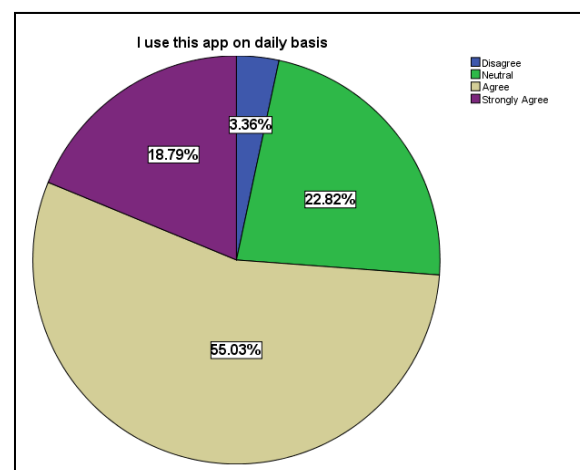


Figure 4 shows response to the question “I use SoloLearn App daily”, 18.79% were strongly agree, 55.03% agree, 22.82% were neutral and 3.36% were disagree with this statement.

Figure 5: SoloLearn App Useful in Studies

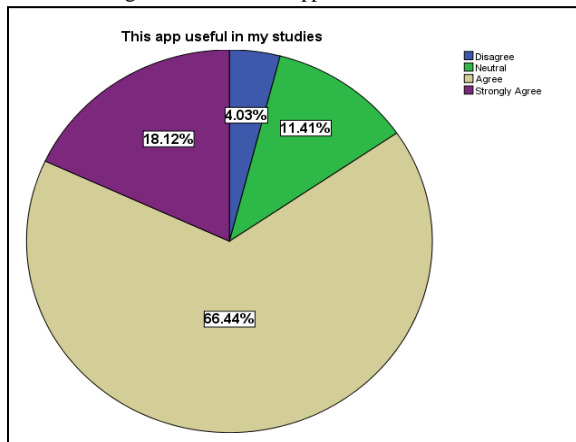


Figure 5 shows response to the question “This app is useful in my studies”, 18.12% were strongly agree, 66.44% were agree, 11.41% were neutral and 4.03% were disagree with this statement.

Figure 6: I can easily download or view Videos

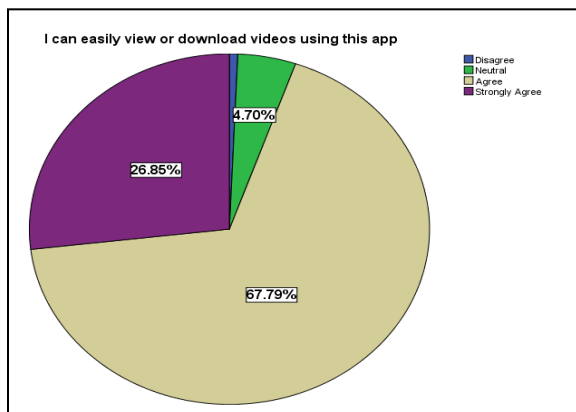


Figure 6 shows response to the question “I can easily download or view videos using this app”, 26.85% were strongly agree, 67.79% agree, 4.70% were neutral and 0.66% were strongly disagree with the statement.

Figure 7: This app loaded with Learning Content

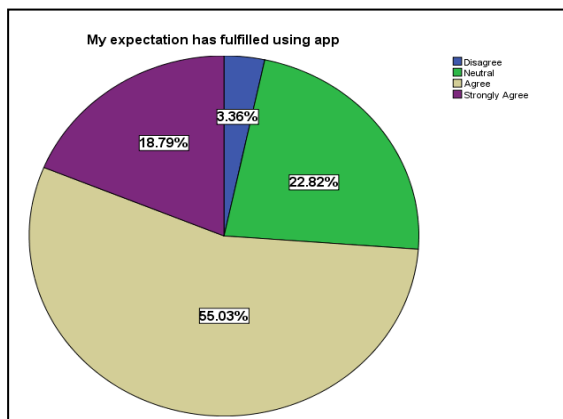


Figure 7 shows responses to the question “This app provides me the learning content which I required”, 73.82% agree with this statement.

Figure 8: Search and enroll for the course

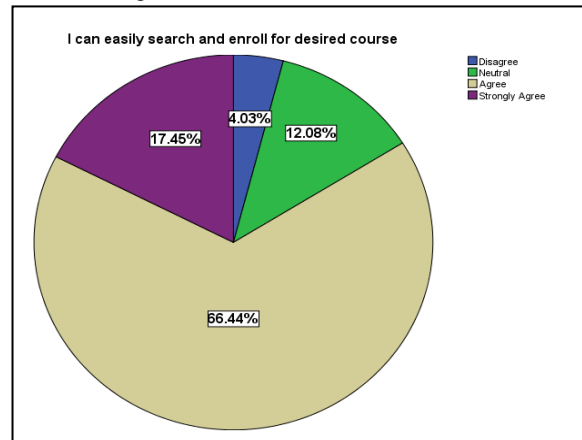


Figure 8 shows responses to the question “I can easily search and enroll for desired course”, 17.45% were strongly agree, 66.44% were agree, 12.08% were neutral and 4.03% were disagree with this statement.

Figure 9: I can easily do programming using this app

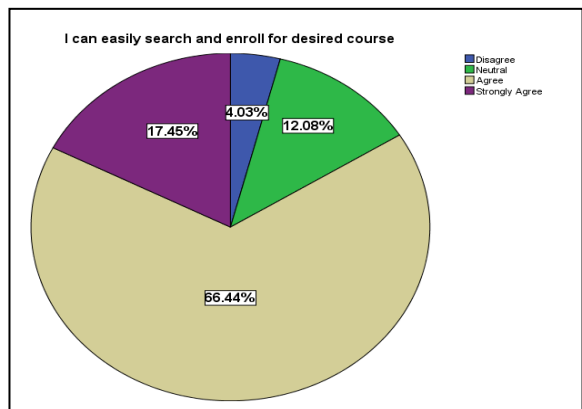


Figure 9 shows response to the question “I can easily do programming using this app”, 17.45% were strongly agree, 66.44% were agree, 12.08% were neutral and 4.03% were disagree with this statement.

Figure 10: In which Course you have enrolled first

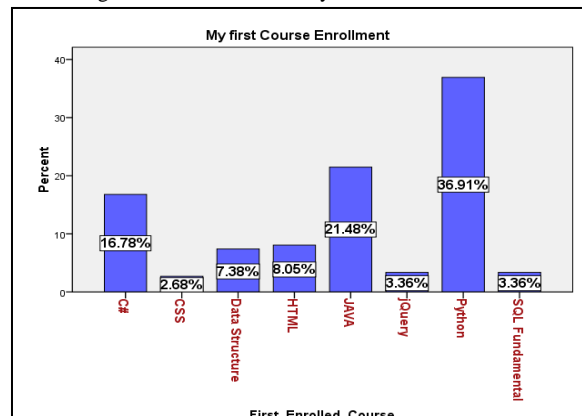


Figure 10 shows responses to the question “In which course you enrolled first”, 36.91% opted for python, 21.47% opted for JAVA, 16.77% opted for C#, 8.05% opted for HTML, 7.38% opted for Data Structure, 3.35 % opted for jQuery and SQL Fundamental and 2.23% opted for CSS course.

8.2 Findings of Coursera Learning App

Figure 11: I use Coursera App daily

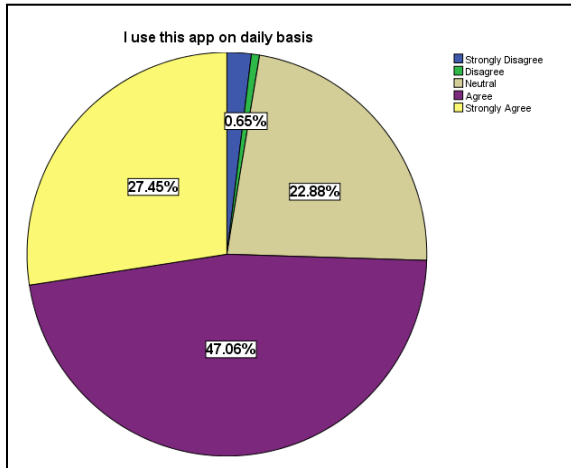


Figure 11 shows response to the question “This app is useful in my studies”, 27.45% were strongly agree, 47.06% were agree, 22.88% was neutral and only 0.65% were strongly disagree with the statement.

Figure 12: Coursera app Useful in Studies

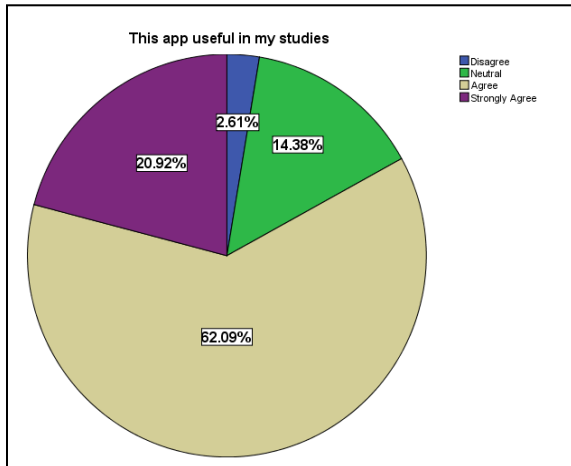


Figure 8 shows response to the question “This app is useful in my studies”, 20.92% strongly agree whereas 62.09% agree, 14.38% respondents go with the neutral and only 2.61% disagree with the statement.

Figure 13: I can easily download or view Videos

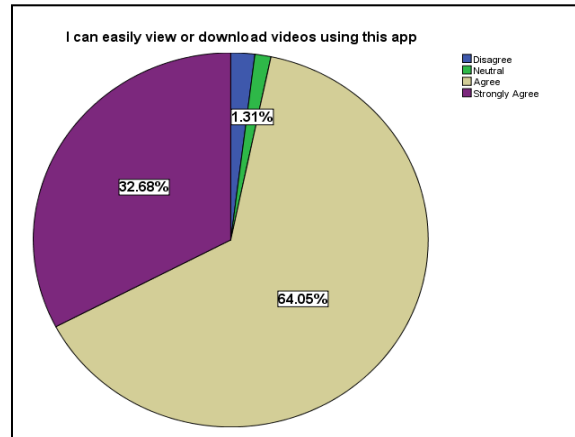


Figure 13 shows response to the question “I can easily download or view videos using this app”, 32.68% were strongly agreed, 64.05% were agreed, and only 1.88% was disagreed with the statement.

Figure 14: This app loaded with Learning Content

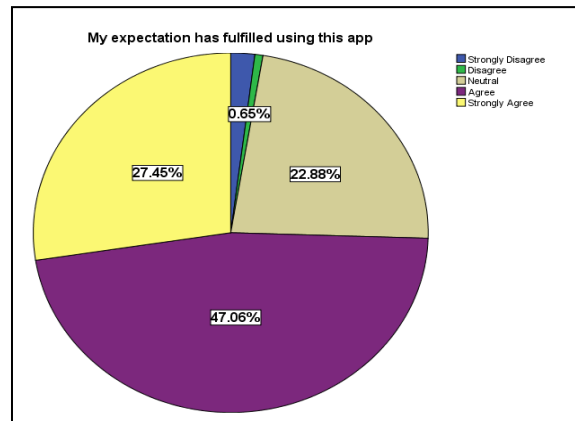


Figure 14 shows response to the question “This app provides me the learning content which I required”, 27.45% were strongly agreed, 47.06% were agreed, and only 22.88% were neutral and 0.65% was disagreed with the statement.

Figure 15: I can easily search and enroll for desired course

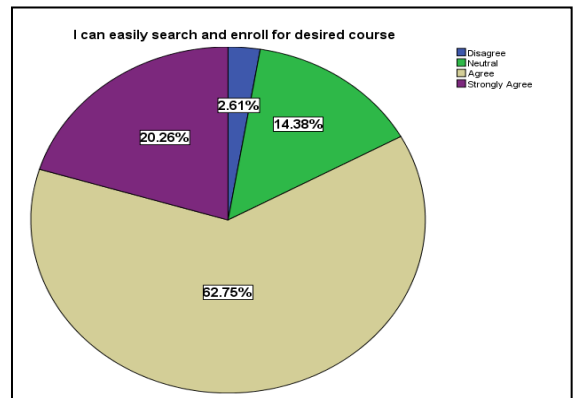


Figure 15 shows responses to the question “I can easily search and enroll for desired course, 20.26% were strongly agree, 62.75% were agree, 14.38% were neutral and 2.61% were disagree with this statement.

Figure 16: I can easily refer Case-Study

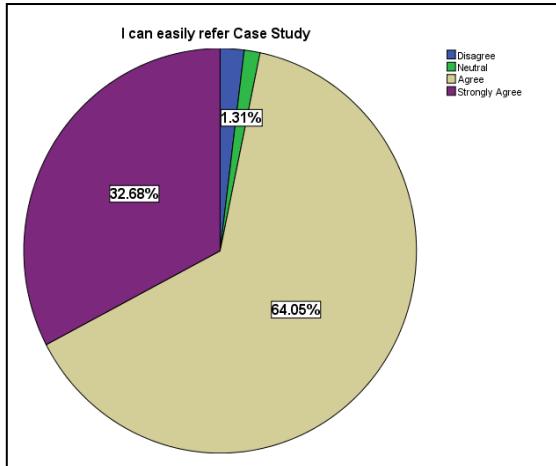


Figure 16 shows responses to the question “I can easily refer Case-Study”, 32.68% were strongly agree, 62.05% were agree, 1.31% were neutral and 1.96% were disagree with this statement.

Figure 16: I can easily refer Case-Study

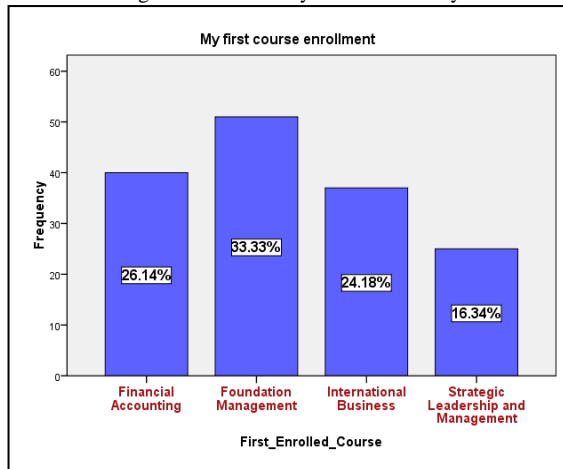


Figure 16 shows responses to the question “In which M-Learning course you enrolled first”, 33.33% opted for Foundation Management, 26.14% opted for Financial Accounting, 24.18% opted for International Business, and 16.33% opted for Strategic Leadership and Management.

Table 3: Mean and SD for SoloLearn

Usability Dimension	Mean	Std. Deviation
Perceived Usefulness	4.09	.647
Effectiveness	4.16	.717
Efficiency	3.99	.621
Learnability	4.15	.665
Memorability	4.09	.706
Satisfaction	4.17	.655

Table 4: Mean and SD of Coursera Application

Usability Dimension	Mean	Std. Deviation
Perceived Usefulness	4.14	.663
Effectiveness	4.28	.673
Efficiency	4.04	.648
Learnability	4.07	.726
Memorability	4.17	.724
Satisfaction	4.32	.704

Table 3 and 4 depicts the results of usability evaluation on perceived usefulness, effectiveness, efficiency, learnability, memorability and satisfaction aspects of SoloLearn and Coursera mobile learning applications respectively. Result shows for perceived usefulness, effectiveness, efficiency, memorability and satisfaction Coursera app has scored more than SoloLearn app i.e. 4.14 compared to 4.09, 4.28 compared to 4.16, 4.04 compared to 3.99, 4.17 compared to 4.09 and 4.32 compared to 4.17 respectively. Result for Learnability SoloLearn app has scored more than Coursera app i.e. 4.15 compared to 4.07.

9. Conclusion

In this research study was conducted to measure satisfaction over SoloLearn and Coursera mobile learning application. The usability dimensions such as perceived usefulness, effectiveness, memorability, efficiency, learnability has been considered the essential aspects in evaluation process. The results show that there was positive response from the participants. The results from the above research study clearly shows that on satisfaction aspect Coursera application has got bigger mean i.e. 4.32 where as SoloLearn application has got 4.17. Majority learners consider both these M-learning applications were effective, efficient, easy to remember and easy to learn applications. There were some limitations as well in this research study such as; this research study has considered responses from two specific courses i.e. MBA and MCA there cloud have added some more undergraduate courses in future research work. This study had focused two mobile learning applications i.e. SoloLearn and Coursera, in future research work can be done on some more mobile learning applications in the context of professional courses in India.

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