PAPER

# Assessing the Effectiveness of Financial Literacy Mobile Apps Using the Content Analysis Approach

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**ABSTRACT**

This study aimed to assess the effectiveness of financial literacy mobile apps for learning purposes using a content analysis approach. For this purpose, 200 mobile apps from Google Play Store and Apple App Store were identified and extracted that were about financial literacy and matched the search criteria using a structured sheet. Using the purposeful sampling technique and selection criteria, 163 apps were shortlisted for the analysis. By means of content analysis method, these apps were examined using 13 different features related to learning design from the cognitive theory of multimedia learning's (CTML) principles, Jakob Nielsen's usability heuristics, and other valuable features of mobile apps from the literature. The results of the assessed features were found to be in the following number of the selected apps: export of data (34/163, 21%), gamification (80/163, 49%), plans or orders (91/163, 56%), reminder (102/163, 63%), community forum (34/163, 21%), social media (33/163, 20%), tailored education (134/163, 82%), tracker (53/163, 33%), free of cost (117/163, 72%), usability (149/163, 91%), multimedia principle (100/163, 61%), pre-training principle (106/163, 65%), and personalization principle (117/163, 72%). These results provide hints regarding the quality of existing financial literacy apps on the two most popular marketplaces of mobile apps.

**KEYWORDS**

financial literacy, mobile apps, financial education, content-analysis, digital learning

## 1 INTRODUCTION

Financial literacy is much needed for making informed financial decisions and spending a better life [1]. It helps people to effectively manage their finances related to everyday living, education, post-retirement, and other major aspects of life along with managing the external uncertainties [2]. In times when pandemics, wars, and financial crisis are recurrent, the individuals' inability to make sound financial decisions exacerbate the situation. Despite the importance of financial literacy, people fail to have even a

rudimentary knowledge of financial concepts [3], [4]. The financial products like household mortgage, insurance, and investment options have become highly complex and the inability people to comprehend them is apparent as it leads to dire consequences [5], [6]. Besides, the widespread use of digital finance is significantly changing the financial industry [7]. This digitization in finance is due to several factors, such as higher process automation, better analytics, improved security, and enhanced cost-efficiency.

Along with digital finance, digital learning is also on the rise that is mainly the result of progress in technology. Smartphones have become a necessity in the present era; in particular, the domain of education is already witnessing mobile phones taking the center stage. The impact of the Covid-19 pandemic on digital learning technologies is well known where the pandemic accelerated digital education [8], [9]. Mobile learning is an established method that has been prevalent for about 20 years, it provides flexibility to use from almost any location and at any time [10], [11]. Particularly, the rapid development in information and communication technology (ICT) along with the excessive growth of smartphone adoption has increased learning through mobile apps [12]. The use of mobile apps in education has significantly increased in almost all contexts, including in schools, home-schooling, informal learning, and professional settings.

The rise of mobile learning has influenced almost all fields, including finance where the mobile apps offering financial education are rapidly growing [13], [14]. The surge in digital finance, fintech, and online banking are some of the key factors that are drawing people towards digitization in finance. This influences financial learning by shifting the cultural practices towards learning finance online. In addition, financial literacy is a lifelong process so the learning focus is mostly directed towards the younger generation [15]. Prior research within the online learning of financial concepts for the younger generation has mainly focused on game-based learning [16], [17], neglecting the investigation of other digital methods, such as mobile app platforms. Although financial literacy mobile apps could also use a game-based approach or similar methods, examining mobile apps holistically by keeping in view their distinctiveness is yet to explored within the financial literacy domain.

The learning on mobile apps is mostly informal [18], [19], in which there is usually no instructor who may provide guided learning. Users have to navigate themselves and self-learn about finance on mobile apps. Given that, the design of mobile apps has a significant influence on users' learning [20]. The working memory of the brain, for instance, has a very limited space [21] that may easily be overwhelmed by the cognitive load if online learning platforms are poorly designed [22]. Thus, if the design of mobile apps does not support the users' needs, it can impede their financial learning [23]. This has serious consequences because if users do not learn about finance effectively or if their learning is inaccurate, it may impact their financial planning and decisions that can cause them substantial financial losses [24]. Yet, there is a huge lack of assessment regarding the quality of financial literacy mobile apps, perhaps due to the relatively recent surge of these apps.

In this regard, this study contributes to assessing the effectiveness of financial literacy mobile apps that are available on the two most popular marketplaces of apps, Google Play Store and Apple App Store. For this purpose, the content analysis method was applied to assess different features of the mobile apps. The factors assessed are essential for learning, particularly through apps. These factors include selective multimedia learning (ML) principles (Table 1) of the cognitive theory of multimedia

learning (CTML) [25] that are developed to improve meaningful learning. Jakob Nielsen's usability heuristics (Table 2) for user interface (UI) design [26] is used to make the UI design more appealing and easy to use. Other valuable features are listed (Table 1) [27], [28] from prior literature that are relevant to enhance the overall learning experience of users with mobile apps.

The ML principles of CTML have been developed for designing instructional material based on how the human mind works [29]. For that reason, such materials are better at supporting meaningful learning in contrast to materials whose design disregards the human mind and focuses more on technical feasibility. As per the CTML, the human brain consists of three memory stores, i.e. sensory memory, working memory, and long-term memory. The learning process starts from the sensory memory that receives information in multimedia format. Afterwards, the information filter and only selected data process further in the working memory. The information is organized in separate cognitive representations within the working memory. These cognitive representations are matched with relevant prior knowledge and stored in long-term memory.

The concept of usability is central to the areas of human-computer interaction (HCI) and user experience (UX). One of the key aims of HCI/UX fields is to ensure that the system under examination is at least usable for humans. In this regard, Nielsen's heuristics [26] has been successfully used by researchers and practitioners to effectively evaluate the usability of a system based on heuristics. Nielsen explained these heuristics as "broad rules of thumb" without specific guidelines for usability. Besides, other essential features that further enhance the learning experience selected from the literature on digital health and were applicable in this context. These features have been studied as a means to engage users and influence their behaviour [27], [28]. Some of these selected features include 'gamification' that is essential for higher learners' engagement, 'tailored education' that is important for increasing learning effectiveness, and 'community forum' that helps learners to have online social support for learning.

Following sections begin by first analyzing the prior literature that discusses studies within the financial education domain. Afterwards, the method section describes the data collection and analysis approaches. Then, the results section illustrates the findings. Finally, the discussion and conclusion section highlight key results along with limitations of the study and further research areas.

## 2    LITERATURE REVIEW

Financial literacy and financial education remain prevalent topics among the policymakers and academics of the field. The effect of financial education on financial literacy has been studied widely and, in most cases, it showed strong positive results [30]. Several methods have been considered and investigated to teach finance. Subsequently, the question of their effectiveness arises unsurprisingly. Assessing the effectiveness of financial education programs helps ensuring their impact on people's responsible financial behavior and informed financial decisions [31]. For this purpose, the assessment of financial education programs is of high importance within the financial literacy domain, especially on fast-growing digital platforms. Several studies examined the efficacy of diverse financial education initiatives online.

The increase in digital financial literacy motivated the study by Lyons et al. [32] to examine the multifaceted measures of financial and digital literacy on financial behaviors related to resilience building. They analyzed survey data from the InterMedia Financial Inclusion Insights for South Asian and Sub-Saharan African countries. The results indicated that in order to build financial resilience, both financial and digital literacy are key factors. Moreover, the findings directed towards the need of redefining traditional financial literacy to include digital literacy, especially for nations that focus on increasing households' financial resilience using a dual approach of financial and digital literacy.

Blanco et al. [33] developed a mobile phone-delivered digital financial education program called Mind your Money (MYM) to improve financial capability and reduce financial stress among low-to-moderate income Hispanics living in the Greater Los Angeles area. For this purpose, randomized controlled trial (RCT) was applied with a wait-list control group. The design of MYM was using a community-based participatory approach that was culturally and linguistically relevant for the target participants. The findings showed that the mobile-based digital intervention had a high retention rate and a significantly positive effect on financial capability. The treatment group showed lower financial stress and they were more likely to plan a budget and had higher financial confidence.

Frisancho, Herrera, & Prina [34] analyzed the impact of financial literacy mobile app on the financial behavior of participants. They applied quasi-experimental design with control group wherein the treatment group received a user-friendly budget recording financial app, and the control group received a placebo financial app. For about six months, every fortnight, the treatment group received non-educative nudges through text messages. One set of biweekly messages consisted of tailored information about their past savings. The other set of biweekly messages provided participants with past information of their spending that gave information on the categories of expenditures. Both types of messages were based on only actual past information, without any financial advice for participants to follow. The results of pre and post-tests showed that no financial education messages were given except the indicative nudges regarding past savings and spending information, the participants in the treatment group showed higher results in financial knowledge.

Malik, Fürstenau, & Hommel [23] studied the design of bank's webpages on the retention and transfer learning of participants regarding the knowledge of household mortgages. They applied the experimental research design, in which participants had to go through the online information and answer the subsequent questions. The treatment group received the webpages with enhanced design supportive of meaningful learning; the control group received the original webpages. The selected webpages were about household mortgages where users can interact with different calculators to support their financial decisions. The results were significantly positive for the intervention group, showing the impact of webpages design on financial learning.

While there are some studies that focus on investigating the effectiveness of financial literacy intervention on digital platforms, the assessment of the existing financial literacy mobile apps is highly scarce. The significance of mobile apps is growing fast particularly in younger people's lives [35], and in financial literacy domain, there is special importance given to increasing financial education of younger people [36]. Thus, this study aims to fill this gap by examining the learning potential and effectiveness of existing financial literacy mobile apps on popular digital market places of apps.

# 3    METHODOLOGY

## 3.1    Research design

The research design consisted of the content analysis method and evaluated the financial literacy mobile apps from Google Play Store and Apple App Store. The analysis was for meaningful learning, usability, and other valuable features in the apps. For meaningful learning, ML principles of CTML were used; for usability, Jakob Nielsen usability heuristics was applied; and, other valuable features were extracted and based upon prior studies. In total, included 13 features to assess the financial literacy mobile apps' learning effectiveness.

## 3.2    Data collection

In total, 200 apps were retrieved from both the app stores, 100 from each, on 11th January, 2023. The searches were using the following five keywords: financial education, financial literacy, learn finance, finance games, and teach finance. Google Play Store and Apple App Store are the two biggest app stores consisting of about 3.5 million apps collectively [37].

**Selection Criteria.** The inclusion criteria of apps were as follows:

- Apps from Google Play Store and Apple App Store only
- Focused on financial learning and education
- Apps should not be for commercial purposes, such as for trading or banking functions
- The language must be English

The exclusion criteria of apps were following:

- Duplicate apps in both Google Play Store and AppleApp Store
- Apps having operating issues or misleading information

**Selection procedure.** The apps were searched on both Google Play Store and Apple App Store using the aforementioned five keywords in the same given order. Each of the keywords were entered in the mobile app stores, and for every keyword, first 100 results were checked against the inclusion criteria. Apps that fulfilled all of the inclusion criteria were selected. This procedure was repeated for all the mentioned keywords until the total selected apps reached the number of 100 for each app store. If 100 apps were selected using less than the given keywords, further search was not initiated. For example, if 100 apps were found that matched the inclusion criteria from the first three keywords, then remaining two keywords were not used. Apps that repeated in the search results due to the multiple keywords search were not taken into account. Lastly, 100 apps were successfully selected within the five keywords from each of both mobile app stores.

In Google Play Store, 44 apps were selected using the first keyword "financial education", 19 apps were selected using the second keyword "financial literacy", 9 apps were selecting using the third keyword "learn finance", and 28 apps were selected using the fourth keyword "finance games". The last keyword of "teach finance" was not required to use because first four keywords had already retrieved 100 apps. As for the Apple App Store, 82 apps were selected from the first keyword

"financial education", and the remaining 18 apps were selected from the second keyword "learn finance". Since the number of selected apps had already reached 100, other three keywords were not used. Once 200 apps from both the app stores were selected, they were further filtered out based on the exclusion criteria, thus the final number of selected apps was 163 (see Figure 1).

### 3.3 Analysis

The apps fulfilling the selection criteria were downloaded and used for the purpose of analysis. The apps were evaluated from three different aspects. One aspect was related to learning, using the multimedia principle, pre-training principle, and personalization principle from the CTML to analyze the effectiveness of financial learning. Another aspect was the usability experience of apps using Jakob Nielsen usability heuristics for assessing whether it's easy to use and navigate through the apps or not. The third facet examined the apps for how well they foster users' engagement and overall user experience based on key features from prior literature. In essence, these three aspects assessed the financial literacy apps regarding how well they can motivate and engage users with financial topics, how good they are for improving the meaningful learning of finance, and how easy these mobile apps are to use. Other than these aspects, factual information was extracted for the average rating of an app given by the users on the app store, whether the app is categorized as a game or not, date of release, last update, and developer's information. The three major aspects were based on the content analysis while the other information was taken directly from the app stores.

The structure of analysis was formed using 13 different features (Table 1). They were categorized into three classifications, which included: (1) valuable features, (2) meaningful learning, and (3) usability. The valuable features contained nine characteristics that have been studied in prior published researches [27], [28]. These are the features that, among others, have been considered important in a mobile app for increasing users' engagement and their overall experience, hence they are termed as 'valuable features' in this study. The meaningful learning included three selective principles from the CTML [25]. The principles of the CTML theory focus on increasing meaningful learning through the multimedia design of learning materials. The usability comprised Jakob Nielsen's five usability heuristics for the user interface (UI) design [26] (Table 2). Although these are five principles of usability, they were considered as one unit in this study.

The scoring of apps' features used a binary system, in which if a particular feature was present in an app then a "1" point was assigned and in cases where the feature was absent, it was indicated by assigning a "0" point. The multimedia principle, personalization principle, and pre-training principle were only measured particularly for the financial learning material within the app, and they were not taken into account for other information of mobile apps like 'about me', 'contact us', and other such sections. It is because these principles are specifically designed for the materials intended for learning purposes. For the multimedia learning principle, if financial learning materials in mobile apps consisted of pictures, either static or dynamic, then it was given 1 point, otherwise 0 point. The personalization principle was assessed and given 1 point if the information of financial learning materials was in conversational style otherwise 0 point. The pre-training principle was analyzed and if mobile apps provided prior descriptions of technical words and terminologies, then it was given 1 point otherwise 0 point.

Furthermore, keeping in view the overall user experience of mobile apps, the usability heuristics were assessed for all the sections of mobile apps including sections designated for financial learning and for other information. For the usability, if an app fulfilled majority of the five usability heuristics as mentioned in Table 2, it was given 1 point, otherwise 0 point.

The export of data feature was considered if a mobile app had the option of sharing a specific information from the app, such as a particular financial topic, a computation, or a graph, then it was given 1 point otherwise 0 point. The generic option of sharing the whole app (present in almost all apps) was not accepted under this feature. The gamification feature was analyzed such that if mobile apps provided incentives to the users for learning a topic, completing a task, and so on, it was given 1 point, otherwise 0 point. The plan and orders feature were taken into account if mobile apps provided specific goals and executable steps for financial tasks; it was given 1 point, otherwise 0 point. The reminder feature was assessed in a way that if it was related to prompting a specific action of financial learning, then it was given 1 point, otherwise, for instance, if a mobile app gave a general notification, it was not taken as a reminder and given 0 point.

The mobile apps that had the feature of community forum within the apps were included as having this feature and given 1 point, otherwise 0 point. The social media feature was considered when a mobile app had a social media presence and also it gave its web-link within the app, it was given 1 point. Otherwise, if it did not have any social media at all, or if it did have a social media but did not provide its web-link in the app, then it was given 0 point in both cases. Since the feature of tailored education was particularly related to learning, it was only assessed within the financial learning section or materials within the apps. Within the financial learning section, if apps provided tailored education in a way that it categorized learning as per the background, needs, and/or aims of the user, it was given 1 point, otherwise 0 point. The tracker feature, as well, was considered only for the financial learning section because if mobile apps provided an option of tracking progress for other than the financial learning materials of an app, then it was not relevant. If the tracker feature provided regular progress information against the set objectives of financial learning materials, then it was given 1 point, otherwise 0 point. The cost feature of mobile apps come in various shapes and there are different costing strategies. For this study, any app that had included any type of cost was given a 0 point, otherwise 1 point.
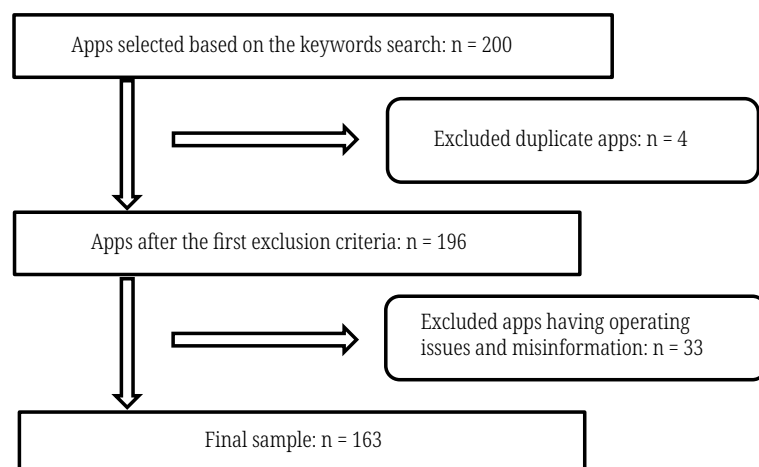


**Fig. 1.** Flow chart of the app's selection process

**Table 1.** Description of factors used for assessing the financial literacy mobile apps

| App Features | Description of Features | Role of Features |
|---|---|---|
| Valuable Features | | |
| Export of data | Feature that lets the user to send any specific information/ data from the app to another platform (e.g., Email). | To enhance collaboration and support |
| Gamification | Feature that offers scores, different levels, stars, or badges as a financial goal is achieved or learners get more engaged (Figure 4). | To increase motivation and engagement |
| Plan or orders | Feature that provides users with target goals and specific steps or plan to reach those goals. | To help learners to achieve their goals |
| Reminder | Feature that's a predetermined alert to evoke the user to continue using specific functions of an app. | To cue learners to act |
| Community forum | Feature that is a space within the app, like a chat room, where people with similar financial issues can share information and experiences and learn from each other. | To provide sense of relatedness and support |
| Social media | Feature that lets the user to share progress with friends and family, or colleagues on social media platforms like Facebook, twitter, WhatsApp, or some other social platforms. | To offer social support and encouragement |
| Tailored education | Feature that provides learner-specific education tailored to his/ her prior knowledge of finance, needs, and interests (Figure 5). | To offer customized education |
| Tracker | Feature that lets users to monitor their own progress against a predetermined goal and adjust their efforts accordingly. | To have self-monitoring |
| Cost | It charges a fee to use the app. | N/A |
| Meaningful Learning | | |
| Multimedia principle | Identification of relevant pictures (static or dynamic) to the financial learning content (e.g., graphs, charts, or other visualizations). It excluded pictures that were not related to the learning content (Figure 2). | The principle suggests that people learn better from relevant pictures along with words added in the learning material than words only. |
| Pre-training principle | Identification of training to use the app, explaining difficult topics, or providing overview of concepts (Figure 3). | The principle suggests that people learn better, when they are familiarized with the main concepts of the material in advance. |
| Personalization principle | Identification of apps' communication in conversational or formal way. | The principle suggests that people learn better, when words are written in conversational manner rather than the formal way. |
| Usability | | |
| Usability | Jakob Nielsen's five usability heuristics to enhance the user interface (UI) design. | To provide an ease-of-use experience for users. |

**Table 2.** Jakob Nielsen's five usability heuristics for user interface (UI) design

| | |
|---|---|
| 1 | Visibility of system status: it is related to the app's function for keeping its users updated about 'what is going on' and/ or how well are they reaching toward an objective. |
| 2 | User control and freedom: app lets the users easily interact with control options like 'exit', 'save', 'go back', or 'edit'. |
| 3 | Flexibility and efficiency of use: app lets the users to complete the intended tasks swiftly and efficiently. |
| 4 | Aesthetic and minimalist design: app is not overloaded with irrelevant information and it is pleasant to look at. |
| 5 | Help users recognize, diagnose, and recover from errors: error messages in the app use non-technical language, easy to understand, and provide clear steps to fix. |
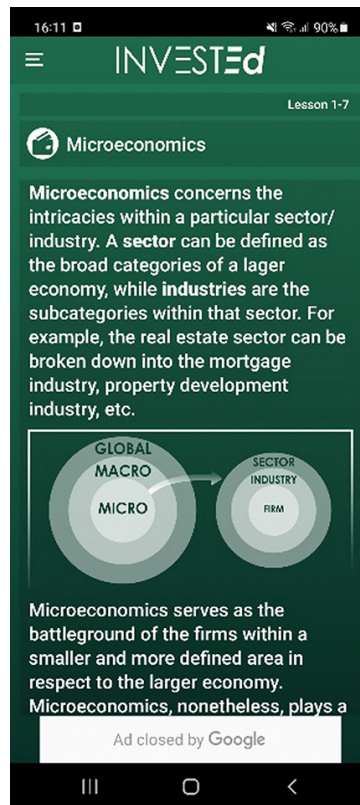
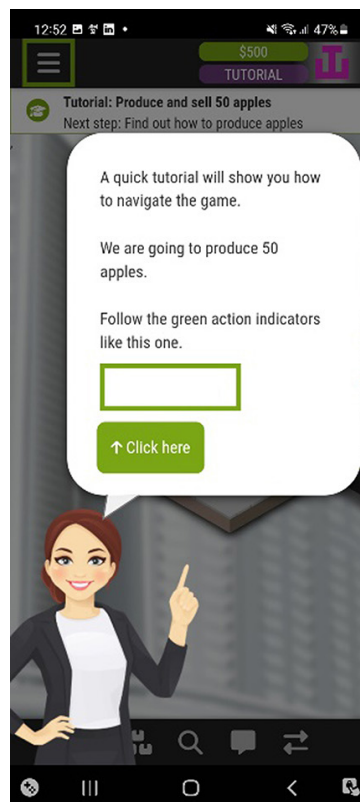**Fig. 2.** Screenshot of multimedia principle in InvestED app



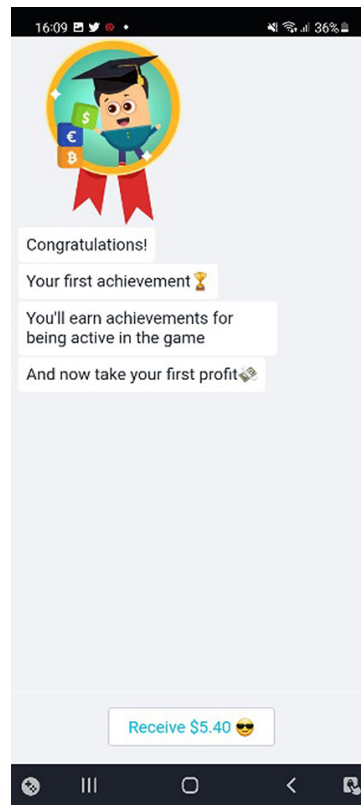**Fig. 3.** Screenshot of pre-training principle in Sim Companies app

Fig. 4. Screenshot of gamification feature in Forex Game Trading 4 Beginners app



Fig. 5. Screenshot of tailored education feature in PomPak! app

## 4    RESULTS

### 4.1    Meaningful learning and usability

According to the goals of the study, the meaningful learning and usability of mobile apps were assessed using the ML principles of the CTML theory and Jakob Nielsen usability heuristics, respectively. To assess meaningful learning, three ML principles were selected, which included multimedia principle, pre-training principle, and

personalization principle. The usability heuristics is an efficient method to assess the design that included five standards and were used to rate financial literacy mobile apps for an overall user experience. Table 3 and Figure 6 presents the results comprehensively.

The multimedia principle was present in 61% (100/163) of apps. As per this principle, the learning significantly improves when material is presented with words and pictures instead of words only. The rationale is that when the learning material is presented in words and pictures, the learners have the opportunity to build both verbal and visual mental models and make connections between them, which foster deep learning [38]. The pictures should be relevant that represent or support the meaning of the learning text, and they could be in either static or dynamic form. The apps were found to have mostly static pictures; very few apps had included videos or gifs for learning. Some apps used graphs to explain a financial concept, while some used visual metaphors to represent such concepts.

The pre-training principle was present in 65% (106/163) of apps. This principle is about making the learners familiar with the complex or main concepts of the materials beforehand. It lets learners to learn deeply when they know the main words and concepts. The reason is that, while learners engage with the learning material, if they don't already know about the technical words and terminologies, this puts additional load on their cognition [39]. In order to manage the additional demands for essential processing, pre-training helps by distributing some processing prior to the start of the actual learning session. The results showed, this was mostly found in the beginning when the app is initially opened to use. In some apps, this feature was always available; users have the choice to view this whenever they needed. Whereas, several apps gave pre-training only once when the app was opened for the first time.

The personalization principle was percent in 72% (117/163) of apps. The principle shows that people learn better when the text in the learning material is presented using a conversational style rather than formal style. It is because when the author communicates in a conversational style, the learners feel that the author is talking to them as a conversational partner, and thus the learners will try harder to make sense of the information [40]. The results showed that some apps used conversational style when presenting general information about the app like their 'about' section, navigation related information, and so on, and when explaining the financial concepts and ideas. However, some apps used conversational style only in either explaining financial concepts, or other information about the app.

The five usability heuristics were found to be present in 91% (149/163) of apps. These let users to easily navigate through the app, have control of basic app's functions, provide flexibility and efficiency in completing tasks, have a sleek and minimalist design, and help in overcoming possible errors.

As far as the apps' ratings are concerned, these are provided by the users usually when they download and start using the app. For the Google Play Store apps, the ratings range from 1 to 5; in which, 5 refers to the best and 1 to the worse. It was found that 29% (48/163) of apps were rated and remaining apps were not given any ratings, and the average rating was 4.3. All of them were Google Play Store apps that were rated, while not a single app of Apple App Store had any ratings.

## 4.2    Valuable features

Part of the aim of the study was to assess the other important features of mobile apps that are found in the prior literature [27], [28]. These features are extensively

studied in the mobile health research area and other studies that showed their importance for several purposes while learning through mobile apps. The results and relevant description of all these features are discussed in the following paragraphs.

The export of data feature is related to sending or communicating specific information or data from the app to other platforms. It was present in 21% (34/163) of apps. If a user has difficulty in learning about a specific financial topic or information, he or she can share that with other financially capable individuals to get support. It was, for instance, present in mortgage related calculations in the apps that users can share to get further clarity. The gamification feature was found in 49% (80/163) of apps. This feature is used to increase engagement with the app. It was in the form of promoting to a higher level, giving badges, or calculating points. A leader board was also present in some apps to compare scores with others. Gamification was used in different ways, such as adding points on completing a finance course, and in trading simulation, if a user generated profits, then a promotion to a higher level was awarded.

The plan or orders feature provides goal setting and plan with specific, executable steps to attain those goals. This feature was in 56% (91/163) of apps showing different types of goal settings. In some apps, once the user enters monthly income and expenses, the output provided goals to attain a specific level of savings per month along with a plan of action. Goal setting was also found in financial games for making higher profits or increasing wealth by applying different financial strategies. The reminder feature was found in 63% (102/163) of apps. it helps to remind or recall the users to continue using the app. These reminders were related to engaging in specific actions for learning finance. If a user gained some badges, the app would remind to get higher badges. The apps also made encouraging remarks while giving reminders.

The community forum is a space within the app where users can interact with other like-minded people to connect with each other on similar issues. This feature was found to be in 21% (34/163) of apps. This feature allows getting help from other people in gaining financial understanding. Some of the apps presented this feature to inspire others by connecting with those who were novice learners to gain financial understanding and got benefits. The social media feature is about sharing progress and learning achievements with family, friends, or colleagues on social media platforms, such as Facebook, Twitter, and WhatsApp. This feature was used by the 20% (33/163) of apps to engage with a wider circle of users. Apps gave an opportunity to share the entire app, and/or some specific instances like winning a badge or promoting to a higher level.

The tailored education feature was found in 82% (134/163) apps. The tailored education is related to provide education as per the background, needs, and/or objectives of the user. This feature was offered in different ways. For instance, tailored education was offered as per the financial topic like budgeting, mortgage, investments, and so on. It was offered by the age group; below 14, between 14 and 22, and above 22. Once age group was selected, further details were collected to provide financial training as per the potential needs of that particular age group. The tracker feature was in 33% (53/163) of apps. It is used to track progress against set objectives and goals. This feature allowed users to track their level of financial learning. In addition, it informed about the effort and time needed to accomplish the intended objectives. The cost feature is about charging a fee for the usage of an app. It was found that 72% (117/163) of apps were free of charge to use.

**Table 3.** Assessment of the financial literacy mobile apps features

| Apps Feature | Apps, n (%) | |
|---|---|---|
| Export of data | 34/163 | (21%) |
| Gamification | 80/163 | (49%) |
| Plan or orders | 91/163 | (56%) |
| Reminder | 102/163 | (63%) |
| Community forum | 34/163 | (21%) |
| Social media | 33/163 | (20%) |
| Tailored education | 134/163 | (82%) |
| Tracker | 53/163 | (33%) |
| Cost | 117/163 | (72%) |
| Usability | 149/163 | (91%) |
| Multimedia principle (CTML) | 100/163 | (61%) |
| Pre-training principle (CTML) | 106/163 | (65%) |
| Personalisation principle (CTML) | 117/163 | (72%) |
| No. of Apps Given Ratings | 48/163 | (29%) |
| No. of apps classified as games | 36/163 | (22%) |
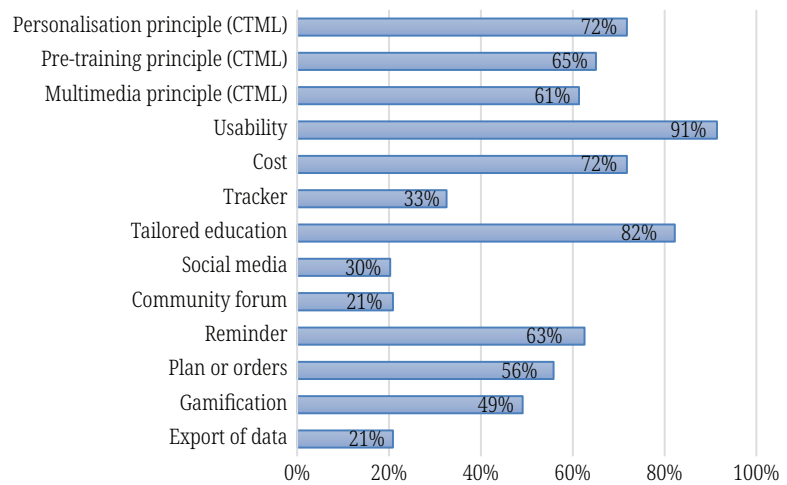


**Fig. 6.** Graph of the financial literacy mobile apps' features

## 5    DISCUSSION AND CONCLUSION

The major aim of the study was to provide an overview regarding the quality of existing financial literacy mobile apps. This study contributed by assessing the financial literacy mobile apps (n = 163), available on the two most popular mobile app stores: Google Play Store and Apple App Store, from three different aspects; meaningful learning, usability, and other valuable features. It assessed 13 different factors that are relevant for learning effectiveness on mobile apps. The three aspects together provide an extensive view of analysis that encompass a variety of factors important for learning on mobile apps. Given the rise of learning on mobile apps, it is important to understand the impact of these advancements within the

financial literacy context. In order to make financial education much more effective to produce better outcomes, improving financial learning through mobile apps is an essential but underexplored step.

As for the findings of the study, the analysis indicated a mixed result for the quality of existing financial literacy mobile apps. To begin with, these apps focus less on providing opportunities for connecting people to learn finance. The three particular features that focused on connecting people was found to be least frequent compared to other features. These features were export of data, community forum, and social media, which were present only 21%, 21%, and 20%, respectively. These features allow individuals to have higher social interactions, share learning experiences with like-minded people, and receive support from family and friends for learning finance. In addition, the gamification feature was found in almost half of the apps (49%). This feature helps increase engagement and motivate people to continue learning, thus other apps being deficient of this feature might influence the engagement of learners. On the other hand, usability of apps was high (91%), which is a very positive aspect. It lets users to seamlessly use mobile apps with a design that is pleasing.

The principles of meaningful learning that included multimedia principle, personalization principle, and pre-training were in the range of 61% to 72%, this should be even higher because learning is a central component of financial literacy apps. Also, given the hands-on design tools available online, and flexibility of adding pictures into the learning material, ML principles of CTML can be easily integrated into the instructional design. The tailored education revealed its presence in 82% of apps, which is positive and it means that designers and developers take into account the users' perspective of learning on financial learning apps in terms of users' needs, goals, and background.

The impact of this study is essential because informal learning is on the rise, especially on digital platforms. Prior studies of assessing financial education are mainly formal learning methods, such as classroom learning. Whereas, the informal digital learning is widely overlooked with regards to its assessment. Moreover, assessing informal digital learning platforms is challenging compared to formal learning methods because informal learning lacks structure, objectives, and in most cases, an instructor. These differences make the assessment of such online platforms difficult compared to other onsite or formal learning methods. Therefore, it is crucial to find ways for assessing this growing medium of learning finance. In this context, this study focused on a different aspect for evaluation, that is, the use of online learning design for assessing the effectiveness of financial literacy through a well-established framework of prior relevant theories.

This study may provide utility in several ways, including aiding designers and developers of financial literacy mobile apps to improve the design of such apps. The learning on mobile apps is growing rapidly; the technological advancements and preference of the younger generation towards mobile learning are some of the deriving factors for this change. As a result, there is also a surge of financial literacy mobile apps, but they lacked investigation. This study may provide areas to improve the financial literacy mobile apps for meaningful and effective learning. Besides, this study may provide directions to further test and analyze new learning designs that may be appropriate specifically for learning finance on mobile apps.

One of the limitations of the study is that a single reviewer had made the assessment; had there been multiple reviewers it would have made the process more objective. However, this limitation was reduced by keeping the assessment binary, in which features of mobile apps were rated by assigning "1" if it was present and "0" if it was not present. This was for retaining the study's rigor as compared to

having more than these two options that would cause higher chances of multiple interpretations. Another limitation is that only English-language apps were selected. There is a good quantity of financial literacy apps in languages other than English, which are available on popular mobile app marketplaces.

For future research, given the growing tendency of mobile learning, different digital learning designs of financial literacy mobile apps can be tested for comparing different sociodemographic variables, e.g., comparing men and women, or younger and older people, which would aid in deepening the understanding of financial learning on mobile apps. Lastly, a subsequent study with a much larger sample is needed for analysis. There are thousands of apps focused on financial learning and more apps are continually being developed, thus a bigger sample that includes not only a higher number of apps but also includes different languages would be essential.

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