

Measuring Usability of the Mobile Learning App for the Children

Zahid Hussain¹(✉), Wolfgang Slany², Wajid H. Rizvi³, Adeel Riaz¹,
and Umair Ramzan¹

¹ Quaid-e-Awam University of Engineering, Science and Technology,
Nawabshah, Pakistan

zhussain@quest.edu.pk, adeell2it@gmail.com,
umair.sheikh1992@gmail.com

² Graz University of Technology, Graz, Austria
wolfgang.slany@tugraz.at

³ Institute of Business Administration Karachi, Karachi, Pakistan
wrizvi@iba.edu.pk

Abstract. This paper presents findings from the usability study that was conducted for the newly developed mobile learning App for the children. The App facilitates the children aged between 4 and 9 of Class-KG and Class-I to learn English with the help of their native language named Sindhi. After the pilot study, actual usability test was conducted with 100 children. In the study, besides usability tasks performed by the children, Smileyometer and Again-Again Table from the Fun Toolkit were also used to assess user experience. The outcomes disclose that the App was very easy and effective as task accomplishment rate was hundred percent. The results from the Smileyometer and Again-Again Table show that most of the children enjoyed the App. There was no statistically significant difference between the baby girls and the baby boys in terms of task completion time which shows that the App was equally efficient for all the children.

Keywords: Child-Computer Interaction · Usability test · Fun Toolkit · Mobile learning App

1 Introduction

Child-Computer Interaction is very important area that needs to be explored further. Many mobile Apps for children have been developed under various categories, e.g., games, learning apps, etc. Evaluating usability of these mobile Apps is crucial for the success of these Apps. Arain et al. have recently evaluated the usability of mobile learning App. Data was collected through formal experiment and System Usability Scale. Results revealed that App is very effective, efficient and user friendly [1].

Read et al. have measured fun through Fun Toolkit containing (Smileyometer, a Fun-Sorter and an Again-Again Table) with kids having age between 5 and 10 years. They additionally examined relationship amongst fun and usability in three dimensions: Endurability, Engagement, and Expectations. They measured these three dimensions of

fun in detail. They concluded that these three measures of fun are useful [2]. The authors provide the guidelines for researchers that how to use Fun Toolkit and other survey methods related with child studies [3]. Two summative evaluation methods have been assessed by [4]: Smileyometer and This or That. Researchers measured reliability and validity of each method with 113 youngsters having age from 3 to 8 years.

Researchers have designed a fun loving interactive Tablet-PC App for playful reading and storytelling for the children. The App was evaluated by 18 children of primary school. Fun Toolkit was used to measure the kids' experience of fun along with usability test [5]. Fun Toolkit has been used to evaluate the children's user experience having age 11–13 years for the prototypes of iPad based game [6]. Smileyometer and Fun-Sorter have been used to evaluate children's experience of fun for the educational software; the children's age was 7–8 years. The authors recommend Fun-Sorter for assessing various products with children [7]. Usability and fun and the relationship between them have been investigated for kids between 7 and 8 years for the educational software [8].

Few learning Apps for children have been developed but not a single App has been developed for learning English-Sindhi Languages. Sindhi language is commonly spoken in Sindh and Balochistan provinces of Pakistan as well as in northern parts of India. We have developed a mobile learning App for the children who are native speakers of Sindhi language to teach them English through the App. Usability test has also been conducted for this learning App and its results are presented in this paper.

The rest of the paper is divided into following sections: Sect. 2 presents overview of the newly developed App. Section 3 describes methodology. Results are shown in Sect. 4 and in Sect. 5 conclusions are given.

2 “Learn English-Sindhi” App

Nowadays children are very accustomed with mobile phones and Tablet-PCs in early age. This provides the chance to teachers and researchers to teach children through interactive mobile learning Apps. By keeping this fact in mind, we have developed an Android based mobile learning App called “Learn English-Sindhi” for Sindhi speaking children in Pakistan to teach them English through their native language Sindhi. The main objective of the mobile learning App is to provide a dedicated Sindhi Application to Sindhi speaking children so that they themselves can learn English through their native language. There is no such kind of App available yet in the Android market.

The mobile App covers the basic activities that the children use to learn in the early level of the education. These entire activities are presented through the images, text and voice in both languages: English and Sindhi. The target of the App is the children aged between 4 and 9 years.

Figure 1 shows three screenshots of the App, screen (a) shows the main menu of the App which contains seven different learning options (i.e., Alphabets, Numbers, Fruits, Vegetables, Colors, Calendar and Body Parts). Screen (b) shows one of the alphabet “G for Grapes انگور”, here text has been written in both languages English and Sindhi with appropriate image and clear voice in both languages, so the children can

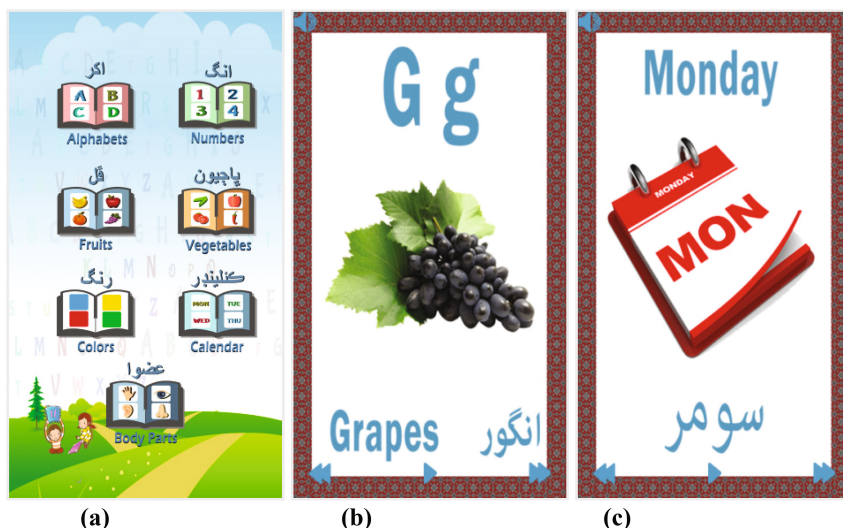


Fig. 1. Screenshots of (a) Menu screen (b) G alphabet from Alphabet (c) Day Monday from Calendar

easily understand the English word through Sindhi and image. Screen (c) shows one of the calendar's days in English and Sindhi Language.

The App also contains “Numbers” in which there is counting from 1 to 20 in both languages: English and Sindhi. In “Fruits” and “Vegetables” there are some common fruits and vegetables that are used in daily life. “Colors” shows basic colors in both languages and “Body Parts” shows body parts in both languages.

3 Methodology

Demographic questionnaire, usability tasks and Fun Toolkit [2] were used in this research study. As the target audience was children, so Fun Toolkit was used to measure the children's experience of fun after using the App. Before actual usability testing, pilot study was conducted with 10 children and 3 of their teachers with permission from the school administration. Based on the feedback of the pilot study, slight changes were incorporated in the App. Based on the data obtained through demographic questionnaire, hundred students ($n = 100$) from Class-KG and Class-I having the age group 4 to 9 years were selected randomly, 58% were baby boys while 42% were baby girls. All of the children were well familiar with usage of the smartphone or Table-PC.

The usability test was conducted and then Smileyometer, Again-Again Table and Fun-Sorter from the Fun Toolkit were immediately administered after the children performed the usability tasks. Each child was asked to perform three simple tasks, the tasks were to find out an alphabet, a fruit and a body part from the App. The Samsung Galaxy S4 smartphone was used during the study. For each child, task completion time and task completion rate was recorded. After completing the tasks, the children were asked to give their opinion about the App using the mentioned tools from the Fun Toolkit.

4 Results

The results are presented in the below subsections.

4.1 Demographic Data

According to the results of the demographic questionnaire, 58% participating children were baby boys and 42% were baby girls; having age between 4 and 9 years. 50% children were from Class-KG and 50% were from Class-I. All the participating children had experience of using smartphone or Tablet-PC and were using different mobile Apps. The participating children’s usage of smartphone or Tablet-PC was: 59% children spend one hour daily, 30% children spend two hours daily, and 11% children spend three hours daily or above.

4.2 Usability Test

There were three tasks to be performed by the participating children during the usability test. The task completion rate was 100%; this shows that the App is easy and effective as every child completed all the three tasks. Efficiency was measured through task completion time; Fig. 2 shows the average task completion time of the participating baby boys and baby girls.

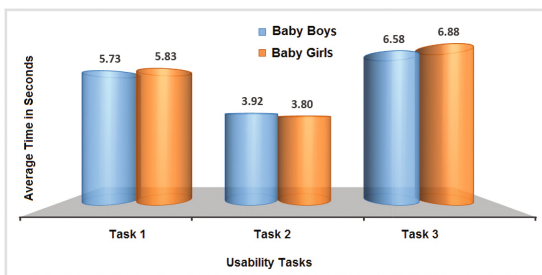


Fig. 2. Average task completion time in seconds

Table 1 shows descriptive statistics of all three tasks in terms of the total task completion time in seconds.

Table 1. Descriptive statistics

S#	Tasks	Mean	Std. Deviation
1	Find out the Letter D (D for Doll) “ڊگڙي”	5.7730	2.8774
2	Find out the Eyes “اڳيون”	3.8738	1.7472
3	Find out the Mango “انڊ”	6.7067	2.3088

Table 2 shows group differences of the participants in categories of gender, education level and smartphone or Tablet-PC usage groups with mean and standard deviation for total task completion time in seconds.

Table 2. Group differences

Group	Category	Mean	Std. Deviation
Gender	Baby boys	5.4114	1.6337
	Baby girls	5.5061	1.9579
Education level	Class-KG	5.4448	1.7386
	Class-I	5.4575	1.8149
Smartphone or tablet-PC usage	1 h daily	5.5126	1.7184
	2 h daily	5.7438	1.9962
	3 h daily or above	4.3236	0.7684

Table 3 shows regarding the participating children that there is no statistically significant difference between gender, education level and smartphone usage groups in terms of total task completion time. The t value of gender group is $t(98) = -0.263$ and $p = 0.793$, so there is no statistically significance difference between baby boys and baby girls. Similarly, in second group education level t value is $t(98) = -0.036$ and $p = 0.973$ and in third group one-way ANOVA has been applied where $F(2, 97) = 2.779$ and $p = 0.067$. The results show that the App is equally efficient for all the participating children regardless of their gender, education level or daily usage time of smartphone or Tablet-PC.

Table 3. Independent samples t-test and one-way ANOVA

Test type	Testing variable	Value	Probability
Independent samples t-test	Gender	$t(98) = -0.263$	$P = 0.793$
Independent samples t-test	Education level	$t(98) = -0.036$	$P = 0.971$
One-way ANOVA	Smartphone or tablet-PC usage	$F(2, 97) = 2.779$	$P = 0.067$

4.3 Fun Toolkit

Fun Toolkit has been used to measure the participating children's experience of fun after completing the tasks.

4.3.1 Smileyometer

Smileyometer from Fun Toolkit has been used to measure the children's experience of fun that how much fun it was to use the various activities of the App. Figure 3 shows a five-point scale (Awful, Not very good, Good, Really good, Brilliant) which is used to record the response from the participating children for the Task 3.

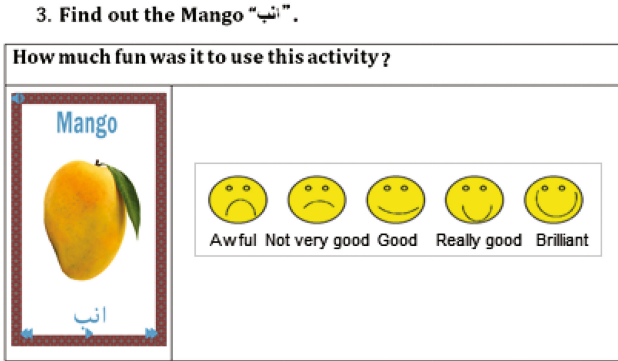


Fig. 3. Smileyometer

Figure 4(a) shows the response of the participating children for Task 1: The total response for Brilliant and Really good is 78%, while the rest of the participants' response is Good. Figure 4(b) shows the response of the participating children for Task 2: The total response for Brilliant and Really good is 79%, while the rest of the participants' response is Good. Figure 4(c) shows the response of the participating children for Task 3: The total response for Brilliant and Really good is 81%, while the rest of the participants' response

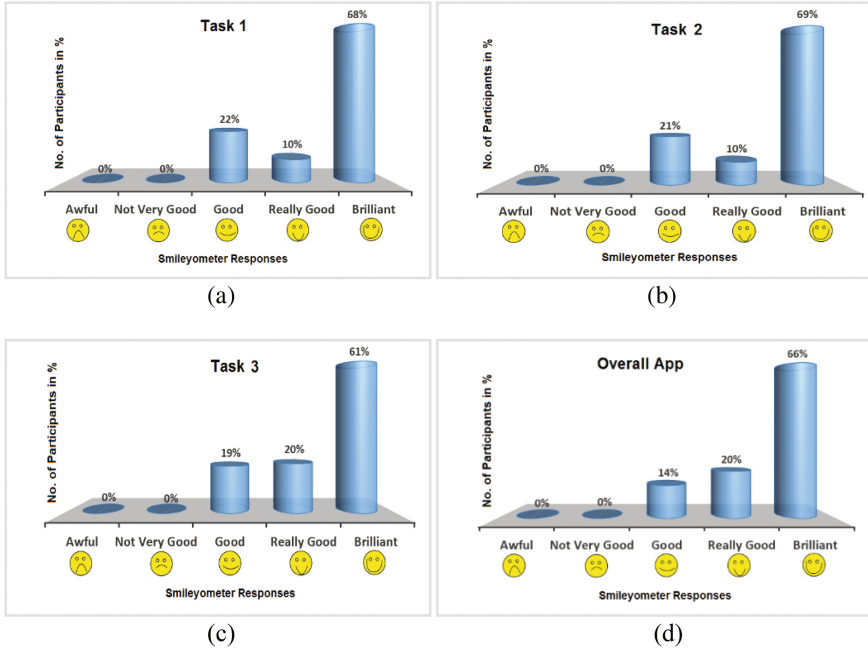


Fig. 4. Smileyometer response of the participating children for (a) Task 1 (b) Task 2 (c) Task 3 (d) Overall App

is Good and Fig. 4(d) shows the response of the participating children for the overall App: the participating children’s experience regarding the App was enjoyable as the total response for Brilliant and Really good is 86%, while the rest of the participants’ response is Good.

Table 4 shows group differences of the participating children in categories of gender, education level and smartphone or Tablet-PC usage groups with mean and standard deviation for the response of Smileyometer regarding all the tasks.

Table 4. Group differences

Group	Category	Mean	Std. Deviation
Gender	Baby boys	4.4713	0.6609
	Baby girls	4.4286	0.6799
Education level	Class-KG	4.4933	0.6538
	Class-I	4.4133	0.6820
Smartphone or tablet-PC usage	1 h daily	4.5141	0.6818
	2 h daily	4.3889	0.5746
	3 h daily or above	4.3030	0.8227

Table 5 shows that regarding the participating children, there is no statistically significant difference between gender, education level and smartphone or Tablet-PC usage groups in terms of Smileyometer response regarding all three tasks. The t value of gender group is $t(98) = 0.315$ and $p = 0.753$, so there is no statistically significance difference between the baby boys and the baby girls. Similarly, in second group education level, t value is $t(98) = 0.599$ and $p = 0.551$ and on third group one-way ANOVA has been applied where $F(2, 97) = 0.662$ and $p = 0.518$. The results show that the participating children’s reported experience of fun about the App is equal regardless of their gender, education level or daily usage time of smartphone or Tablet-PC.

Table 5. Independent samples t-test and one-way ANOVA

Test type	Testing variable	Value	Probability
Independent samples t-test	Gender	$t(98) = 0.315$	$P = 0.753$
Independent samples t-test	Education level	$t(98) = 0.599$	$P = 0.551$
One-way ANOVA	Smartphone or tablet-PC usage	$F(2, 97) = 0.662$	$P = 0.518$

4.3.2 Again-Again Table

Again-Again Table is used to ask the opinion of children whether they want to use the App or to do the activity (task) again or not, for capturing an idea of engagement, as illustrated in Fig. 5.

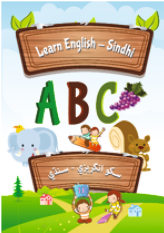
Would you like to use "Learn English - Sindhi" App again?			
	Yes	May be	No
			

Fig. 5. Again-Again table

Figure 6(a) shows the response of the participating children for Task 1 in terms of Again-Again Table: The total response for YES is 86% and response of MAYBE is 14%, while participants' response for NO is 0%. Figure 6(b) shows the response of the participating children for Task 2 in terms of Again-Again Table: The total response for YES is 90% and response of MAYBE is 10%, while participants' response for NO is 0%. Figure 6(c) shows the response of the participating children for Task 3 in terms of

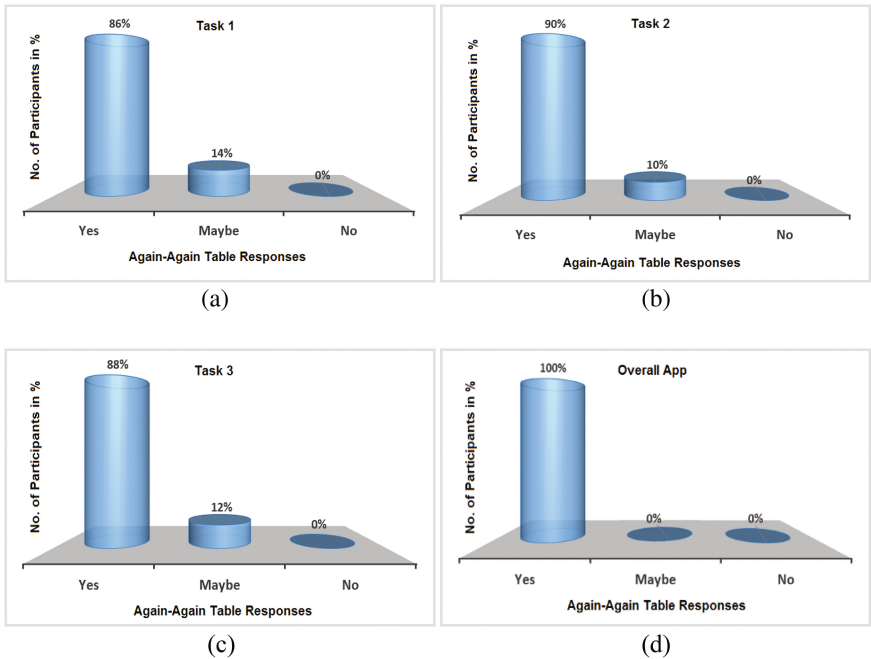


Fig. 6. Again-Again table response of the participating children for (a) Task 1 (b) Task 2 (c) Task 3 (d) Overall App

Again-Again Table: The total response for YES is 88% and response of MAYBE is 12%, while participants’ response for NO is 0%. Figure 6(d) shows the response of the participating children for the overall App in terms of Again-Again Table: The total response for YES is 100% which shows that all the participating children want to use this App again.

Table 6 shows group differences of the participants in categories of gender, education level and smartphone or Tablet-PC usage groups with mean and standard deviation for the response of Again-Again Table regarding all the tasks.

Table 6. Group differences

Group	Category	Mean	Std. Deviation
Gender	Baby boys	2.9078	0.2240
	Baby girls	2.8412	0.2878
Education level	Class-KG	2.9266	0.2265
	Class-I	2.8330	0.2723
Smartphone or tablet-PC usage	1 h daily	2.8814	0.2821
	2 h daily	2.8667	0.2850
	3 h daily or above	2.9091	0.3015

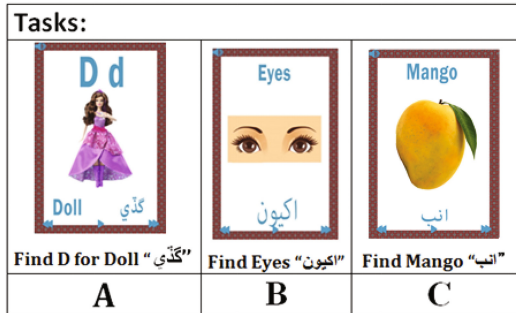
Table 7 shows that there is no statistically significant difference between gender, education level and smartphone or Tablet-PC usage groups in terms of Again-Again Table response regarding all three tasks. The t value of gender group is $t(98) = 1.300$ and $p = 0.197$, so there is no statistically significance difference between baby boys and baby girls. Similarly, in second group education level, t value is $t(98) = 1.869$ and $p = 0.065$ and on third group one-way ANOVA has been applied where $F(2, 97) = 0.091$ and $p = 0.913$. The results show that the App would be equally used again by the participating children regardless of their gender, education level or daily usage time of smartphone or Tablet-PC.

Table 7. Independent samples t-test and one-way ANOVA

Test type	Testing variable	Value	Probability
Independent samples t-test	Gender	$t(98) = 1.300$	$P = 0.197$
Independent samples t-test	Education level	$t(98) = 1.869$	$P = 0.065$
One-way ANOVA	Smartphone or tablet-PC usage	$F(2, 97) = 0.091$	$P = 0.913$

4.3.3 Fun-Sorter

Figure 7 shows the Fun-Sorter response of the participating children about three tasks.



	Best		Worst
Easiest to do	A	C	B
Most Fun	B	A	C

Fig. 7. Fun-Sorter

According to the participating children’s reported opinion, Task 1 is the easiest task to do. The participating children found Task 2 as the most enjoyable activity as compared to two other activities.

5 Conclusions

This paper shows results from the usability study that was conducted for the newly developed mobile learning App for the children aged between 4 and 9. The findings show that the App was very easy and effective as task accomplishment rate was hundred percent. There was no statistically significant difference between the baby girls and the baby boys in terms of task completion time which shows that the App was equally efficient for all the children regardless of their gender, education level or daily usage time of smartphone or Tablet-PC. According to the results most of the children enjoyed the App and all the participating children want to use this App again. Future work would include the observation of the children while using the App and comparing the observational data with the children’s reported experience of fun.

References

1. Arain, A.A., Hussain, Z., Rizvi, W.H., Vighio, M.S.: Evaluating usability of m-Learning application in the context of higher education institute. In: Zaphiris P., Ioannou A. (eds.) *Learning and Collaboration Technologies*. LNCS, vol. 9753, pp. 259–268. Springer, Cham (2016). doi:[10.1007/978-3-319-39483-1_24](https://doi.org/10.1007/978-3-319-39483-1_24)
2. Read, J.C., MacFarlane, S.J., Casey, C.: Endurability, engagement and expectations: measuring children's fun. In: *Interaction Design and Children*, vol. 2, pp. 1–23. Shaker Publishing, Eindhoven (2002)
3. Read, J.C., MacFarlane, S.: Using the fun toolkit and other survey methods to gather opinions in child computer interaction. In: *Proceedings of the 2006 Conference on Interaction Design and Children*, pp. 81–88. ACM (2006)
4. Zaman, B., Abeele, V.V., De Grooff, D.: Measuring product liking in preschool children: an evaluation of the Smileyometer and this or that methods. *Int. J. Child-Comput. Inter.* **1**(2), 61–70 (2013)
5. Alaamri, F., Greuter, S., Walz, S.P.: Trees of tales: a playful reading application for Arabic children. In: *International Conference on Entertainment Computing*, pp. 3–10. Springer, Heidelberg (2014)
6. Sim, G., Cassidy, B.: Investigating the fidelity effect when evaluating game prototypes with children. In: *Proceedings of the 27th International BCS Human Computer Interaction Conference*. British Computer Society (2013). Article no. 53
7. Sim, G., MacFarlane, S., Read, J.: All work and no play: measuring fun, usability, and learning in software for children. *Comput. Educ.* **46**(3), 235–248 (2006)
8. MacFarlane, S., Sim, G., Horton, M.: Assessing usability and fun in educational software. In: *Proceedings of the Conference on Interaction Design and Children*, pp. 103–109. ACM (2005)