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EVALUATION OF EDUCATIONAL MOBILE APPS FOR TURKISH PRESCHOOLERS FROM GOOGLE PLAY STORE

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Abstract:
There are many mobile applications (apps) for learning in Google Play Store. People usually evaluate the apps based on their personal view/criteria, and others have an idea about that app with its rating score and/or user comments. This study, aims to analyze the educational mobile apps objectively by using a reliable rubric tool; REVEAC (Rubric for the EValuation of Educational Apps for preschool Children). This is a descriptive research based on content analysis method. The mobile apps were selected in this study based on their following characteristics: belonging to educational category for children five years old and under; being free, trial or freemium; and having Turkish content. Android apps were selected because of its commonly usage in worldwide. The selected 44 apps have scores from 2.9 to 5 according to Google's five-star rating system. The selected mobile apps had medium level of rubric scores. The rubric scores ranged from 29 to 66 points with a mean of 43.20 ± 7.89. There was no statistically significant correlation between rubric scores and a) Google Play scores; b) the number of people who voted for the mobile app, and c) how many times the mobile app downloaded. The 39 apps could be categorized as games, and five apps were interactive e-books. The most popular five contents of the apps were; animals, numbers, colors, fruits and vegetables, and shapes. Almost all of the apps were promoting learning through repetitive practices. The study also presented additional notes for the apps in terms of four domain; educational content, design, functionality, and technical characteristics.

Keywords: mobile apps, educational apps, pre-schoolers, REVEAC rubric

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1. Introduction

> *"With the technology at our disposal, the possibilities are unbounded. All we need to do is make sure we keep talking."*
>
> Stephen Hawking

The mobile applications are commonly used tools for everyday activities including learning and practicing. The mobile apps marketplace offers a continuously growing new media where parents have many new alternatives for engaging and educating their children (Federal_Trade_Commission, 2012). As defined by (Dogtiev, 2018), the mobile app ecosystem, which includes both smartphone owners and app developers, will celebrate its 10th year on summer of 2018. Last year the total number of downloaded mobile apps were 197 billion (a forecast) and predicted to grow to 352.9 billion in 2021 (Statista, 2018a). There are approximately 3.5 million apps in December 2017 in Google Play Store while it was only one-million apps in July 2013 (Statista, 2018b). At the end of the 2017, education apps were the most popular category (Statista, 2018c). The children of today usually have a question on their mind: *Is there an app for that (Chiong & Shuler, 2010)?*

It is very familiar for us to see children playing with mobile devices and people congratulate their usage skills. Because all children, even in low-income families, have opportunities to contact with smart mobile devices as a *new era toy*. While some of the children have their own mobile device, some of them use their parents' devices. Moreover, families give the devices to the children because of "pass-back effect" which is defined as keeping the child busy in a car or in a restaurant by passing the smartphone or tablet to him/her (Chiong & Shuler, 2010). Sometimes parents give their smartphones or tablets to the children to placate or distract his/her behavior with these "digital pacifiers" (Kabali et al., 2015). Young children (between 6 months and 4 years) are playing games, using apps and watching videos on mobile devices (Kabali et al., 2015).

According to a five year old study conducted by Turkish state agency RTÜK (Radio and Television Supreme Council), the 69.4% of the kids from age 6 to 9 (from K1 to K4) have PC/laptop/tablets and 54.8% have Internet in Turkey (RTÜK, 2013). FATIH Project (English: Movement to Increase Opportunities and Technology), which is conducted by Turkish Ministry of National Education, aims to deliver each child at least a tablet, a learning portal, EBA (Education and Informatics Network) store/repository, cloud account, digital ID, homework portal, e-mail account and individual learning materials as free of charge. Until today, almost 1.5 million tablets were given to the students. Many of the families, "even in low-income", had reached these mobile devices. Preschoolers had the opportunity to play with these tablets via their siblings or brothers.

Mobile apps transform the digital devices into learning and entertaining tool (Papadakis, Kalogiannakis, & Zaranis, 2018). These apps can be categorized as *gaming apps*, *creating apps* and *interactive eBooks* (Cohen, Hadley, & Frank, 2012). There are many

kind of sub-categories in terms of classifying these apps. For example, game apps include instructive, manipulables, puzzles, role-play, simulations and casual; the interactive eBooks include read-to-me or read-and-play categories (Chau, 2014).

Parents are tended to believe that mobile apps provide real learning opportunities for their children, but related research says that many of these apps are only digital candy (Hirsh-Pasek, 2015). The previous studies which were analyzed the educational apps from Apple Store or Google Play found similar results that, almost half of these apps are inappropriate, unregulated or doesn't meet the necessary criteria for educational category (Dua & Meacham, 2016; Papadakis, Kalogiannakis, & Zaranis, 2017; Vaala, Ly, & Levine, 2015; Watlington, 2011). However, good quality mobile apps have so many advantages. A well designed educational app should activate the children in four areas; participation, engaging with the content, experiencing meaningful learning and interacting socially (Papadakis et al., 2018). According to Sesame Workshop, which has experience on children's media testing more than 40 years, the overall visual design of the mobile app should trigger discovery and exploration (SesameWorkshop, 2012). The open-ended content and children's self-use of the apps (such as choosing the colors independently for drawing) are critical indices for the app's educational value (Kucirkova, Messer, Sheehy, & Fernández Panadero, 2014).

Learning with mobile apps takes place through cognitive, affective means and psychomotor-based (Noorhidawati, Ghalebandi, & Siti Hajar, 2015). The kind of app and appropriateness of the learning activity depends on the child's age and developmental stage (Chau, 2014; Chiong & Shuler, 2010; Cohen et al., 2012). Many parents seek quality standards, prefer healthy ingredients while buying something for their little ones; so why they are not asking about which educational apps are "appropriate" or "good" for their kids (Dua & Meacham, 2016)?

There are universal review sites such as Common Sense Media, Children's Technology Review, Appolicious (Dua & Meacham, 2016); and rating systems such as Entertainment Software Rating Board (ESRB), Pan European Game Information (PEGI), Computer Entertainment Rating Organization (CERO), and German Youth Protection working for informing its' quality and the content's target group. In term of the apps with Turkish content there is not enough source conducted with scientific methods to assess and evaluate the educational apps. This study plans to make an awareness between parents, teachers, children, and app developers to consider the factors which makes an educational app better. In this context, the author aims to get answers to the following questions:

1. What kind of educational mobile apps with Turkish content are available for children with age five and under in terms of the content and categories?

2. How much score do mobile apps have...

a) in Google Play store?

b) according to rubric scores?

3. Is there a significant relationship between rubric scores and …

a) Google Play scores of the mobile apps?

b) how many times the mobile app downloaded from Google Play Store?
c) how many people voted for the mobile app in Google Play Store?

4. What are the qualitative attributes of the selected apps in terms of its' educational content, design, functionality, and technical characteristics?

2. Method

This is a descriptive research based on content analysis method. The mobile applications were determined and analyzed according to their educational content, design, functionality, and technical characteristics by using an evaluation tool and scored. The apps were reviewed with a qualitative perspective, but the evaluation tool gave opportunity to analysis results with a quantitative aspect.

2.1 Selecting the Sample

The mobile applications for preschool children are the study objects of this research. While selecting the sample from mobile store, the following rules were applied: a) belonging to educational or family category for children with age five and below, b) being free, trial or freemium, c) having Turkish content, and d) existence in Google Play.

The Android Operating System (OS) were selected in this study for such reasons. Firstly, the tablets, which were started to pass out as part of FATIH Project, have Android OS. Secondly; in the second quarter of 2017, 87.7% of all smartphones were medium with the Android OS while only 12.1% were iOS (Statista, 2018d). On the side of tablets' OS, Android is still leading the market, with a portion of 60% since 2013 (Statista, 2018e).

There were 52 apps according to above criteria. But eight of the apps were elected because of following reasons; poor design and content, not working, repeated form of another app, and the excessive number of ads (advertisement). Total performance scores of 44 mobile apps were assessed and calculated based on Rubric scale. The device used in this study was a 9.7 inch tablet and the software was Android KitKat (4.4.4).

Actually, there were some applications as language free which have intuitional design with a music or sound, but we did not evaluate these universal applications because of our Turkish content criteria. All the selected apps were available publicly in Google Play, so the author did not prefer to use alias in reporting the results.

2.2 Data Collection Tool

REVEAC (Rubric for the EValuation of Educational Apps for preschool Children) Scale (Papadakis et al., 2017) was used as the evaluation tool. The author contacted with Stamatis Papadakis and got written approval by e-mail to translate the rating tool into Turkish and using it with Turkish sample. The items were translated into Turkish by the researcher and then three experts' views were asked to check the congruence. The experts were agreed for 53 boxes and disagreed for 19 boxes. After editing the

translation according to their recommendations, the document resent to the same experts and they were asked to check the translations again if all their recommendations were conducted or not.

It gives a total summative score of 18 items/categories with four rating points (18x4=72 boxes in the rubric). The tool have four factors/domains as educational content (7 items), design (4 items), functionality (4 items), and technical characteristics (3 items). The Cronbach's alpha reliability of the scale was .79 in original version and, .86 in Turkish version.

2.3 Data Collection Process

The mobile applications were downloaded from Google Play between 23rd February and 6th March 2018. The author also recorded the app's Google Play score, how many people rated, how many times the app downloaded, and the last update of the app. All the apps were evaluated by the author who has a PhD in Instructional Technologies. 16 mobile apps were selected randomly to be evaluated by a volunteer second rater, who is a preschool teacher for 20-years. The inter-rater correlation between coders was found as .88 ($p< .05$).

2.4 Data Analysis

Data were analyzed with SPSS software (SPSS, 2008). The descriptive (frequency, percentage, mean, standard deviation) and correlational statistical methods were used with 95% confidence interval. The qualitative analysis were reported by using the reviewer's notes.

3. Findings and Discussion

The findings of the study are given below according to order of the research questions. The first question was exploring the content and categories of the mobile apps. As mentioned before the selected educational mobile apps have Turkish content and available for children with age five and under. The apps have literacy, math, social studies and social/emotional learning content areas. Many of the apps were including the educational content about animals, numbers, colors, fruits and vegetables, shapes, letters, and vehicles.

The detailed list of the contents is given below in Figure 1.

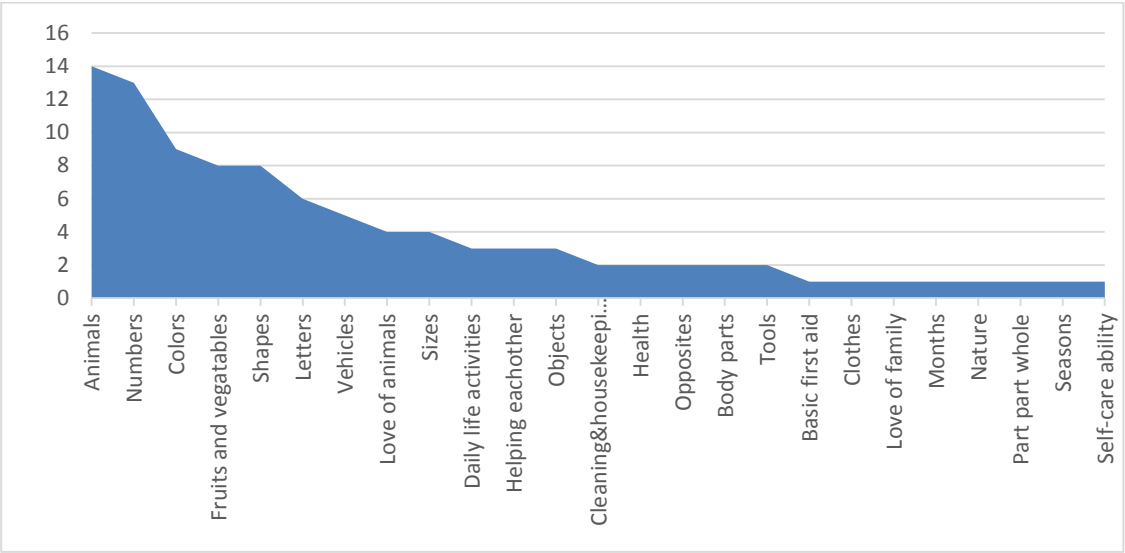


Figure 1: The content list of the mobile apps

The mobile apps were classified under three categories; "games and learning activities", "interactive eBooks" and "creating" apps (Chau, 2014). The results of this study revealed that, while 39 of the mobile apps were under games category, the five apps were under interactive eBook category. There was not a stand-alone "creativity" app in our sample. The "games and learning activities" category also has different perspectives in terms of their design such as; instructive, creativity, role play, puzzle, simulation etc. In our sample the creativity category, which allows children to draw or to build (Neumann & Neumann, 2014), were usually coloring books and embedded in the app with other activities. The role play games were about *housekeeping* and *basic first aid* activities. The puzzles were embedded as a jigsaw puzzle in some of the applications, only in one application it was presented as tangram. The simulation games were for "*tooth-brushing*" and "*in the airport*" situations. The instructive games were usually presented with flashcards, memory cards, question-answer or matching format based on repetition of knowledge or skills. The distribution of game app types is given below (See Figure 2). In a similar study conducted with 100 apps, 73% were game apps, 28% were interactive eBooks and 13% were utilities such as creation or production tools (Chau, 2014).

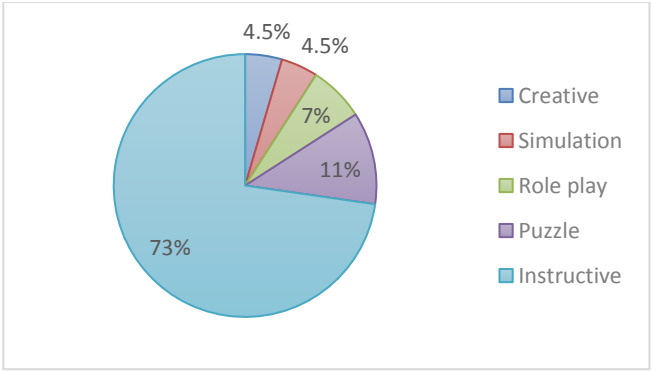
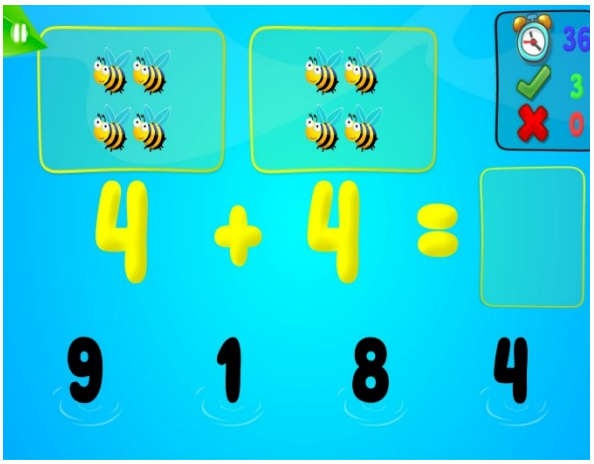


Figure 2: The distribution of game app types

Most of the mobile apps have drill and practice instructional strategy (e.g. flashcards, memory cards, and question-answer) which promotes learning through repetitive activities for skill or knowledge acquisition. If the same activities were repeated too often, the students could become disengaged (Fabian & MacLean, 2014). In the reviewed mobile apps, the skills asked for the child were predominantly based on drag and drop, pattern recognition, matching, and grouping the items (See Figure 3). The apps were asking children for several cognitive skills such as, reasoning, decision making, problem solving, and knowledge of concepts, eye-hand coordination, and understanding of instructions, attention, visual perception, and auditory perception.

1. 

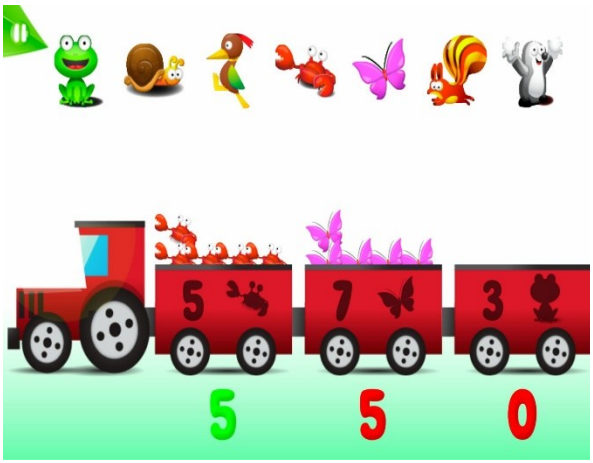
2. 

Figure 3: Mobile apps with such skills: drag and drop, pattern recognition, matching, and grouping the items

Google Play score is reflecting a subjective view of the app's users who voted for the app. Some of the apps have sub-category ratings as; *gameplay*, *graphic*, and *control*, but not all of the apps. The author recorded these data but didn't use for analyzing, because of the missing values. In this study, Google Play rating scores of selected mobile apps were between 2.9 and 5 with a mean of 4.28±0.33.

The mobile apps had evaluation scores from 29 to 66 with a mean of 43.20±7.89 by using the rubric (See Figure 4). The *educational content* section scores changed between 9 and 28 with a mean of 15.77±3.94. The mean score of *design* section was 10.59±2.73 (min: 5, max:16). The scores for the *functionality* section were between 5 and 14 with a mean of 9.57±1.99. The *technical characteristics* section of the rubric scores were changing from 3 to 10 with a mean of 7.27±1.22.

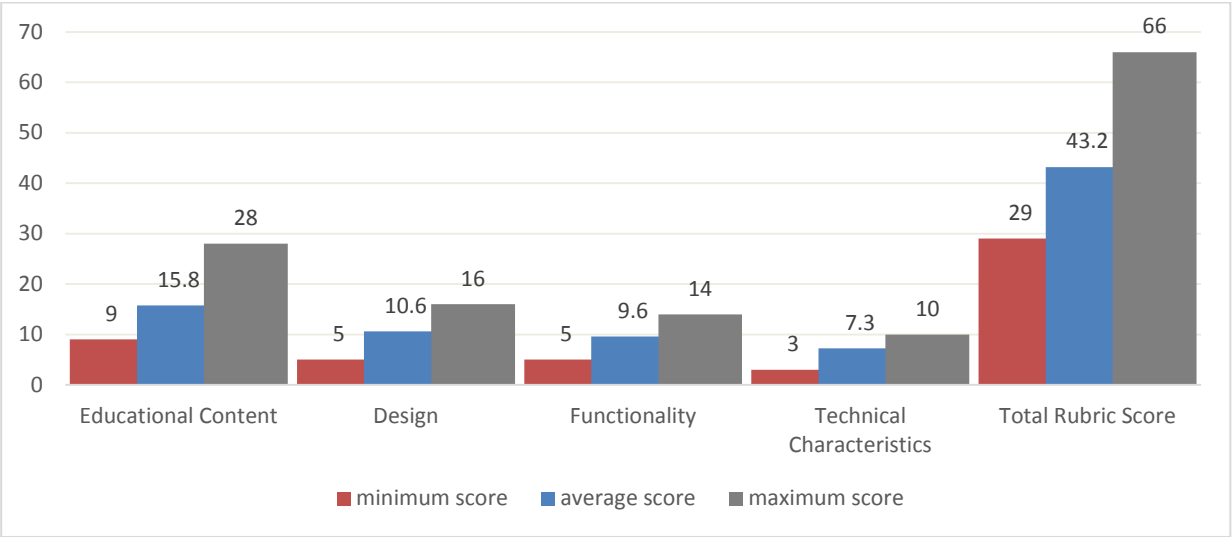


Figure 4: The min, max and average of Rubric scores of the mobile apps for all domains

Google Play Scores are based on five-star rating and the rubric scores are based on four levels. In order to compare and interpret easily, the rubric scores transformed into five levels with a formula [NewRubricScore= (MainRubricScore*1.25)/18]. The new rubric scores over five points were between 2.01 and 4.58 with a mean of 3.00±.054. There was no significant correlation between Google Play scores and the rubric scores (r = .14; p >.05) in this study. The results showed that, there was no significant correlation between how many times the mobile app downloaded and the rubric scores (r = .18; p >.05). And, there was no significant relationship between the number of people who voted for the mobile app and the rubric scores (r = .20; p >.05). The minimum number of voters was two, and the maximum number was 36.850 for the selected mobile apps. In the original study of the rubric, there was no statistically significant correlation in terms of number of stars, number of download, and number of voters with rubric scores (Papadakis et al., 2018).

The oldest update was on 13th May 2013 and the newest update was on 3rd March 2018. The dates were calculated as days; minimum three and maximum 1758 with a mean of 429.77±342.35 days. The last update variable may not be a direct quality indicator (Papadakis et al., 2018), but may be thought as the developers are considering the app and working for it.

3.1 Educational Content

In terms of educational content factor, the mean scores, minimum and maximum scores were given in Table 1. The knowledge package of the mobile apps were at good quality in general, but still some of them needs improvement in terms of difficulty for the target group, still including English words in the content, or incompliance with learning goals. Learning was provided through drill and practice activities in most of the selected apps (See Figure 5) (Hirsh-Pasek et al., 2015).

Table 1: Rubric scores of the mobile apps for educational content

		min	max	M	SD
Educational Content	Knowledge package appropriateness	1	4	2.55	.98
	Learning provision	1	4	1.64	1.08
	Levelling	1	4	1.55	.79
	Motivation /Engagement	1	4	2.61	1.04
	Error correction /Feedback provision	1	4	2.02	.51
	Progress Monitoring / Sharing	1	4	1.59	.84
	Bias free	2	4	3.82	.54

Figure 5: Mobile apps with drill and practice instructional strategy

Many of the apps were lack of multiple difficulty levels and not providing personalized learning experiences. The levelling option provides a solution for integration of a sequential curriculum and sustained engagement (Cohen et al., 2012). In terms of motivation and engagement, many of the selected apps may keep the learners engaged with the activities, at least five minutes. Engagement can be thought as lack of distracting elements, and keeps the child's attention focused continuously (Hirsh-Pasek et al., 2015). Levelling option makes the child feel in a challenging situation. Children feel bored if the game doesn't provide levelling option (Cohen et al., 2012).

Most of the selected apps have limited feedback that doesn't enhance learning. It just gives a true/false notification. However, wrong answers are an opportunity for children to learn. According to Sesame Workshop (2012), wrong answer feedbacks may suggest moving the child forward, and they have three levels of scaffolding for each try: 1st try: notifying the false choice, give encouragement as "*that's not it. try again*", 2nd try: notifying the false choice, restating the aim, offering a hint in addition to giving encouragement as "*that's not right. you need to find a square. it has 4 sides and 4 angles! try again"*, and 3rd try: notifying the false choice, restating the aim, offering a hint and highlighting the true reply as "*that's not right. you need to find a square. it has 4 sides and 4 angles!<square highlights> tap on the square!*".

Many of the apps doesn't monitor the progress of child, limited number of apps keeps history, analysis his/her performance and provides statistical information (See

Figure 6). These progress trackers are very helpful resources for parents (SesameWorkshop, 2012).

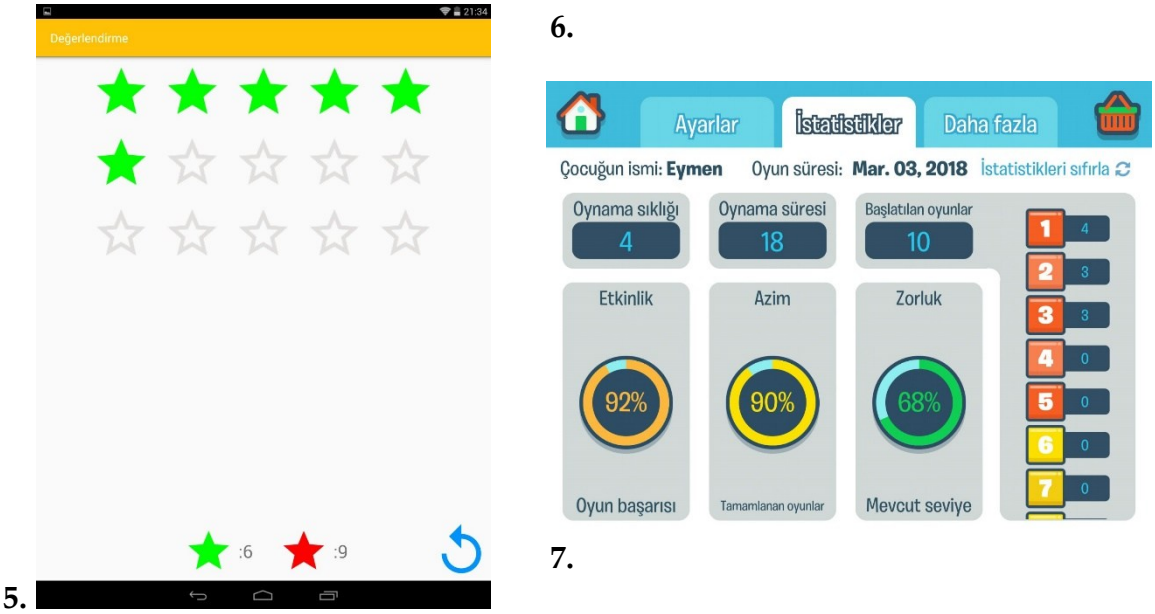


Figure 6: Mobile apps with progress monitoring/sharing options

It is a good opportunity for children in Turkey, the existence of a Turkish television station as named TRT Çocuk, which is a part of TRT (Turkish Radio and Television Corporation), and it broadcasts cartoons for children since autumn of 2008. TRT Çocuk has its own mobile applications, games created for children for different age ranges by using its own cartoon characters (TRT-Çocuk, 2008). This invites the child to an environment where the child experiences an extended engagement with the familiar characters on screen (Sesame Workshop, 2012). The TRT Çocuk applications have designed and developed by professional teams with good quality or as exemplary, without ads.

In terms of bias free perspective, some of the selected apps have gender stereotypes. For example in TRT-Canım Kardeşim application, if the child prefers to help his/her mother he/she clean the house or cooks or bakes with the mother; on the other hand the father has tasks in garden such as; building and painting a house for the dog, organizing his toolbox, and kind of tasks in the garden. On the other hand, some of the applications including Turkish content but originally developed by another country. In a translated mobile app, while teaching the seasons, the app uses images related to their culture (See Figure 7); e.g. one has a title written on it "back to school" for September, one has pumpkins for October, another one uses shopping theme for November etc. These images were not suitable vectors for this age group either. While translating these apps it is not enough to translate the sounds only. The developers should consider the content either.

8. 

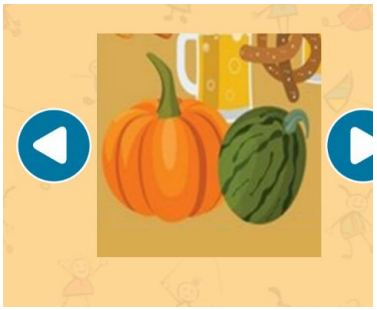
9. 
10. 

Figure 7: Culture biased images from mobile apps

3.2 Design

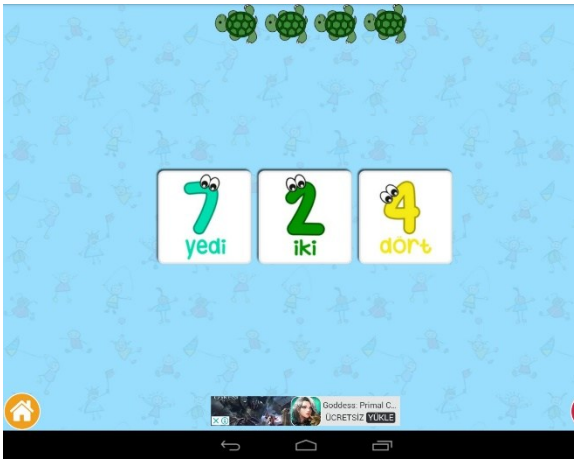
In terms of design factor, the mean scores were given in below (See Table 2). The graphics used in the selected apps were attractive and had good or medium quality images. There were also poor quality or complex images for the child's cognitive age. Child-facing fonts (e.g. Zaner-Bloser, Sesame Street etc.), which are not including serifs, should be preferred (SesameWorkshop, 2012) in children digital world. The graphics should be clearly interpretable, help to recognize faster, and the images should be relevant to the content and appropriately used (Masood & Thigambaram, 2015).

The sound quality was very poor in some of the apps with a very low level even the volume of the device was set to maximum, not easily understandable for such reasons; poor or unprofessional recording of the voices, using text-to-speech records in some of the translated apps etc. In some of the applications, children were asked to guess the correct answer by listening the sound of that animal. In some of the apps there was not a replay button when the child needs to listen that sound more than once. Some of the feedback notification sounds were very distractive when the child successes/fails the task.

Table 2: Rubric scores of the mobile apps for design

		min	max	M	SD
Design	Graphics	1	4	2.55	1.09
	Sound	1	4	2.41	1.02
	Layout / scenery	1	4	2.80	.59
	App/menu design	1	4	2.84	.71

In terms of interactive eBooks, some of them were not including read to me option. These books should offer reading options with or without narration, and allow parents to turn of the hotspots (SesameWorkshop, 2012). Most of the apps have intuitive design, but the child may still need further assistance. In some of the apps, the layout was not responsive (See Figure 8). The screen neither automatically arranged itself according to the device (tablet or smartphone) nor rotated its interface. The preschoolers are tended to hold their devices in landscape view (SesameWorkshop, 2012).

11. 

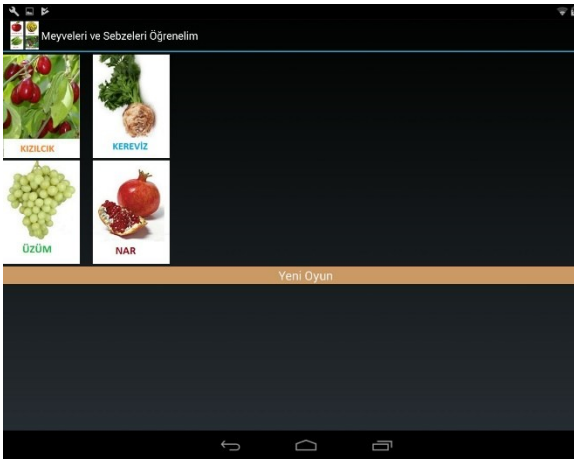
12. 

Figure 8: Unresponsive layout of mobile apps

In this study, the app/menu design most of the apps were suitable. But almost all of the applications were not providing an exit button to stop the application, as in other studies (Masood & Thigambaram, 2015; Papadakis et al., 2018).

Design is very important theme for educational applications. In well-designed apps the child may able to play easily and engage with the learning tasks. According to Cohen et al. (2012), if the app's interface is intuitive, age appropriate, and children engage in trial-and-error efforts; they move on quickly from novice to mastery.

Some of the apps prefer a toy box to collect a list of toys after finishing a level or a task (See Figure 9). There was also apps which aimed to finish a photo album with the tasks of the game, when finishing the task, it allows child to take a photo (as print screen) and imports it into the album. In a well-designed gaming app, the child engages in a personal-best competition than winning or losing (Cohen et al., 2012).

13. 

14. 

Figure 9: Engagement provision by collecting objects/toys during the game app

3.3 Functionality

In terms of functionality (See Table 3), most of the apps may be categorized as easy to understand and use, but most of them were not providing "palm rest" option. "Palm rest" is an important option for children because their body is weak and small; and many children prefer playing with tablets on their lap, or by lying down on the floor

(Neumann & Neumann, 2014). Preschoolers are inclined to rest their wrists along the bottom edge of devices (SesameWorkshop, 2012). The app should not designed with menu, buttons or interaction objects at bottom side, and prevent children to touch these spots unintentionally.

Table 3: Rubric scores of the mobile apps for functionality

		min	max	M	SD
Functionality	Child-friendliness	2	4	2.89	.62
	Autonomy	1	4	2.98	.88
	Instructions existence	1	4	1.82	.84
	Configuration ability	1	4	1.89	.54

Even some of the selected apps, the child can use the app without an adult's help after the first time, some of them still ask for support from a parent in order to make configuration, or in order to try the task (Masood & Thigambaram, 2015) with "complicated, incomplete, inaccurate or incomprehensible" instructions (Papadakis et al., 2017) or with text-only instructions for preschool children (See Figure 10). While tapping into the child's play as a 'technical expert', parents and older siblings/brothers get opportunity to share, and scaffold, the child's imaginative play, sometimes just for few seconds (Verenikina & Kervin, 2011).

Main instructions for the mobile app or task should be presented both visually and verbally, when we consider that preschool children cannot read (SesameWorkshop, 2012). On the left image, in Figure 10, the needed task given as written words on the top "collect the yellow apples" without any voiceover. On the right figure the app still includes English menu and words, and the child have to double-tap on menu button to select another task. But double-tapping gesture is far from the preschoolers' capacity (Papadakis et al., 2018). The interaction gestures were divided into two as most intuitive (tap, draw/move finger, swipe, drag, slide) and least intuitive (pinch, tilt/shake, multi-touch, flick/fling, double tap) for children with developing motor skills (SesameWorkshop, 2012). In a study, small-age children have difficulties on dragging (Vatavu, Cramariuc, & Schipor, 2015) because of their fine motor skills.

15. 

16. 

Figure 10: Text-only instructions without voiceover for prescholers (left) English words in Turkish version with double tapping menu button (right)

In some of the selected interactive eBooks, there was not voiceover option, so the child may need support in some parts of these apps. In another example, some of the apps (e.g. Animal Sounds for Toddlers by Papumba) have tasks to play with parents as finding the bear in the cave which asks for putting the tablet in a dark room and searching the bear together. Integration of parent-child interactions during the digital experiences are recommended and may be supported with parent tips (SesameWorkshop, 2012).

The instructions were very limited. In many of the games, there is not any instructions for the child who doesn't know what to do. If the child has no experience with digital games, some of the skills may be difficult for her/him. The barriers of an app's usage are as follows; unclear, unresponsive or unfriendly interfaces, too many distractions, lack of "palm rest", ambiguous game objectives and playing without feedback or reward (Cohen et al., 2012).

The configuration ability of the most apps was allowing the child to mute the sounds or music (Papadakis et al., 2018). Small number of the apps asks child to select a friend (boy/girl) or a character to play the games with. Sesame Workshop (2012) is calling these characters as "hosts" or "guides" which were named as "educational agent" in educational software. App interface design, child's prior digital gaming experience, and the adaptation of the app to the child's developmental level are correlated (Cohen et al., 2012).

3.4 Technical Characteristics

The technical characteristics of the most apps (See Table 4) had good quality, and they were loading and running quickly. There were two applications having crash or freeze problems for only a task in them.

Table 4: Rubric scores of the mobile apps for technical characteristics

		min	max	M	SD
Technical characteristics	Performance and Reliability	1	4	2.86	.67
	Advertisements /Electronic Transactions	1	4	3.36	.81
	Social interactions	1	3	1.05	.30

The ads usually were not disrupting the child's attention in-app advertising systems. But in some apps, the ads placed bottom on the screen which was not a problem with tablet but while playing with a mobile phone it may cause the break of "palm rest" area. In an application which was excluded from the sample, the existence of the ads were such irritative that pops up even in 20 seconds.

As mentioned in our selecting criteria the apps were free, trial or freemium versions. While some of the in-app purchase systems, the apps have parental region with "baby-gate" windows (SesameWorkshop, 2012), in some of the apps the child easily make payment to buy the full version or open some functions of the app (Figure 11). In baby gate windows of parental region, there were different strategies with unintuitive gestures such as press the area more than two seconds, multi touching (with two fingers) on the screen, or entering the given numbers that were written as words.

17. 

18. 

Figure 11: In-app purchase systems with and without parental region

Almost all of the apps don't provide any form of social interaction. Only in one app (Animal Sounds for Toddlers by Papumba) as mentioned above, kinesthetic tasks with parents were integrated as a form of family activity. Similar to other studies (Chau, 2014; Papadakis et al., 2018) these apps don't support physical, emotional, and social development of children too much. According to Rockman et al (an evaluation firm), the apps can sustain children's interest and learning with the following features; the right content for their cognitive and developmental age, levelling or fresh content, short waiting times, amusing activities, motivating attributes to keep the child playing, goal setting and playing with parent or a friend (Chiong & Shuler, 2010).

4. Conclusion and Recommendations

Visual and audio based learning with appropriate materials supports the child's development with rich learning experiences. This study aims to explore the qualities of media and content in mobile apps which are offered to preschool children. The researcher concluded that most of the mobile apps with Turkish content have medium level quality and far from conducting thinking, exploring, reading, and listening skills. Most of the mobile apps have design strategies with drill and practice exercises predominantly which supports rote learning. According to Cohen et al. (2012), 2- to 3-year-olds want a response to their gesture and their goal is "to do", they are learning by experiencing, familiar characters are attractive for this group, simple and colorful designs with responsive and accessible interface should be preferred. The 4- to 5- year-olds enjoy using "trial-and-error" to explore, they enjoy making or drawing, they are learning by schema adaptation, familiar characters with intuitive and interactive design increase engagement, and "winning" or "making something" sustains their interest (Cohen et al., 2012).

Most of the mobile apps in digital markets can be called as "first wave" of digital revolution (Hirsh-Pasek et al., 2015; Kucirkova, 2014). The first wave product may be thought as electronic versions of some printed materials; games etc. "Second wave" considers the app's pedagogical role (Kucirkova, 2014) which is difficult to analysis for parents and even teachers. Parents and teachers need to find answers for the following questions (Hirsh-Pasek et al., 2015); "*Is the child engaged in the learning experience and remaining on task? Is the child finding meaning that goes beyond the app? Is the child engaged in high-quality social interaction with others while playing with the screen? And does the app provide a learning goal?*" Educational researchers, practitioners and app designers should collaborate closely to enhance the quality of educational apps (Kucirkova, 2017). The results of this study shows that professionally designed mobile apps had not only better scores than others, but also consider many of the design rules with professional sound and image qualities. The only gap with these professionally designed international apps is translation problems and cultural elements. Large-scale tablet projects, including Turkey (The FATIH Project), provide mostly hardware without curriculum supporting software or electronic materials (Kucirkova, 2014). Education and Informatics Network (EBA), which is a repository/store with free learning resources, provides content for the tablets but they need more support to develop well-designed materials. Educational foundations should take a proactive role on the educational apps' development and evaluation processes (Hirsh-Pasek et al., 2015). TRT Çocuk presents good examples of Turkish mobile apps, especially in recent years.

There is not longitudinal study about the impact of mobile apps on children. Parents have concerns about possible risks and benefits of mobile devices usage in general and mobile app usage in particular. We cannot depart children from technology, but we need to be certain about they are not harmed in any way (physical, intellectual, emotional, and social) while using it (Ebbeck, Yim, Chan, & Goh, 2016).

Considering the content quality of mobile apps is as important as the screen time in a day (Dua & Meacham, 2016).

First and foremost, this study presents a perspective on critical look to the mobile digital marketplace. It is not enough for an app to be labeled as educational. Teachers or academicians can use Turkish version of the REVEAC tool to evaluate the apps objectively. The results of this study based on the rubric scores. The app's descriptions, user comments may be reviewed and analyzed to interpret the results with a wide perspective.

It doesn't make an app great to be listed as #1 in the app store under education category (Dua & Meacham, 2016). Parents should read reviews, try the apps themselves before kids (Dua & Meacham, 2016), and find apps requiring the child's mental effort, far from repetitive activities, providing sustained engagement, allows children to connect old and new knowledge, presenting opportunities for social interaction, and guiding child to explore and discover on their own (Hirsh-Pasek, 2015). As a user, parents offer feedback to app-developers via e-mail (Dua & Meacham, 2016), or write comment under the mobile app in store, in order to make the app better.

The practitioners create websites to share an objective report about the app, evaluated by experts (educational technologists, psychologists, subject area expert etc.) in terms of different aspects for parents, teachers and children.

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Appendix: Scoring and data table of the 44 mobile apps

Name of the apps	Google Play Rating	Rubric Score	Educational content	Design	Functionality	Technical characteristics	How many people voted	How many times downloaded	Last update
TRT Ege ile Gaga Tangram	4,3	49	18	14	9	8	1264	100.000	04.10.2017
TRT Kare	4,3	53	22	14	9	8	2831	500.000	16.02.2017
TRT Canım Kardeşim	4,4	52	19	16	9	8	6831	1.000.000	14.03.2017
TRT Hayvanları Keşfediyoruz	4,4	45	17	14	7	7	589	100.000	21.12.2017
TRT Kare Havalimanında	4,5	57	22	14	12	9	683	100.000	25.01.2018
Harika Peri Masalları	4,6	39	12	11	8	8	10760	100.000	25.04.2017
Bebekler İçin Hayvan Sesleri	4,3	66	28	14	14	10	747	100.000	13.12.2017
Yavru Kutup Ayısı	4,3	52	21	12	13	6	1881	100.000	19.04.2017
Okul Öncesi Öğretmeni	4,6	33	12	8	6	7	193	10.000	23.05.2017
Minikler Öğreniyor Okul Öncesi Eğitici Türkçe Oyun	4,2	41	14	11	8	8	7695	1.000.000	06.03.2017
Hayvanları Öğrenin	4,1	31	12	5	7	7	136	10.000	23.02.2016
123 Awesome Park Çocuklar İçin Sayıları Öğrenme	4,3	53	22	13	11	7	247	100.000	13.12.2017
Kids Garden Çocuk Bahçesi	4,1	39	14	11	9	5	8472	1.000.000	18.02.2018
Preschool Okul Öncesi Maceralar1	4,2	34	14	10	7	3	2463	1.000.000	03.03.2018
Mevsimler	4,4	29	12	5	5	7	77	10.000	01.01.2016
İlk Sözler First Words	4,4	50	18	13	10	9	10183	1.000.000	22.12.2017
Preschool Okul Öncesi Maceralar 2	4,2	45	18	11	9	7	2095	1.000.000	29.12.2017
Harfleri Öğren	4,3	46	16	12	10	8	709	100.000	19.11.2015
Hayvanlar	4,4	47	18	12	10	7	36850	1.000.000	22.12.2017
TRT Kuzucuk	4,2	50	17	14	10	9	4070	1.000.000	05.02.2016
TRT Kolay Gelsin	4	44	17	11	9	7	3164	100.000	10.08.2017
TRT Orman Doktoru	4,2	53	20	14	10	9	2081	100.000	15.07.2016
Pepe ile Diş Sağlığı	4,3	35	13	7	7	8	721	500.000	12.05.2017
Eğitici Oyunlar	4,5	37	13	8	8	8	5589	1.000.000	14.05.2017
Okul Öncesi Zıt Kavramlar	4,6	42	15	9	11	7	101	10.000	29.08.2015
Okul Öncesi Meyveler ve Sebzeler	3,9	44	15	10	12	7	17	10.000	13.06.2016
Okul Öncesi Renkler ve Şekiller	4,4	42	15	9	11	7	28	10.000	14.04.2016
Okul Öncesi Alfabe ve Sesler	4,2	40	12	9	12	7	191	100.000	21.03.2016
Okul Öncesi Taşıtlar	5	41	14	8	12	7	7	5.000	28.06.2016
Okul Öncesi Vücudumuz	4,5	38	12	8	11	7	17	10.000	28.06.2016
Okul Öncesi Sayılar ve Sayma	4,5	40	15	8	10	7	122	50.000	06.09.2015
Okul Öncesi Mevsimler Aylar	2,9	35	9	9	10	7	8	10.000	28.06.2016
Okul Öncesi Araç Gereçler	5	36	11	8	10	7	2	1.000	28.06.2016
Okul Öncesi Hayvanlar	3,8	39	13	9	10	7	13	5.000	14.04.2016
Çocuklar İçin Öğrenme Şekiller	4	42	14	10	10	8	7211	1.000.000	06.07.2017
Okul Öncesi Sayıları Öğren	4,5	48	17	12	11	8	70	50.000	10.12.2016
Okul Öncesi Sayma Oyunları Matematik Oyunları	4,3	49	18	13	11	7	656	500.000	13.03.2017
Okul Öncesi Eğitsel Oyunlar	4,3	36	16	7	6	7	116	50.000	13.05.2016
Okul Öncesi Eğitim Setim	4,4	45	15	11	13	6	243	10.000	26.03.2017
Okul Öncesi Eğitim Seti	3,6	34	11	8	7	8	279	100.000	13.05.2013
Kelime Öğren	4	32	12	6	9	5	131	100.000	06.03.2017
Kirpinin Maceraları	4,3	56	24	14	10	8	16721	1.000.000	22.11.2017
Kids Car	4,7	41	12	12	9	8	21	10.000	28.02.2018
Fruit Puzzle	4,3	41	15	12	9	5	44	10.000	09.03.2017

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