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## Implementation of Hierarchical Task Analysis for User Interface Design in Drawing Application for Early Childhood Education

Mira Kania Sabariah<sup>\*</sup>  
Telkom University

Veronikha Effendy<sup>\*\*</sup>  
Telkom University

Muhamad Fachmi Ichsan<sup>\*\*\*</sup>  
Telkom University

### Abstract

Draw learning in early childhood is an important lesson and full of stimulation of the process of growth and development of children which could help to train the fine motor skills. We have had a lot of applications that can be used to perform learning, including interactive learning applications. Referring to the observations that have been conducted showed that the experiences given by the applications that exist today are very diverse and have not been able to represent the model of learning and characteristics of early childhood (4-6 years). Based on the results, Hierarchical Task Analysis method generated a list of tasks that must be done in designing an user interface that represents the user experience in draw learning. Then by using the Heuristic Evaluation method the usability of the model has fulfilled a very good level of understanding and also it can be enhanced and produce a better model.

**Keywords:** *User Interface, User Experience, Drawing, Early Childhood Education*

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<sup>\*</sup> Mira Kania Sabariah, S.T., M.T, School of Computing Telkom University, Informatics Engineering Program

E-mail: mirakania@telkomuniversity.ac.id

<sup>\*\*</sup> Veronikha Effendy, S.T., M.T, School of Computing Telkom University, Informatics Engineering Program

E-mail: veffendy@telkomuniversity.ac.id

<sup>\*\*\*</sup> Muhamad Fachmi Ichsan, S.Kom, School of Computing Telkom University, Informatics Engineering Program

E-mail: fachmiichsan@gmail.com

## Introduction

Early childhood education is an education stage that aims to increase the growth of physical and spiritual development in order to have a readiness to proceed to the higher education stage in formal or informal schools. Early childhood is a group of children who are in the process of unique growth and development; specifically, the pattern of growth and development (fine and gross motor coordination), intelligence (thinking, creativity, emotional intelligence and spiritual intelligence), social emotional (attitudes, behaviour and religion), language, and special communication [9]. Learning to draw in early childhood is an important learning and fun as well as the activity of drawing is filled by the stimulation of the process of growth and development of the children. By drawing, children can train their fine motor skills, creativity, imagination, concentration, memory, patience, thoroughness, and growing interest in learning. Drawing is also a method that is carried out in developing the abilities of children according to their interests and talents and also introduces children to the world around [9].

Today we have had a lot of applications that can be used to perform learning, including interactive learning applications. By using media interactive learning applications we expect that learning undertaken by early childhood is more effective, efficient and targeted. We conduct the usability test of two drawing applications that are popular in Google Playstore (*How to Draw and Ayo Menggambar*) which produces a several data that showing the experiences gained from the both of interface have a weakness on the part of the tasks and the user's own ability to understand the interface that do not lead to optimal learning, so both of application interface is not able to represent the characteristics of early childhood learning (4-6 years).

Based on the background of those problems, Hierarchical Task Analysis method was used in this research to explore and define the tasks, what should be done and required in designing an user interface and using the Heuristic Evaluation method to be able to evaluate the results of an user interface and application that has been made so as to produce a good model and can represent the characteristics of draw learning for early childhood.

## Method

### Curriculums and Expert Interviews

Studies in this phase is done by reading and resume early childhood curriculums from government itself, books, papers, articles and other literature and also conducted interviews with a psychologist / person engaged in early childhood education and the art of drawing which will be a reference in designing an user interface.

Here is a list of early childhood education and child development curriculums that related to introduction to drawing and continue with the interviews regarding the introduction of the drawing that will be used as a additional foundation for making a model of user interface. First, regulations of national education minister No. 58 Year 2009, which includes the development and physical growth (fine motor skills), cognitive (general knowledge and science), (concepts, shapes, colours, sizes, and patterns), language, social, emotional and artistic. Second, regulations of national education minister No. 137 Year 2014 which include the development of curiosity, self-confidence, creative and aesthetic, discipline, self-contained, recognizing the surrounding environment, technology, art, culture, show known, felt, needed, and thought through language, music, movement, and works productively and creatively. Third, BKB by BKKBN West Java in 2009. Fourth, daily activity plan and child development card. Fifth, interviews with psychologists and art lecturer that produce a statement such as the characteristics of children who included into the category of pre-school and "Z" Generation (birth 1995-present), development of physical maturation. Every "Z" generation-children needs different stimulation in learning. Then explained that the draw learning is important because it stimulates the ability to concentrate, attention, visual perception, visual therapy, and also recognize the various forms and comparison (examples: differences in large / small size). The last is about a good order in draw learning such as scribbling, tracing and imitating.

### User Persona

Survey method that conducted in this research was based on user persona criteria. This questionnaire was used to identify the user needs and characteristics whom in this case is 4-6 years old child. Then the criteria that included in these questionnaires were based on factors of user persona itself such as profile, personality, technology expertise, user knowledge, references, influences, must do and must never, tasks, and user likes.

Interviews were conducted in two different kindergartens which was taken place in Aryandini Kindergarten (Bandung) and Al-Ghifari Kindergarten (Bandung). This Interview was done by doing a

direct observation and asks several questions to 15 children that divided into 3 categories (High, Middle, Low). This category is divided by considering the level of user's knowledge and technology expertise such as reading, the ability to recognize symbol, picture and etc. Here are the characteristics and abilities of 3 divided user persona categories.

#### **High User Persona**

Users were already accustomed to using gadget such as tablet PC and Smartphone. Users do not look confused while using a drawing application that has been given. Understand the A-Z letters, common symbols. numbers (1-20), read 1-4 syllables, basic geometric shapes, simple images, simple icons representing the original function, understand the sound instructions, primary and secondary colours.

#### **Middle User Persona**

Users were already accustomed to using gadget such as tablet pc and Smartphone. Users do not look confused while using a drawing application that has been given but there are several users who confused about the tasks of the application. Understand the A-Z letters, common symbols. numbers (1-10), read 1-3 syllables, basic geometric shapes, simple images, simple icons representing the original function, understand the sound instructions, primary and secondary colours.

#### **Low User Persona**

Users were not accustomed to using gadget such as tablet pc and Smartphone. Users look confused while using a drawing application that has been given but there are several users who understand about the tasks of the application. Understand the A-Z letters, common symbols. Numbers (1-10), read 1-2 syllables, basic geometric shapes, simple images, simple icons representing the original function, understand the sound instructions, primary and several secondary colours.

### **Modeling the User Experience Using Hierarchical Task Analysis**

#### **Mental Model**

Mental model is build by combining 2 apps that have the same kind (drawing tutorials) of apps which in this case is combining "Ayo Menggambar" app with "How to Draw" app. Those apps were chosen because of similarity of the genre, high rating in Google Playstore and of course those apps are often to use by the users.

From both of apps we can conclude a new mental model by combining drawing curriculums, interview data from experts, and the user persona categories that have been described in next section. This mental model function is representing what users believe about this apps and this mental model has been used and adopted to build the scenario and conceptual model, as Figure 1.

#### **Scenario and Hierarchical Diagram of User Experience**

From the mental model and application's scenario we can complete the hierarchical task (Figure 2) diagram which will be a foundation to build a conceptual model and user interface.

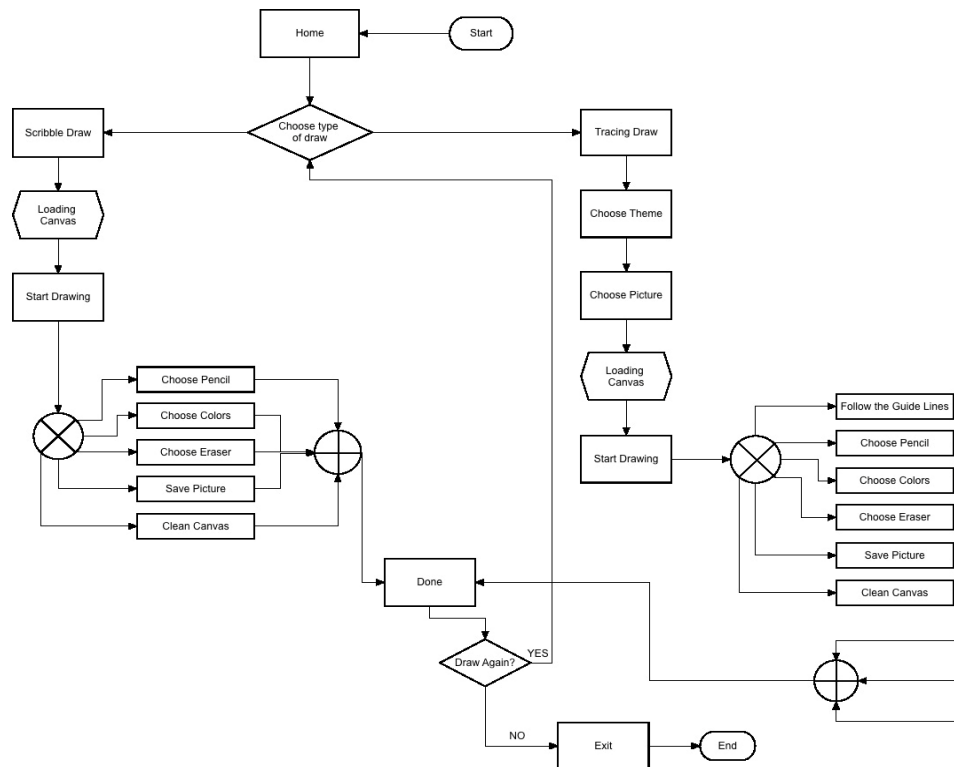


Figure 1. Mental Model (flowchart) of Drawing Application

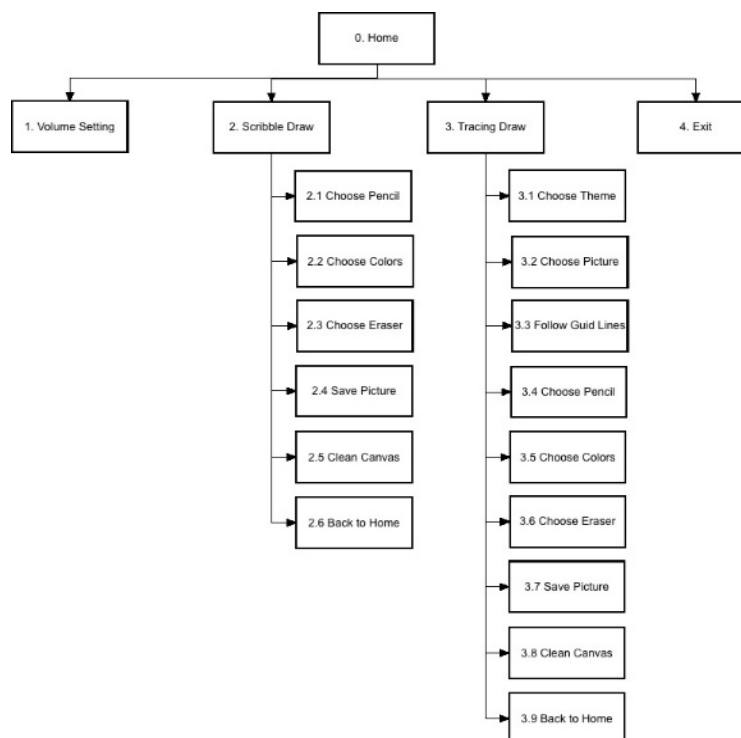


Figure 2. Hierarchical Task Diagram of Drawing Application

## Conceptual Model

According to the definition of the function of conceptual model is representing an actual, accurate model of the system. In this step the design of the complete conceptual model was build and

will be describe in Table 1. This conceptual model was containing elements which used in each page and the positioning of those elements which will create the user interface model.

Table 1. Conceptual Model Table

Element	Characteristics	Positioning - Tasks
Background	Background was built by considering of the curriculum themes.	All Page
Song	Genre : Country This song was used in this apps to increase the attention.	All Page
Volume Icon	Shape : Speaker This Icon is contrast to the background colour.	Top – Left (Home)
Exit Icon	Shape : Exit Door (Representing done action) This Icon is contrast to the background colour.	Top – Right (Home)
Sound	Function : guide the users to choose icons or tasks.	All Page
Canvas	Shape : Rectangle Colour : White	Scribble and Trace Drawing Page
Pencil Icon	Shape : Pencil Colour : Black Function : Choosing the size of pencils	Top toolbar (number 1)
Colour Icon	Shape : Circle Colour : 12 Colour (curriculum themes)	Bottom toolbar
Eraser Icon	Shape : Eraser Colour : Black Function : Choosing the size of the erasers	Top toolbar (number 2)
Clean Canvas Icon	Shape : Recycle Bin Colour : White-Black Function : Remove all pictures	Top toolbar (number 3)
Save Icon	Shape : Box with Text Colour : Black-White Function : Save all pictures	Top toolbar (number 4 )
Back Icon	Shape : Arrow (left is representing previous action) Colour : Brown	Top – Left in all pages except Home
Guide Lines and other Guide Icons	Guides : Line, number and direction of drawing Colour : Yellow-Blue	Middle of drawing canvas

## Implementation and Testing

### Heuristic Evaluation Testing

The early design of user interface of interactive media application which will be called “Mari Menggambar” was based on Flash Application. See figure 3 for example of user interface (Home Page).

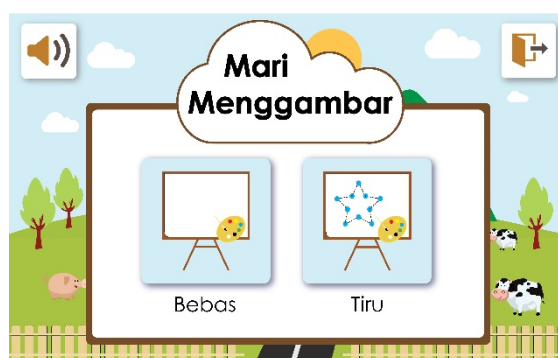


Figure 3 Home Page

The results of this design were tested and produce a several analyzed data and final design. Testing will be conducted in 2 steps, including early design testing and final design testing. Both of steps were aim to improvement of the design that have been created which will representing the characteristics of draw learning application and users (4-6 years).

Here are the aspects which will be the base in testing:

1. Visibility of system status
2. Match between system and the real world
3. User control and freedom
4. Consistency and standards
5. Error prevention
6. Recognition rather than recall
7. Flexibility and efficiency of use
8. Aesthetic and minimalist design
9. Help users recognize, diagnose and recover from errors
10. Help and documentation

Testing was done by using questionnaires and interviews to get the impression from the users both from Aryandini kindergarten and Al-Ghifari Kindergarten about the user interface. The questionnaires consists of above aspects that created by extracting the definition and goals from heuristic evaluation aspects into several questions.

After conducting the interviews, the value will be add to each questions. See Table 2.

Table 2. Value of Testing Questionnaire

No.	Questions	Value	
		Yes	No
1	Question 1	0,25	0
2	Question 2	0	0,25
3	Question 3	0,25	0
4	Question 4	0,25	0
TOTAL		1	

Then, Analysis was conduct based on 3 personas categories (High, Middle, Low). Each aspects of heuristic evaluation have the value from 0 to 1 and will be represent by percentage value. 100% is maximum value of experience of those aspects. Categories of understanding were based on Suharismi Arikunto. See Table 3 [8].

Table 3. Level of Understanding

No.	Interval	Category
1	81 – 100 %	Very Good
2	61 – 80 %	Good
3	41 – 60 %	Moderate
4	21 – 40 %	Bad
5	0 – 20 %	Very Bad

### Testing Analysis

These testing was divided in 3 categories and conducted after the several few refinements of the design (Final Design). This chapter will describe about the quantitative data of heuristic evaluation that described in results and discussion section.

Table 4. Understanding Level of High Persona

Heuristic Evaluation Aspects	Percentage	Understanding Level
Visibility of system status	100%	Very Good
Match between system and the real world	100%	Very Good
User control and freedom	100%	Very Good
Consistency and standards	100%	Very Good
Error prevention	100%	Very Good
Recognition rather than recall	90%	Very Good
Flexibility and efficiency of use	92%	Very Good
Aesthetic and minimalist design	96%	Very Good
Help users recognize, diagnose and recover from errors	100%	Very Good
Help and documentation	100%	Very Good

Table 5. Understanding Level of Middle Persona

Heuristic Evaluation Aspects	Percentage	Understanding Level
Visibility of system status	100%	Very Good
Match between system and the real world	96%	Very Good
User control and freedom	94%	Very Good
Consistency and standards	92%	Very Good
Error prevention	100%	Very Good
Recognition rather than recall	95%	Very Good
Flexibility and efficiency of use	84%	Very Good
Aesthetic and minimalist design	92%	Very Good
Help users recognize, diagnose and recover from errors	90%	Very Good
Help and documentation	100%	Very Good

Table 4 (High User Persona) and table 5 (Middle User Persona) showed that all of aspects of Heuristic Evaluation fulfilled the very good understanding level. Refinement that have been conducted were very effective by add the application guidelines and changing several icons such as save icon (help and documentation). Refinements that have been conducted also make the differences in other aspects, for example is point 7 (flexibility) that occurred the lower value (both of persona decreases 4% of understanding level). This lowering occurred because of the user's comfort ability in drawing activity and refinements in low user persona category (point 6, 8, 10) were not always understood by all persona categories.

Table 6. Understanding Level of Low Persona

Heuristic Evaluation Aspects	Percentage	Understanding Level
Visibility of system status	100%	Very Good
Match between system and the real world	80%	Good
User control and freedom	100%	Very Good
Consistency and standards	100%	Very Good
Error prevention	100%	Very Good
Recognition rather than recall	70%	Good
Flexibility and efficiency of use	80%	Good
Aesthetic and minimalist design	72%	Good
Help users recognize, diagnose and recover from errors	100%	Very Good
Help and documentation	92%	Very Good

Table 6 showed that 6 from 10 aspects of Heuristic Evaluation passed the very good category and 4 other aspects are include to good category. Those aspects were not fulfilled the very good understanding level because of users in low persona category were lack of knowledge and technological experiences, low in reading, understanding the drawing tasks, and low experiences in using a touch screen gadgets. Good results achieve because of the refinements that have been conducted in point 10 were very effective by add the application guidelines and changing several icons such as save icon. Refinements in point 6 and 8 were also effective, the refinements produce a good understanding level category which were the refinements were done by changing the save icon and colour of the guidelines and directions. With all of these refinements and testing we can conclude that users now understand about all tasks and elements on this user interface. Refinements that have been conducted also make the differences in other aspects such as point 2 (decrease 8% of understanding level). This lowering occurred because of prototype's icon was difference than other general similar application which used before.

## Results and Discussion

Based on the final analysis of the testing, refinements that will be conducted have to accommodate all of each elements and user persona categories which is aim to get the better understanding level in each categories without sacrifice the value of other heuristic evaluation testing aspects, Specifically in low user persona category, the refinements have to accommodate the user's knowledge and characteristic to produce a better usability of the user interface. Then, this research needs deeper analysis in interaction design (pattern and style) in whole drawing activity so as to produce better experience and can meet the learning goals.

## Conclusions

From the results of analysis and implementation we can conclude a several statements that by Using User Persona the characteristics and needs of users (4-6 years) can be identified and by using the Hierarchical Task Analysis method the needs of tasks can be designed as to produce a good user interface that meets the user experience of draw learning. Also, by using the Heuristic Evaluation method the usability level of user interface can be measured which is fulfilled a very good understanding level average such as high 98%, middle 97% and low 89%. By using this method the model of user interface that has been created can be enhanced too and produce a better model.

## References

- Alan, Cooper, *About Face 3 The Essentials of Interaction Design*, Indianapolis, Indiana, Canada: Wiley Publishing, Inc, 2007.
- Ardy, W.Novan dan Barmawi, *Format PAUD*, Ar-Ruzz Media, Ed. Sleman, Jogjakarta, Indonesia: Ar-Ruzz Media, 2012.
- B., Ballard, *Designing the Mobile User Experience*. West Sussex, USA: Wiley Publishing, Inc, 2007.
- Chen, M., Kolko, B., Cuddihy, E., & Medina, E., "*Modeling and Measuring Engagement in Computer Games*," , Vancouver, Canada, 2005.
- Darmawan, D., *Inovasi Pendidikan*. Bandung, Jawa Barat, Indonesia: PT. Remaja Rosdakarya offset, 2012.
- Darryn Lavery, Gilbert Cockton, and Malcolm Atkinson, *Heuristic Evaluation Usability Evaluation Materials*. Glasgow, United Kingdom: Department of Computing Science, University of Glasgow, 1996.
- Effie L-C. Law , Virpi Roto, Marc Hassenzahl, Arnold P.O.S. Vermeeren, Joke Kort, *Understanding, Scoping and Defining User eXperience: A Survey Approach*. Europe: ACM, 2009.
- Eprints, UNY. 2008. [Online]. Available : <http://eprints.uny.ac.id/9737/3/BAB3%20-%2008111241012.pdf> [accessed 2 Juni 2015].
- Fadlilah, Muhammad, *Desain Pembelajaran PAUD*. Jogjakarta, DIY, Indonesia: Ar-Ruzz Media, 2012.
- Galitz, Wilbert O., *The Essential Guide to User Interface Design An Introduction to GUI Design Principles and Techniques*, 3rd ed. Indianapolis, USA: Wiley Publishing, Inc., 2007.
- Lawrence.Erlbaum.Assoc, *The Handbook of Task Analysis for Human Computer Interaction*, Neville Stanton Dan Diaper, Ed. Mahwah, New Jersey, USA: LAWRENCE ERLBAUM ASSOCIATES, PUBLISHERS, 2004.
- Morville, Peter, (2004, June) [semanticstudios.com](http://semanticstudios.com/user_experience_design/). [Online]. HYPERLINK "http://semanticstudios.com/user\_experience\_design/"
- Mujahidah Rapi S.H. (2013, Oct.) Konsep Pendidikan Anak Usia Dini. [Online]. HYPERLINK <http://sulsel.kemenag.go.id/file/file/ArtikelTulisan/oklv1383112871.PDF>
- Nielsen, Jakob. (2010, October) <http://www.nngroup.com/>. [Online]. HYPERLINK "http://www.nngroup.com/articles/mental-models/"
- Nurcahyanto, Guntur, *Ebook Uji Instrumen Penelitian*, Indonesia: Ismail, 2010.
- P. Tsai. (2012, March) [web.simmons.edu](http://web.simmons.edu/~tsai/Papers/PBartley-empirical-usability-eval.pdf). [Online]. HYPERLINK "http://web.simmons.edu/~tsai/Papers/PBartley-empirical-usability-eval.pdf."
- Winn, M. a., *The Design, Play, And Experience Framework*. Michigan, Michigan, USA: Michigan State University, 2006.
- Wu, Cheng-chih, Dale, Nell B.Bethel Lowell J, *Conceptual Models and Cognitive Learning Styles in Teaching Recursion*. Taipei, Taiwan: National Taiwan Normal Univ.Taipei., 1994.