**Abstract**

Heuristic Evaluation for products based on children’s technology needs new analysis. What is the importance of a heuristic approach in children technology? What are the challenges of heuristic evaluation in the technologies for children? A method to find formulate heuristics for evaluation children products are proposed. With proposed method, new heuristics to find out errors efficiently on existing children technologies are formulated.

Chapter 1

# Introduction

## Summary

This chapter introduces the context of children technology and heuristics along with all reasons to do this research project.

## Introduction

Heuristics are used as a set of guidelines to evaluate usability; in this research it will be evaluating usability of children’s technology. Heuristics are used to find and discover errors in the usability of a system. The people evaluating are frequently usability experts and test a system or technology in contradiction of these heuristics. It is carried out, so these errors can be fixed to make a more usable systems for the user. So, to evaluate children’s technology usability a specific set of heuristics need to be created so usability errors can be found related to child technology. The aim of this paper is to create heuristics that can be used to find key errors in children’s technology such as finding errors preventing the child in preforming tasks and identifying optimization issues.

## Project Motivation

Children technology gains its more attention from modern world. Through heuristics evaluation, children are still struggling to get a perceptual interaction. Modern heuristics approach are needed to face advancements especially in children technology.

## Problem Statement

Changing advancements in technology and higher child development characters are considered challenging atmosphere to carry out research. Interface to child users does not only depend on children itself. It moves further down to technical details of devices used by children.

## Aim and Objectives

In this study, it also considers some of the research objectives such as:

* To recommend the ways of developing the heuristic methods applied to the children technologies
* Create Heuristic that can be used evaluate children’s technology

## Children Technology

Evaluation of children technology is the process of examining the perspectives of children. It is done by observing children when are given with these child products and making decision about their perception. It helps to produce better outcome for futuristic products. Evaluation starts firstly by choosing the correct evaluation method among different variety of evaluation methods available to produce appropriate results. The main categories of methods to evaluate a children products are observation methods, Verbalization methods, The Wizard of Oz method, Survey methods, Diaries and inspection methods. Heuristics is one of those inspection methods available for study. Inspection method can also be called as expert evaluation or analytical evaluation. Heuristic evaluation, as influential method of inspection available to evaluate a particular product. In general inspection method usually come out as walkthroughs.

## Ethics

In case of involving a child into this research, consent should be obtained from both the child and its guardian whoever responsible. Heuristics evaluation will not undergo such practical process to carry out the research. In case of fetching any data obtained from a particular children, inducement on privacy of participants should be taken. There should not be any physical or psychological risk while gathering information or data from children. In case of bringing any participants into this activity special consent should be obtained from them. The study on these ethics of carrying out research on heuristics is only an alarm. This may not be used entirely since the task involved in this research is only a theoretical approach. (Markopoulos, et al., 2008)

## Project Outcome

Evaluation through heuristics helps to reduce intangible mistakes done during design. Perspective of children is completely different from adults. Getting technical nuances of children perspective on their interaction with modern technological interface are difficult process. By stating modern way of evaluating heuristics through this project, new errors based contemporary technological condition can be evaluated.

## Report Structure

The general structure of report contains nine chapters with sections inside each of these chapters.

Chapter 2

# Research Context and Questions

Heuristic evaluation is one type of methods which has usually ten principles. In this regard, it can be said that this method is developed based on inspections in that the evaluators can give some scenarios for exploring the interfaces by identifying those ten principles. Heuristics techniques help people to become enable and capable to use new technology in order to improve their lifestyles. By identify various children’s technology that uses heuristics principles on their usability evaluation, the research extends by defining ways of developing heuristic principles and propose new heuristics to find out errors in children’s technology more efficiently.

What are the ways to develop heuristics to evaluate children’s technology?

How efficient will be the newly proposed heuristics on different children applications?

Is it possible to reduce previous errors with new heuristic proposals?

Chapter 3

# Literature Review

## Introduction

In this chapter, literature review on children technology along with various software and products related to children technology are conveyed. Various heuristics posited from articles are also explained through this study.

## Heuristics Evaluation

Evaluation through heuristics is a short time process and takes few hours to complete. Recruiting the correct evaluator decides the flow and outcome of any heuristic evaluation. Neilsen in his paper stated the importance of having 3 to 5 experts to cover almost eighty percentage of the usability problems. Work done by evaluators is wholly independent and at times they have assisted with experts of the domain taken for instance game developer for a gaming application. Based on the availability of time along with the size and complexity of problem they have been involved in, the evaluation process is decided. (Markopoulos, et al., 2008)

Two choice of examination can be taken into consideration, one is to think about how mistakes are made. The other method is to evaluate the product by doing actions such as playing the child gaming application with their perspective. It could also be useful to make a note on step by step process involved while engaging in evaluation. This actions should also be made in a way to describe the intermediate goals which are needed to be achieved during the child’s engagement with the product In case of finding any flaw with the child product as a part of violation of heuristics. All the heuristics which are violated on that particular section should be stated clearly without leaving with main contents. Severity and its ratings are equally important to standardize heuristics evaluation. It is done by both individuals and on group session. Severity ratings helps to fix most of the problems with resources taken. (Markopoulos, et al., 2008)

## Design Principles of Children Technology

Sonia Chiasson and Carl Gutwin (Chiasson & Gutwin, 2005) in their article put forth the principles of designing children technology. Part of the article from Sonia Chiasson and Carl Gutwin also expresses the usage of graphical metaphors that are considered as helpful ones for children’s interface. Story telling application which is one of the children product, has been encouraged with images as a part of their inclusion where children get a chance to express their ability to learn something. Queries based on text as interfaces are found insufficient for users who are considered young. On help functions, children has lesser capacity to read out the manual or help file. Instead of making a manual, product can be designed to provide default guidance to the users.

## Heuristic Evaluation on Mobile Games

Hannu Korhonen and Elina Koivisto (Korhonen & Koivisto, 2006) from this paper stated heuristics on playability for mobile games. Taking mobile application as their product for evaluation. Heuristics has been proposed by them. Generally mobile application should have convenience, reliability and usability to find its usefulness. In the context of gaming, instead of focusing of user interface. It could be minimal enough to get the user attention towards game instead of design. Children product like gaming gives different arena for the evaluators. With the experience from previous study, this paper also states the difficulty in rectifying all problems put forth by the user with a brief list of heuristics. An optimized approach is enough to make a difference through heuristics.

In their research paper, totally there are 61 playability problems have been found. Among those 61 problems, only 16 are identified to have connection with proper heuristics. After finalization, five problems are identified to have real connection with heuristics and it alarms to make a concern on the type of product or software chosen among all many available children technologies. During validation, mobile games are taken down for evaluation by two experts. One of them on usability and the other one on game design.

## Usability Heuristics of E-learning

Alsumait and Al-Osaimi (Alsumait & Al-Osaimi, 2009) research on few heuristic principles to evaluate children technology products. Major benefits of using a heuristic process are cost effectiveness, non- dependence on laboratory, interviews and recordings about user interactions. Experiments which are considered expensive to process and produce results are avoided. Even with the evaluator alone, these researches can be processed without any problems on usability of the complex system which is going to be used. SEEM method that contains checklist added with question stated from the theory of Norman is helpful to produce promising results. Usually evaluation based on the perspective of children found to have hard to focus. The review on previously available journals and particulars happened due to lack in the adjustment to modern children technological. E-learning application which is the children product have some heuristics especially designed for children.

Application designed for child users should have levels of challenging and exciting particulars to awake children intuitive knowledge. Frequent hints as feedback and have meaningful insights should be added into it. Surprise, humour and interesting factors should be added to make it meaningful for children especially. Input and output devices used for accessing should be specified for that particular age group. Using hardware devices also increase motor skills of children largely. Buttons without functionality should be reduced so that users can access the software with very less effort. Efficient layout on screens are pleasing to eyes of children. Using consistent size, colour and choice match up with children gives the child interface attractive look. At the beginning stage, it should start with less amount of information and gradually it bring children to further level. For this context of e-learning, with gentle pressure and without any frustration, the interface design should be added. The article also suggest the factors that help to build up imagination inside children through their comprehension. With different layers of curiosity, it can promote cognitive curiosity of children. Including humour, surprises, topics that make child more interesting can have the chance of increasing curiosity of children.

In addition to children usability heuristics, Alsumait and Al-Osaimi also suggests E-learning usability heuristics. E-learning context bring out textual display for children. Using vocabulary and terminology that are appropriate for learners. Characteristics of e-learning include providing proper guidance and direction for children to reach their way. Through the usage of variety of educational tools and things that meant for communication, e-learning could be made more successful if the inputs for children if proper rewards, encouragement and interesting activities are added into it.

## Child Computer Interaction

Markopoulos et al (Markopoulos, et al., 2008) from their research on child computer interaction reveals various methods involved in the evaluation of heuristics for children’s technology. Even in this primitive paper, computers and video game consoles as technologies that interact with many children on home are argued appropriately. Seven stages of Norman on what people do while dealing with things they want to do. These stages of action are common things that every person do while one committed to do something. It may vary on the basis of rationality, when comparing it with children. BRIDGE method is used to investigate and evaluate fun and usability on gaming. Most of the children who are selected to heuristics are under aged. Problem Identification Picture Card (PIPC) method is used for children aged between 4 and 5. Laddering technique stated by zaman is proposed in this report by stating the reliability to state the reliability of this technique. The method is based on views obtained from consumer about how a product is consumed by user. Apart from many underlying concepts that motivates customers to buy a product, attributes of a product which is the main deciding factor for better functionality.

## Children as Evaluators

Heuristic Evaluation is basically carried out with expert evaluators. Kishan and Gavin (Salian, et al., 2013) (Korhonen & Koivisto, 2006) have described their evaluation research on how children can be engaged in heuristics. Totally 14 children between 10 and 12 are taken for this evaluation. A music making game called JamMo application is taken to evaluate their capacity and understanding. Previously problems on understanding heuristics and severity ratings are put forth as prime factor. Comparing with human interaction, children interaction interface has gained more attention in the recent years. Both qualitative and quantitative approach is taken out for data collection. Korhonen and Koivisto heuristics is taken since it is a music making game. About 27 instances of problems are identified during its experimentation. Only 11 out of 27 problems are found to be in relation with heuristics. After filtering those results only three problems match appropriately with the design. Problem with drag and drop functionality, confusion while using cupboard, children with disability having trouble to use such application. Compared with adult observer who has reported nearly 81 problems, child observers has observed only about 26 problems. Study reveals the ability of children in critical evaluation. Executing more interactive session can have the chance of getting their attention into evaluation. Children rather than adults also have the ability to evaluate these kind of mobile application with certainty. (Salian, et al., 2013)

## Children in Authentication

Dhanush Kumar (Ratakonda, 2019) on his paper about understanding and usage of children’s authentication on this widespread technology reveals the fact of forming a connection between human and technology in deciding the real-time possibilities. Credentials used by children are factors taken form this paper to make a study. Security measures are one of the important thing to be taken into consideration for children. While using username and password during its selection by children, implication are largely on the side of forgetting passwords and username details. Most of the children tend under ages between 5 and 8 are considered to come under development stage. A research study on evaluating the ability of children to remember their username and password details are carried down on this study and it reveals whether any children under the age of 7-8 has the capacity to create username and password on their own. Two different approaches are used among children to evaluate their creation capacity and it revealed that children. Graphical passwords and textual passwords taken down to check one’s ability. Comparable to graphical passwords, children who are created textual passwords felt easy remembrance. The qualitative research carried on this paper, reveals the efficiency of one children in accessing their own credentials with any forgetfulness. Apart from theoretical knowledge on password creation and remembrance, most of the children and even adults forget their. This happens mainly because of lesser practice. At this stage, children need more practice to regulate a process. On usability heuristics, at this point children usually need usability feature which makes them interesting as well as give them practice or learning.

## Think-aloud Method

Over many views on the usage of think-aloud method to carry out evaluation on usability of children. Sprawling growth of technologies also gained attention from children to personalize the options provided in many technological software. Cooperative enquiry, the bag of stuff technique and the mixing ideas technique are taken as an important techniques to evaluate the issues in technologies. Anderson et al from this paper has stated finally about the importance of planning earlier to carry out the research on evaluation of heuristics. Constant comparative method is one of those methods involved to find out a way to analyse the key arguments involved in the context of the research. Children usually have less developed motor skills associated with them which have limitation to reach out. Preference, perception, style, likeness and unlikeness are also considered to be among those factors influencing children and their functionality. Think-aloud test is one of those tests stated as influential ones in evaluating the needs and findings of child. (Andersen, et al., 2017)

## Child and Technology

Fariza et al (Razak, et al., 2013) on their qualitative research posited their opinion about children computer interaction and their technologies. Through this research children of different age group are included. The research says that children of different age show difference on their interaction with computer systems. For ages between 3 and 7, reasoning skills are undeveloped at this stage. For children under 8 and 12 range have sense of logic, reasoning and abstractness under development. The product here for children is a game. For such design, user centric approach is necessary to follow. The paper also emphasis the difference in users where all-knowing adults are on HCI (Human Computer Interaction) and all-learning children on CCI (Children Computer Interaction). Children are considered as chief consumers who involved in entertainment and technologies and tend to express variety of cognitive, emotional and social skills. From the view of Fariza et al, most of children want technologies to be wearable, have natural interaction, ubiquitous and also have a child-centred approach where children are more sensitive to use technology. The design should have adequate resistance against damage, shake and even have water proof.

## Severity Rating

Jakob Nielsen (Sauro, 2013) on his scale described five levels which scales up from 0 to 4. Stating from with no problem with usability, cosmetic problems, minor and major usability problem, it ends up with usability catastrophe. Jeff Rubin (Sauro, 2013) on his paper also stated severity rating with four levels. Irritant in which the problems seems to occur at regular interval of time. Moderate condition states the ability of product to be used with moderate problems. Severity limits the user with its range and the final level as unusable where in the users are not specified to use the product entirely. Apart from these above stated measurements there are also few other severity rating scale available. Even though severity ratings have more important functions to do, it is limited to fetch with the heuristic evaluation. In case of involving many heuristic evaluators for a single product, severity ratings collected from each of those observers should be added up to formulate the usability problems.

## Evaluation through Drawings

Sylla (Sylla, 2010) also carried out a study on evaluating interfaces through drawings of children. Children of age 4-5 years are taken down to carry out this research process proposed. Among many methods to gather the usability experience of users, this kind of evaluation technique is considered to be one of them. A computer screen with images of spacecraft are placed at the corner of a room. Each participants who are children here are advised to draw what they see on the screen. Drawings of children are collected for the analysis. With scoring mechanism, results of evaluators are formulated in a table.

Chapter 4

# Research Questions

1. What is the importance of a heuristic approach in children technology?
2. What are the challenges of heuristic evaluation in the technologies for children?
3. What are the ways to develop heuristics to evaluate children’s technology?
4. How efficient will be the newly proposed heuristics on different children applications?
5. Is it possible to reduce previous errors with new heuristic proposals?

Chapter 5

# Method

## Stage I

In this exploratory stage, various heuristics evaluation done before on children products and their results are seriously taken into discussion. Comparatively, study on design principles of children technology and perceptual development of children are found to found to be useful to produce depth in results.

### Child Development

Children under different age group are possessed with different character. Knowledge development in children occur only through their experience stated in constructivism. It happens through their conscious engagement in public entities. Four important aspects put forth by Juan includes maturation which happens due to change in cognition, experience that help to build up the knowledge structure, social aspects (interaction) that helps to pass their knowledge, emotions which also has major influence in children. Based on their age children gain different psychological developments. (Hourcade, 2007)

|  |  |
| --- | --- |
| **Child Age** | **Stages under development** |
| 0-2 | Sensory-motor stage |
| 2-7 | Pre-operational stage |
| 7-11 | Concrete operations stage |
| 11-16 | Formal operations stage |

Table 1 Stages of Child Development (Hourcade, 2007)

In the pre-operational stage children tend to more egocentric and they can only fetch to one character at a time. They also fail to understand hierarchy at this stage. Children at concrete operations stage, appreciate other and also have the skill to analyse things logically. At formal operations stage, they also show understandings on hierarchy.

On the developmental stage children may fail to complete their task. Scaffolding techniques are used at times to encourage children to complete their tasks. Based on the interface, application of scaffolding technique varies. Even though interactions are done through computer, it should also be important to not leave children with computers. Children as they are at developmental stage, they tend to choose variety of strategies to do a task. Even this could make hard to think on the perspective of a children. Human are born with the character of learning something, this can be seen vividly from child stage. Using techniques to remember and respond quickly are useful for interfaces to get child attention.

### Memory

Young children are not likely to remember many chunks. Only adults have the capacity to remember numerous things through their cognition and intuition. Young children always prefer to have symbolic representations to do a task. Pre-schoolers have the capacity of following procedure to do a task whereas elementary ones do not have such capacity.

### Problem Solving

Middle schoolers always like to solve problems immediately. At the beginning stages of their development, planning ability gradually increase further to reach the top. While doing a task, children at first look for number of ways to do it and finally by getting older, they settle down with the proficient way to do a task.

### Design

Children usually have problem with textual interface and that should be reduced. Visual complexity basis, using multilayer strategy where user can move to next level of their application after being more proficient with previous levels.

### Manipulation

During direct manipulation there important actions make an efficient usage. This includes rapid movement which children expect with interest, reversibility which helps children to come back to their previous stage in case of jamming. Incremental setup where children go further to reach their required stage. In the incremental state, children should have better hierarchical understanding. Giving a click-move-click options to younger ones in place of drag and drop are helpful while dragging with pointed devices like mouse. (Hourcade, 2007)

### Special Child Products

While considering children, it should also include children with mental and physical disabilities, carrying out a study on these characters are also meant to be useful to evaluate new heuristic principles for children as common. For visual impairment children, product design based on memory and audio are used. For speech and hearing impairment kids, products that increase the word accuracy like copycat and stepstone are given as example. For children who are hospitalized, tools that generally help children to communicate with others are used. (Hourcade, 2007)

## Stage II

In this descriptive stage, summary of findings from stage I are postulated to find out the key characteristics. To formulate heuristics, facts about children and their interaction with modern technologies are considered as important ones. Some of the key things identified through literature are given below.

### Effective Design

In general any system design developed for the usage of people should be remembered and learnt easy, effective, and pleasant for the user. On studying through this paper proposed by Rolf Molich and Jakob Neilsen, it states the interaction between human and computer after a successful design. Ineffective design and usability features make any system less standard even difficult for uses like children. (Neilsen & Molich, 1990)

### Placing Relevant Information

Dialogues between user and system should only contain relevant information. Expression of machine to human interactions should be the language of users. Based on varying retention of every user, interactions should not involve frequent recall. Surprising users through varying words, actions situations will not compete a good design since it negotiates the consistency challenge for a finite design. Giving feedback to users about what is happening inside builds up a healthy human-system interaction. None of the users likes to follow a lengthy interaction, users could be in hurry finding a shortcut which should be available. Additionally users might also touch functions by mistake. Readily available escape plan is always helpful to tackle hurriedness. Error messages finds its usefulness to be added to indicate user about their mistake. (Neilsen & Molich, 1990)

### Curiosity to Users

Two states of curiosity are put forward by Molone on his proposal. Adding sensory curiosity in design brings out attention and learning. Cognitive curiosity helps by posits the user about the inadequacy of skills and make them to learn further. For child users fantasy elements are necessary ones to produce results. Children likely to control the game on their own way, giving enough controls to users are always are adequate. Extrinsically, interface should produce a cooperative environment to function. It result in creating an interactive learning environment. Purpose of menu, characters and other buttons on the interface are easily recognized by users. Providing options to compare their results with other are always welcomed. (Malone, 1982)

### Knowing the Difference

Tech products for children are completely different from adults. Adult technologies cannot be applied for evaluating children interfaces. Tools developed for adults cannot have the qualification to meet the efficiency and ability of children. Study from this paper also advices that children cannot be considered as miniature of adults. Needs and goals of children are completely different. Value for a product can only be attained through usage. The main target of many children products are to bring their attention into the design continuously without diversion. Skills, abilities and expectation of a pre-schooler is completely different than a ten year old child. Guidelines or principles stated from this paper stated from this article also states the important points that should be taken to remember while carrying out heuristic evaluation on children and their technologies. (Chiasson & Gutwin, 2005)

### Going with Graphics

Instead of texts, graphical forms and image as visual communication is helpful and also interesting for children. In addition to pre-existing visual representation, voice characters can increase the communication level with children. Responsiveness should also be at considerable level. Younger children who tend to communicate only through visual and auditory medium expect a quick response even after a single touch. Repeated actions annoy younger ones and they should be avoidable. Every software product designed for children should be intuitive or giving enough guidance. Sending feedbacks to children about their actions and their results help them to learn a lot about the gatherings inside an interface. At some cases, avoiding feedbacks is also represented as a good choice to follow as it increases the cognitive responsibility of children. Placing useful icons are intuitive and helpful for children to follow. Slow start packed with lesser stuffs while accessing a product are always a good choice to follow up until the children get attracted with the new system. (Chiasson & Gutwin, 2005)

### Considering Age of Children

Children with under age feel difficulty to follow the abstract concept of interface. Younger children are under aged and they less perception in finding in depth concepts stuffed inside an interface. To deal younger children especially, simplistic design approach is helpful one to follow. Once a child get to know the concept of interface, they get themselves immersed into the pretended situation. To reduce difficulty using mouse, touch screens nowadays become unavoidable ones to follow. Introducing on screen characters are always welcomed if it promises not to distract anyone. Children usually want to do activities by their own, interface should come up with a balancing concept needed at every level. Adding up domain specific agents express a positive effect. (Chiasson & Gutwin, 2005)

### Context Specific Options

Game usability Heuristics advices to concentrate audio-visual presentation to attract children in the game. Layout of screen should be efficient in presenting visual treat. Adequate amount of visibility in the indicators. Terminology about the subject which is the gaming part here should be understood by children. Logical, minimalistic and consistent navigation is required. Keys involved in controlling the game match with convenience. Enabling feedback that control the action of players. Giving players less cognitive strain. From the gameplay heuristics of Korhonen and Koivisto the importance of keeping users within their control line without any diversion a. Non-repetitive, interesting, changing and encouraging strategic design are stated as largely welcomed by child users. (Korhonen & Koivisto, 2006)

### Navigation

Neilsen and Norman on their research posited guidelines as heuristics for evaluation of website. The outcome of their discussion are found to be set of rules that are efficiently important to taken into consideration. Information provided on interface should not pull out user’s effort to scroll down. Texts should be come up with large fonts based on its parsimonious use. On navigation basis, children must be informed with their location on a particular page. Using standard child-friendly navigation system are welcomed. Going with ‘only-icons’ as graphical metaphors are not encouraged. Using graphical metaphors along with the combination of texts are preferred. While allowing advertisements into the child website, separate that differentiates the websites from advertisement should be followed. Providing some space to adults to change the browser settings along with children founds to be a fine option that helps adult as well as children. Stating the particular age group who can use the website, characters can also be added to the website to make interaction more efficient.

## Stage III

This correlational stage, specially identified characteristics from Stage II are examined with previously available case studies. This help to publish heuristics on a finite way. Some of the case studies on researching with children and technologies are prescribed below. Based on the type of technology or children product taken, privilege to the type of heuristic varies. This can be clearly seen by studying through the case studies.

### Heuristics for Child Reading

Druin et al (Hutchinson, et al., 2006) carried out an experiment to understand how children perceive technologies as users of digital library. Talking 12 children from four different countries as regular users of International Children’s Digital Library, surveillance happened for a period of four years. Questions to bring out opinions and understanding about digital libraries from children are asked. Few important findings or suggestions conveyed from children are reported by Druin et al. Interface of digital library for children contains specialized design which could be welcomed by children. Along with text based searches, graphical searches are also placed to make their search more interesting. The proposed experiment reveals some few facts to consider.

While seeking through many books around the world, they felt language as their major barrier to communicate and read many books. At every instance, they liked to have variety in their search. Since the intention of the children here is to read out somethings, they invariably avoided pictorial representation to convey a meaning. Comparable to larger novels, all of the children preferred shorter books as their main choice. Study also reveal that children tend to follow Neilsen heuristic stating about the real-time flexibility, they tend to get attached more with real time objects. Children always tend to find out an activity that result in interaction. Children who have used digital libraries tended to interact more with their parents. Instead of having lesser knowledge about the technology they are using, it gives digital libraries have created confidence among them.



Figure 1 User Interface of ICDL (Hutchinson, et al., 2006)

### Heuristics for Pedagogy

Lester et al (James C. Lester, 1997) from this paper speaks about the importance of pedagogical agents in learning products for children. In their experiment, real time possibilities are simulated in their concept on designing a plant. The important things that determine a well-defined pedagogical environment includes promotion of learning, increased believability, should not diminish are reduce the believability elements on adding more inputs. Factors that influence and increase believability are taken as their topic of concern. Visual quality and computational properties found to increase believability along with liveliness, heavier visual impact which creates interesting things into their package. Adding more complex patterns gives more believability rather than easy exploration. The research also reveals that competition based sequencing are considered to be an important approach to increase the believability along with more animated pedagogical agents.

### Identifying Fun and Usability Heuristics

Seo Yoon Han et al (Barendregt & Bekker, 2003) on his paper stated the difficulties addressed by evaluators while considering both fun and usability factors involved evaluating an interface. During the evaluation, the evaluators needs to identify their problems with proper explanation. Below are the list of questions advised for the evaluators to notice during evaluation. Various heuristics on fun and usability has also been discussed earlier.

* Whether the identified problem has any chance of solving through verbal explanation or not. In case of getting an ‘yes’ it comes under usability problem and on ‘no’ it is fun problem
* Whether the identified problem contains difficulties or not. In case of ‘yes’, it comes under fun problem and vice versa.
* Whether the problem can be solved by taking over mouse or not. If it is ‘yes’ concerns should be on the motor skills developed. If it is difficult to tackle by mouse it is highly challengeable to fun factors.

### Heuristics for Story-telling

Chu and Quek (Chu & Quek, 2014) on their proposal, posited the importance of background compared to no-background condition. Comparing to no-digital background condition, storytelling can be done with audio outputs added with visuals. On using speech from characters to represent their story telling, it dumbs the narrative experience of children. At some places of heuristics, auditory medium are most recommended ones for children, experimentation with backgrounds by to replace audio inputs are encouraging ones. It has produced useful results in story-telling platform. Giving backgrounds and cutting out audio has produced many differences. Character’s action about their doings help children to narrate along with the character. Children get attracted more on digital backgrounds involved in story-telling. For different context taken, different heuristics should be formulated to carry out the research. The research also states the importance of paying attention to evoke imagination of children.

## Stage IV

In the previous stages, ideas to formulate heuristics are obtained through case studies and analysis on different journals. In this explicative stage, a new heuristics needed to correct error in existing children technologies are proposed in a standard specification.

During evaluation process through heuristics, documentation of all gatherings that are identified as a part of their evaluation. Earlier, part of the product which is being violated over heuristics are described. All that heuristics principles which are being violated are given separately. The evaluator should have the ability to show up a strong justification on how things are violated. By stating the severity of problem found on the product, solution to fix such problems are also stated in their explanation.

## Stage V

In this stage of assessment, heuristic principles that are applicable for better understanding can be formulated. Matching with traditional heuristic principles such as Neilsen heuristic principle, new heuristic project is validated. Suggestion from heuristics of various child products available online are also taken into account.

## Stage VI

In this stage of Refinement, feedback from participants are taken out as a part of realistic validation and refinement. Along with finding the errors, explanation on importance of these errors are also described in this stage.