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Affective Design Components of Educational Application for Children

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Abstract: Affective design of educational applications mainly for children is vital to ensure that the learning process can be successfully delivered to the children. Understanding children's preferences in designing the educational application is important as it could induce a positive experience and ensure they are engaged with the application. Even though there are various kinds of educational applications in the market, the interface design specifically for children is still questionable. Therefore, the purpose of this study is to identify the affective design components and elements of educational applications that are specifically appropriate for children and cater to their learning needs. This study employed a qualitative approach that comprised two activities; (i) works of literature searches retrieved from two main databases, and (ii) constructing the components and elements using thematic analysis. The findings revealed two components which are affective interface design and content.

Keywords: *Children Computer Interaction (CCI), Affective design, Assistive technology, Educational application, Child-Centered Design (CCD) Approach.*

1. Introduction

Technology provides tremendous benefits to every person in this world. The advancement of technologies enables both normal and disabled people to perform their daily activities. However, Assistive Technology (AT) is unable to assist those with disabilities on its own. Assistance is required to ensure that AT might be utilized effectively (Akcil, 2018). Moreover, using AT in an educational setting could ensure the student's learning needs, particularly those with disabilities (Sandoval-Bringas et al., 2021). Nowadays, AT is not only limited to support physically but also to support digitally. Digital support is any electronic equipment or application that can support people with disabilities to enhance their capabilities in doing their job tasks or any regular activities. Despite various devices and auxiliary technology in the market, the computer remains the primary and essential tool for disabled people to do their work, study, and communicate (Markova & Byalmarkova, 2021). This includes providing the affective interface design.

An interface design that is understandable and usable is very important for the users. Furthermore, understanding the uses of the application before its development is crucial due to the requirements are different. Interface design for children is different from that of adults, and similarly, the interface design for normal people also differs for people with disabilities. Despite the fact that the interface was created with children in mind, each age group has different needs (Giraldi et al., 2021). The level of cognitive load that can be handled by the individual is different from one another. Too much information on the interface might put a burden on certain individuals. The mixture of affective and cognitive aspects in the interface design could enhance the usability and user acceptance of the product (Prastawa et al., 2019). Moreover, Prastawa et al. (2019) also mentioned that to ensure that the application is usable, the two aspects namely affective and cognitive must be taken into consideration even though these two work interdependently.

The major core of the interface design is to ensure that the application is usable and accepted by the users. Research that had been conducted by Latiff et al. (2019) states that many good applications in the market still experience losses due to the fact that the interface designs are unattractive, too complex, too broad, and not focused on the children as the end user. Moreover, little attention has been given to the interface design that focuses on the affective aspect especially applications developed mainly for children. Therefore, this study attempts to identify the affective components and elements of interface design of an educational application mainly for children based on previous works of literature.

This paper is divided into several parts where the literature review explains the previous studies on affective design that relates to the concept of Kansei, Kansei Engineering, how Kansei Engineering relates to the study and previous applications that focused on children as the users. The methodology describes the activities involved in finding the works of literature, followed by the results and discussion, as well as the conclusion and future work of the study.

2. Literature Review

Affective Design based on the Concept of Kansei: Affective design in the concept of Kansei engineering was introduced at first in the automotive industry to assist in designing cars that could evoke the user's positive feelings (Nagamachi, 1995). After that, the area had been expanded to other industries like manufacturing, electronics, and the educational sector as well. Kim et al. (2016) carried out research on a smartphone that focused on the appearance and applications inside. This explained that the affective aspect could not only be used to study the appearance of the product but also the software applications. Furthermore, Lokman (2013) stated that people react positively when they look at something attractive and appealing. When this happens, they tend to pay more attention and have an interest in using it. The usability and functionality of the product come later. Additionally, the users of the products tend to look at the product first, then they have a perception towards the product, and lastly, they react or use it accordingly (Prastawa et al., 2019). This justified that, a product that could evoke a user's positive feeling has the advantage.

The study that had been conducted by Prastawa et al. (2019), stated that affective design factors influenced the learning process as it could impact the emotion of the learner. The study also made a comparison between e-learning and e-commerce websites regarding affective and cognitive factors on usability. The result revealed that the affective factor influenced more on the usability of the e-learning website more than the e-commerce website. The affective indicators highlighted in the study are color, brightness, harmoniousness, salience, appeal and pleasantness, comfort, reliability, and attractiveness. Meanwhile, cognitive indicators are error prevention, interactivity, feedback and help, learnability, readability, memorable, easy navigation, logical navigation, u-site direction, and easy-to-go-back option. Therefore, this indicated that the affective factor is significant to the websites or any applications that incorporate educational content.

On the other hand, Han et al. (2001) revealed that the usability factor for the products was related to the performance and image or impression. Performance could be categorized into three aspects; the first one was the thought and understanding of the product itself (perception or cognition), second, the time taken to learn how to use the product and memorize it (learning or memorization), and finally the reaction towards the product (control or action). Meanwhile, an image or impression also could be classified into three categories namely, basic sense, description of the image, and evaluative feeling. Basic sense relates to the direct impression of the characteristics of the image that the user looked at. Description of the image means how the users describe the image based on their experience. Lastly, evaluative feeling describes how the users make a judgment or evaluate the products to express whether they like or dislike the products. Similarly, Kim et al. (2016) also conducted research based on the three phases of affect namely primitive, descriptive and evaluative. Additionally, the study considered the three levels of appraisal which are sensory-motor, schematic, and conceptual level. The findings of the study revealed that the appearance of the smartphone involved three phases. However, the smartphone application excluded the primitive phase due to the reason that the applications had customization features.

Kansei Engineering (KE): In the past, the manufacturer designed a product based on its design plan regardless of consumer demand or preference. Some products cannot be sold well due to the lack of consideration for customer preferences. Kansei Engineering (KE) was developed by Nagamachi to create new products that are ergonomic consumer-oriented technology (Nagamachi, 1995). In KE, the development of the new product takes into account the consumer's psychological feelings and image, and translate those feelings and image into a product. Industries that employed KE in the product development process are automotive, construction machines, electric home appliances, office machines, house construction, costume, and cosmetic industries (Nagamachi, 2002).

The manufacturer that employed KE would break down the zero-level concept of product development into several sub-concepts until they managed to highlight a suitable physical feature that matches the characteristics of the sub-concepts. The process then continued with the ergonomic test until the product design concluded (Nagamachi, 2002). Those steps involved Kansei Words (KWs) at the beginning of the phase. Lokman & Kamaruddin (2010) identified 820 KWs that falls into forty-three cluster which is called as Kansei Affinity Cluster. Among the clusters are creative, decent, elegant, happy, inferior, trustworthy, sad, technological, weird, negative perception, and positive behavior. Meanwhile, examples of KWs identified are inspiring, appealing, arousing, enjoyable, incapable, optimistic, depressing, user-friendly, boring, conservative, and persistent.

How Kansei and Kansei Engineering (KE) relate to the Study: This study makes an effort to adapt the KE concept in designing an educational application for children. The KE concept takes the user's psychological state and image and then transforms those into the product. It is believed that users tend to examine the item first before beginning to use it if they sense something that might draw them to it. The study attempted to elicit favorable sensations in users when they looked at the item. One of the issues the researchers may confront is figuring out how the children feel and perceive the things that they look at. Therefore, the researchers must ascertain the preferences of children for the interface design before developing the application. This is necessary to guarantee that a favorable or positive feeling could be evoked. Moreover, comprehending the Kansei Words in the Kansei Affinity Cluster like enjoyable and optimistic could assist the researchers in making sure that the children could feel the positive feeling while interacting with the application.

Reviews of Existing Educational Applications: The educational applications that could foster students in their learning activities are essential. Even though there are so many educational applications that are available in the market but still a new form of research must be conducted to ensure that the applications developed are tailored to the specific needs of the children. The interface design that is suited for all children must take into account as the interface is different for adults.

Latiff et al. (2019) developed a mobile learning application that focused on children. The design of the application takes into consideration the eight design elements namely Navigation, Text, Image and Icon, Audio, Content, Colour, Input or Output Support, and Feedback. The elements have resulted from the thorough study carried out by the researchers and expert validation. SugarCad Kids is a 3D modelling software program that focuses on the recent graphic user interface concept. The program was developed by Giraldi et al. (2021) and the target users were children aged three to seven years old. The development of the program followed the User-Centered Design (UCD) approach as the primary method for the Child-Centered Design (CCD). Other than that, the program also used a Human-Centered Design (HCD) approach. The focus of the program's development was to design an interface that was suitable for the children who were equipped with the criteria of understanding, enjoyment, friendliness, and intuition. Gasah et al. (2019) conducted research that focused on developing an e-learning application that could induce positive emotions in children while learning. The e-learning application focused on the kindergarten syllabus like the alphabet, numbers, shapes, and colors. The major concerns of the development were regarding the positive and negative emotions towards the layout, color, and typeface.

Besides, Sandoval-Bringas et al. (2021) developed an educational application for visually impaired children to learn Braille signs. It is a type of mobile learning application that incorporates gamification elements so that the children can experience fun learning and motivate them through the learning process. The interaction method of the application is the touch screen, vibration, and sound. Meanwhile, Othman et al. (2020) researched an application that allows low-vision children to learn Mathematics subject through playing games. The application was developed for Android tablets and the target users are low-vision children aged seven years old. The storyline is related to conflicts between animals in the animal kingdom. Users need to complete various challenges that involve mathematical operations to go to the next level of the game. Rewards and positive feedback were given to the users when they managed to complete each task. Another educational application that used the game as a method to increase the learning process is by Riza et al. (2020). The labyrinth game, especially for blind children, consisted of four aspects namely (i) the characteristics of the blind, (ii) the problem-solving learning model, (iii) the lesson plan, and (iv) the concept of the story. The

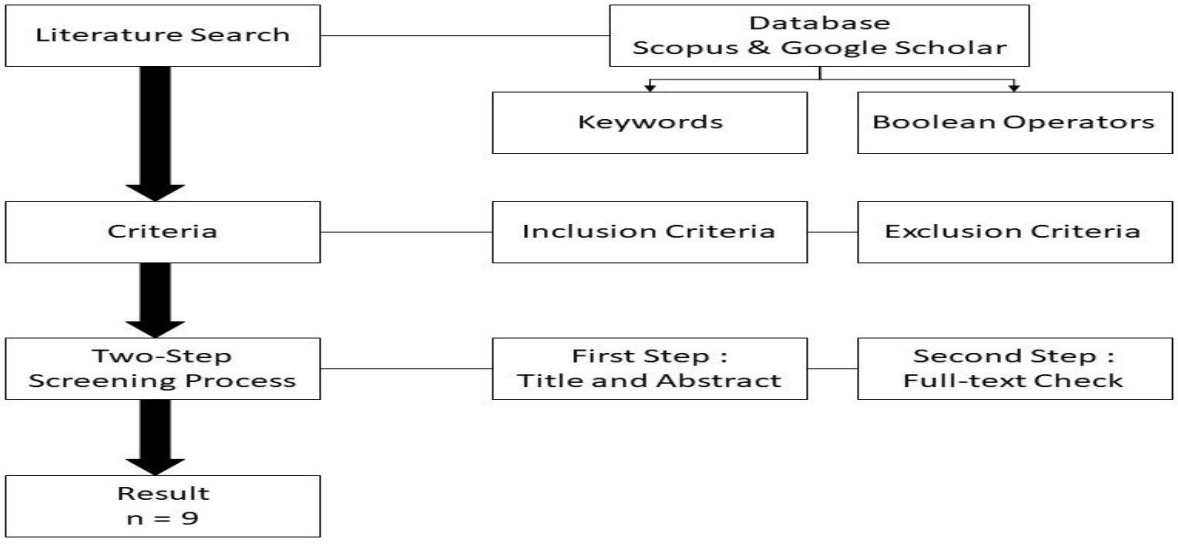
labyrinth game developed positive feelings as they enjoyed and felt excited while using the game as the learning media. Furthermore, the examination of attitudes and knowledge revealed an improvement following the use of the game.

Other than that, Groba et al. (2021) developed an educational application called ASD Module, specifically for autistic children. The ASD Module was built with the idea known as the perspective and the central axis was the autistic person, with the activities and interests of that person's life arranged around that perspective. The activities were scheduled, for education, leisure, communication, and computer access. The research aimed to identify the elements to support the interface design for autistic children and also to assist them in understanding their lives. Digital games can be an effective tool for children with special educational needs to improve socialization, learning, and professional activities. They can aid in the development of skills for object classification, observation, and self-control. Markova & Byalmarkova (2021) identified several requirements when developing digital games for children with intellectual disabilities. The development should take into consideration in terms of the elements of the interface design of games. The elements highlighted were clarity of the image and transitions, presence of the boundaries of the objects, color design, number of objects in one window, roles, interactivity, game levels, and options for sound selection. The findings of the research revealed that three factors could have an impact on the users. The factors are game content, game structure, and game mechanism. Having, reviewed the identified existing educational applications for children this study extracts the components and elements of affective design principles through the methodology as describes in the next section.

3. Methodology

The study used Scopus and Google Scholar as the main databases to find works of literature. Several keywords and a combination of Boolean Operators were used in the literature search which are *affective, design principles, multimedia,* and *children*. The Snowball technique was also used in finding the relevant articles. There were certain inclusion and exclusion criteria to be matched during the search of the articles. The inclusion criteria were (i) the articles must be from the year 2019 to 2022, (ii) the articles must discuss the design principles for children not only limited to normal children but also disabled children, and (iii) the design principles highlighted should for all kind of devices. The exclusion criteria were (i) articles that discussed design principles, not for children, (ii) articles written in languages other than English, and (iii) articles below from the year 2019. The relevancy of the articles has been carried out through the two-step screening process. The first screening process involved checking through the title and abstract. Next, the articles that resulted from the first screening process would be further examined. The second step of the screening process was to read the contents. As a result, nine articles were chosen for the final analysis. Figure 1 shows the process of literature search and retrieval of relevant articles.

Figure 1: A Process of Literature Search and Retrieval of Relevant Articles



Thematic analysis was used to categorize the interface design principles for children. A total of twelve elements had been identified and the elements were grouped into two which are design principles and content. The elements under design principles were image or graphic or animation, text, audio or voice, color, layout, visual complexity, information displayed, and navigation. Meanwhile, elements of content were storyline, feedback, activity or difficulty level, and reward. The next section discusses the results gathered from the review process.

4. Results and Discussion

This section highlights the elements found in the previous works of literature by dividing them according to the two major components which are affective design principles and content. The elements for each of the components are also being discussed. Table 1 shows the matrix table of the components and elements found in the literature.

Table 1: Summary of Components and Elements

NO	AUTHOR	YEAR	PRODUCT / APPLICATION	DESIGN PRINCIPLES								CONTENT			
				IMAGE / GRAPHIC / ANIMATION	TEXT	AUDIO / VOICE	COLOUR	LAYOUT	VISUAL COMPLEXITY	INFORMATION DISPLAYED	NAVIGATION	STORYLINE / CONTENT STRUCTURE	FEEDBACK	ACTIVITY / DIFFICULTY LEVEL	REWARD
1	Betania Groba, Laura Nieto-Riveiro*, Nereida Canosa, Patricia	2021	Computer application for children with ASD	/	/	/	/	/	/	/		/		/	
2	Gergana V Markova and Petya Y Byalmarkova	2021	Digital games for children with intellectual disability	/	/	/	/	/	/				/	/	
3	Laura Giraldi, Mirko Burberi, Francesca Morelli, Marta Maini,and Lorenzo Guasti	2021	SugarCad Kids	/	/		/				/		/		
4	Sandoval-Bringas et al.	2021	Mobile Application to Learn Braille Symbols (games)		/	/					/		/	/	
5	E Song, N M Suaib, A J Sihes, R Alwee and Z Mohd Yunos	2020	Mathematics Game			/						/	/	/	
6	Othman et al	2020	Serious game prototype (mathematical subject) for low vision children	/	/	/						/		/	/
7	Riza et al (2020)	2020	Labyrinth Game	/	/	/	/				/	/		/	
8	Halimatus Saadiah A. Latiff, Rozilawati Razali, Fatin Filzahti Ismail	2019	Mobile learning application	/	/	/	/			/	/	/	/	/	
9	Magrizef Gasah, Nurul Hidayah Mat Zain, Aslina Baharum	2019	E-learning application	/	/	/	/	/				/			

Affective Design Principles

Text: According to Latiff et al. (2019), any serif or San serif fonts with a single story on the letters 'a' or 'g' like Comic Sans MS should be used. Moreover, single-story letters are the kind that are typically introduced at the preschool level which is simpler for children to understand. The researchers also mentioned that a font size change function should be added to the application to increase readability especially if the users are visually impaired children. Gasah et al. (2019) mentioned that the recommended font type for children aged four to five years old was Tahoma or Century Gothic because the font was readable and understandable. Additionally, Gasah et al. (2019) discovered that using a certain type of font could induce certain emotions in the children such as Tahoma (Joy), Comic Sans Ms (Excited), Palatino (Interest), and Felix Titling (Admiration).

The selections of font type, size, and formatting are significant to children with disabilities. Different types of disabilities would prefer a different set of types, sizes, and formatting. According to Groba et al. (2021), children with ASD prefer lowercase letters, and calligraphic-linked styles like Comic Sans or Edelfontmed, and the size must be large. Meanwhile, low-vision children prefer Serif font type and the size must be at least 18 points (Othman et al., 2020). This is consistent with the research conducted by Riza et al. (2020) regarding font type and size where the visually impaired people could understand better with certain font types only

and the size should be large enough to be seen. The highlighted font types were Arial, Comic Sans, Verdana, and Tahoma. Additionally, text formats like italics underscores, and text that has a distance of adjacent letters should be avoided as it could make them face difficulties in reading. Besides, the use of upper and lower case, 1.5 spacing, and simple words could assist them in grasping information while learning.

Image, Icon, Animation and Character: Children process information in a visual setting more effectively than verbal information. The information could be grasped easily when it is supported by images or pictures. Besides, the usage also could motivate the children to continue to use it. A picture is more realistic, and relatable to their daily lives (Groba et al., 2021), and the cartoon drawing style is preferable (Latiff et al., 2019). Moreover, putting together visuals and words has a greater impact on the children (Groba et al., 2021). The image must be sharp and in some cases, the presence of borders around the image could resolve the problem of difficulties in recognizing the image when the image blends with the background color (Markova & Byalmarkova, 2021). Moreover, images that have less saturation are preferable (Groba et al., 2021). Some applications use icons, however, sometimes the icons are a bit confusing. Therefore, the text reference must be added to the icons for easy interpretation (Giraldi et al., 2021) as the children are still learning to read and recognize the alphabet (Latiff et al., 2019). The application might be more appealing if it used simple animation rather than static images. For example such as the animation could be activated when a finger or cursor hovers over or touches the animation (Giraldi et al., 2021). Object speed is also crucial as low vision children require slow speed and must be in the same direction (Othman et al., 2020).

Apart from that, the application also should have a character to support children in the learning process. The character must possess a good quality attitude as it could increase the interaction between the children and the application, and give motivation to the children to continue using the application. The character must be intelligent, eager to learn, and able to move, speak and show expressions (Latiff et al., 2019). Moreover, the usage of cartoon drawing for the background or picture of the application was more suitable to gain the attention of the children while using the application (Gasah et al., 2019).

Color: The selection of color according to the age group of children is important as it could give a pleasant feeling to them. Certain colors could evoke certain emotions in children. Positive emotions like happiness could be triggered when using Yellow color, Natural (Green), Earthy (Brown), Clean (White), and Neutral (Grey) (Gasah et al., 2019). It is necessary to choose the colors that children can easily identify such as pastel and bright colors (Latiff et al., 2019). Furthermore, for normal children aged 3 to 7 years old, neutral colors for the background and homogeneous colors for the action icon are more suitable (Giraldi et al., 2021). Color plays an important role in the learning process. However, if it is not being used wisely, it might become a distraction or problem for disabled children. Color serves specific purposes such as to enhance the information displayed and also for categorization. The background color must be different from the foreground color and any images on top of the background color (Groba et al., 2021). Riza et al. (2020) used bright letters on a dark background and dark letters on a white background. Color contrast can assist low-vision children in differentiating the objects in any application.

Meanwhile, for the categorization, the color could work as the color coding for the various set of instructions such as red color for the exit button and green color for the help button (Groba et al., 2021). Striking colors could only be used to emphasize important information on the screen (Latiff et al., 2019). Besides, there is a need to allow the children to change the layout's color as some of them might face problems with color recognition (Markova & Byalmarkova, 2021). Moreover, allowing children to change color based on their liking could boost their desire to learn (Latiff et al., 2019).

Audio (Sound / Music / Voice Command): Audio is significant to convey information to the users. The main function of the audio is to make the application lively and interesting. (Latiff et al., 2019) stated that audio relates to the background music and sound effects of the application. The distinction between background music and sound effects is that the former refers to any music played while a user using the application, while sound effects denote any sounds added to make an application more engaging. However, it was advisable to use background music and sound effects that are incorporated with the learning theme. The background music chosen must be the one that could instill the excitement of using the application in the children. Audio

also could serve other functions such as giving feedback and providing instructional support to the users (Song et al., 2020). Moreover, instructions provided using audio must be clear (Othman et al., 2020).

Gasah et al. (2019) stated that the instructions using a real human voice were preferable to the computer or robotic voice as the children might face problems in understanding the learning content. However, the option can be given to the children whether to turn on or turn off the sound as some normal children (Latiff et al., 2019) and disabled children found this as a disturbance (Markova & Byalmarkova, 2021). Other than that, Sandoval-Bringas et al. (2021) suggested that binaural sound where the sound that has different frequencies could be added to the application to accommodate the capacities of visually impaired children. Riza et al. (2020) developed audio-based games where the audio in the game could enhance the atmosphere of the game's storyline and assist in giving the material for the mathematical formulation process. Moreover, the authors also ensured the clarity and the speed of the audio was acceptable.

Voice Command: Some of the elements like buttons and menus should be equipped with sound or voice commands. The sound should be played one at a time (Othman et al., 2020) due to some disabled children, especially low-vision children face difficulty in understanding the content if multiple sounds are played simultaneously. The voice command could be a recorded human voice or the use of speech synthesis. Autism children prefer software that has speech synthesis for the voice command as it is believed could ease communication between the software and the children (Groba et al., 2021). Besides, the educational application that manages to understand human speech and allows users to execute tasks using voice commands is also appreciated (Sandoval-Bringas et al., 2021).

Navigation: One of the basic features that the application must have is navigation. The application should allow easy movement from one point to another on the same screen and also to the other screen. The menu design should be simple and preferable with audio (Othman et al., 2020). (Latiff et al., 2019) had highlighted some descriptions regarding navigation. The descriptions were the navigation (i) should be simple, easy to understand, and easy to remember, (ii) consistent on every page, (iii) the rule is not more than three clicks to get to the content page, and (iv) scrolling should be avoided.

Layout or Placement of the Elements: All the elements on the screen must have a consistent distribution and follow a left-to-right organization. Other than that, the wording that is being used together with the visual must be located at the bottom of the visual. The reason is to allow children to focus on the visual first and then read the wording to understand better (Groba et al., 2021). According to Gasah et al. (2019), children preferred a layout that followed the standard layout, using a grid, portrait, or landscape layout. Meanwhile, the dissatisfied layout was the layout that had more whitespace and complex layout as those could lead to the emotion of boredom and confusion.

Information Displayed: Multimodal representation is where more than one sensory channel is being used. It is thought that the usage of multimodal representation like the integration of visual and auditory information could aid children to absorb the information presented easily (Groba et al., 2021). Nevertheless, the information could be presented in a graphic format and the size must be big enough (Othman et al., 2020) depending on the users of the application. Furthermore, a simple screen design (Othman et al., 2020), reducing information on the screen (Groba et al., 2021), and only displaying necessary information (Latiff et al., 2019) could help children to focus as the cognitive load is less. Therefore, the "rest page" should be offered in the application as the page works to ease children's minds after absorbing information (Latiff et al., 2019).

Visual Complexity: The information that can be processed by the PWDs is different from one another. As highlighted by Groba et al. (2021), the visual complexity must be reduced to ensure that the children are focusing on the main elements of the screen. Too many elements on the screen might distract children's attention from the information that is being delivered. Some of the applications provide working space for the children to work on. Therefore, the number of elements on the screen must not hinder this working space (Markova & Byalmarkova, 2021).

Content (Storyline, Feedback, Activity/Difficulty Level, Reward): A good application is not only concentrated on the design principles but also the content of the application. An effective educational

application could evoke users' positive emotions and keep them motivated to learn (Song et al., 2020; Markova & Byalmarkova, 2021). The content of the educational application must correspond with the school syllabus of the targeted children. For example, children aged four to five years should consist of syllabi like Alphabet, Number, Shape, and Colour (Gasah et al., 2019). In addition, these can be accomplished by having an exciting storyline, offering the level of difficulties, and providing positive feedback for every achievement (Song et al., 2020). Latiff et al. (2019) also emphasized the content structure of the application which is introductory and learning content, training, games, quizzes, or time-based assessment. Furthermore, the suggested delivery method for the introductory and learning content was storytelling or using character as the instructor. Before starting the games or activities, the program must also offer tutorials. This makes it easier for children to comprehend how the game or activity is played. Othman et al. (2020) highlighted that if the educational application is in the form of gamification, then an interesting storyline and fun game could engage the children with the application. The storyline should be incorporated with background audio. The level of difficulties or challenges must be matched with the target user's ability. Not only that, the level of difficulties like low, medium, and high levels also must be added for all content, quizzes, and games in the application (Latiff et al., 2019).

Feedback is a vital component especially when the application is an educational application as it is believed that it could reinforce new abilities and strengthen existing knowledge of the children while interacting with the application. Giving immediate feedback for every activity like feedback concerning progress, encouragement, and support could increase children's engagement and trustworthiness towards the application (Latiff et al., 2019). In addition, various methods of feedback should be supplied such as text, audio, and video feedback. Positive feedback can be in the form of a reward or result displayed on a screen (Markova & Byalmarkova, 2021). The reward must be in an attractive form to motivate users to continue with the application (Othman et al., 2020). Moreover, the application mechanic that could automatically generate the next activities based on the progress made by the users should be put into consideration (Sandoval-Bringas et al., 2021). Children's performance in every assessment also must be shown in the application to gauge their level of comprehension of the course material (Latiff et al., 2019).

Besides, the language chosen also plays an important role in making the content easy to understand (Othman et al., 2020) and it is recommended to use simple language (Latiff et al., 2019). Besides, a bilingual language also could be offered like using Bahasa Melayu as the native language and English as the foreign language (Gasah et al., 2019). This is due to the fact that not all children mastered a foreign language.

5. Conclusion

Designing an interface that is suitable for children is vital to make a learning process take place. Interface design for children is different as compared to adults as it has certain criteria that need to be considered. This paper contributed to finding the affective components and elements that are suitable for children when designing an educational application for them. It is believed that when the design is in accordance with the children's preferences, it could evoke a positive feeling and as a result, children could learn better. The positive feelings could make them engaged with the application and motivate them to continue using the application. The negative feeling of difficulty understanding the application must be avoided as it could lead to a bad learning experience while navigating through the application for the children. This study contributed to an affective interface design for the children. There were two main components identified namely the design principles and the contents. Each component has its elements that could foster positive feelings in the children while learning using the application. Future works of the study will focus on evaluating the gathered components and elements through an expert review method before proceeding with the development of affective educational applications for children.

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