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DESIGN OF EDUCATIONAL GAME TOOLS RECOGNIZING BODY MEMBERS USING THE KANSEI ENGINEERING METHOD

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ABSTRACT
Education is very important in realizing a strong and advanced nation. So, the process must be carried out early. Therefore, Early Childhood Education is the main foundation for the development of a nation's generation. While the standards of Early Childhood Education are not evenly distributed, in fact there are still many that are lacking, especially in the learning media of Educational Game Tools. In this research, an Educational Learning Tool will be made in the form of a fuzzle using the Kansei words and Kensei engineering methods. The results of this study indicate that the child's response is very good and very helpful in the learning process. The combination of the kansei words and kansie engineering methods produces a unique educational game tool that makes children more interested in participating in learning.
Keywords : *Educational game tools, kansei engineering, kansei words,*

1. Introduction

Currently, education is the main thing to create a strong and advanced nation. The education level starts from an early age, therefore early childhood education becomes the main foundation for a person's development so that they get something valuable or results when they grow up. Early Childhood Education (PAUD) is a level of education that is the basic foundation for the next level, where children learn, play and so on. Unfortunately, there are many PAUD schools currently lacking in terms of playing facilities, both in terms of facilities and infrastructure available to support the availability of play equipment and other learning facilities. Quoting from the ministerial regulation number 137 of 2014 concerning the national standard of Early Childhood Education (PAUD), there is a level of achievement of a child's development that is achieved as the learning process takes place, so that the results of the learning process are achieved optimally, learning must also provide optimal media (Sumardi, et al, 2018).

According to research conducted by Hasanah (2019), educational game tools/Alat Permainan Edukasi (APE) are important to be given to early childhood children. Without educational game tools, children will feel bored and bored in learning. In addition to aiming for children not to feel bored and bored in learning, APE will also make children happier and can explore with learning according to the theme. Likewise the results of a study conducted by Nilawati, et al (2017). The game tools developed have various functions in supporting the implementation of children's learning processes so that activities can take place well and are meaningful and fun for children, and educational game tools for children are play tools that can stimulate the five senses and intelligence of children, which include the sense of sight. , smell, taste, touch and hearing.

The available learning media must be proportional to the number of students in schools so that learning can run more effectively, but many schools in Indonesia have minimal funds so that game tools and supporting facilities as learning media are lacking in availability in schools. There is one school that has minimal funds, namely TK X. Table 1 shows that TK X in Taluk Kuantan from the income and expenditure results are balanced at IDR 7,500,000 in other words it is sufficient, but to increase the availability of educational game tools as a learning method is quite difficult because there are 50 students while the game tools there are only 35 units available.

Table 1 - Table of TK X educational institutions:

Data	TK X
Income	RP 7.500.000

Outcome	RP 7.500.000
Number of Students	50 people
Number of APE	35 units

(Source: BP PAUD and DIKMAS, 2020)

Based on Table 1 it can be said that the number of game tools available is not proportional to the number of students, a good solution is to make additional tools. One solution that can be done is the need for the use of cheap and easy-to-obtain raw materials in terms of overcoming the shortage of play equipment for PAUD children. And so that the learning process can be optimal the number of game tools that are good is proportional to the number of existing students.

Fig. 1. Body shape educational game

Judging from the existing problems, the price of the game tools offered is quite expensive depending on the size to be purchased, where the quality of the material which is less sturdy is inversely proportional to the price offered, which is ± Rp. 50,000, while the simple game tool only displays a simple face puzzle form that uses wood-based material that should be sold for Rp. 30,000. From this, the prices offered are relatively high so that some schools or children's educational institutions that have minimal funds in the procurement of game equipment will find it difficult to procure the purchase of game equipment. With regard to the selection of facial puzzle game tools, this game tool was chosen because it is friendly in its purchase price and as a learning aid as well as being able to suffice the number of game tools in the field of biology, because in the field these game tools can be said to be non-existent/not yet available. The educational game tools designed are game tools that have been adapted to the material from biology learning for children aged 5 years. So based on the initial survey that has been carried out and from the existing literature review, APE here is designed to stimulate child development and help children to know the structure of the body that exists in humans by using the Kansei Engineering method.

According to Aryanny and Saputri (2020) the Kansei Engineering method is a method in which a type of technology that translates customer feelings into design specifications where the R & D team takes customer feelings by analyzing data using psychological, ergonomic, medical, or engineering methods and designing new products based on information analysis.

2. Literature Review

National Education System Law No. 20 of 2003 Article I paragraph 14 which states that Early Childhood Education (PAUD) is a coaching effort aimed at children from birth to the age of six which is carried out through the provision of educational stimuli to help physical and spiritual growth and development so that children have readiness in entering further education, which is held on formal, non-formal, and informal channels (Latif, 2013 cited by Nilawati, et al, 2017). It can be concluded that early childhood is children aged 0-6 years. This age is a very decisive age in the formation of a child's character and personality. This age is also the age when children experience rapid growth and development who are in the early childhood growth and development stage which has unique characteristics and differs from later ages.

Characteristics in early childhood is a childhood when children have specific behavior. Her small body shape and cute behavior make adults feel happy, excited and impressed. However, sometimes it also makes adults feel annoyed, if the child's behavior is excessive and cannot be controlled (Husnuzziadatul Khairi, 2018. All forms of activity and behavior shown by a child are basically nature. Because, early childhood is a period of development and growth. that will shape their personality when they grow up. A child does not yet understand whether what he is doing is harmful or not, beneficial or harmful, right or wrong. The most important thing for them is that he feels happy and comfortable in doing it. Therefore, it has become a duty parents and education to guide and direct children in their activities so that what they do can be useful for themselves so that later they can form a good personality (Husnuzziadatul Khairi, 2018).

Before discussing the characteristics of early childhood development, it would be better to understand what development is. Development is an increase in the ability to structure and function of the body which is more complicated in a more regular and predictable pattern as a result of the process of developmental maturation, where the process includes emotional, intellectual, and behavioral development as a result of interactions with the environment (Husnuzziadatul Khairi, 2018).). In general, the characteristics of early childhood are grouped into ages (0 to 1 year), (2 to 3 years), (4 to 6 years) as follows (Husnuzziadatul Khairi, 2018):

a) Age 0 to 1 years

At this age, explain the characteristics of babies, including: learning motor skills, skills using the five senses (seeing, observing, touching, hearing, smelling, and tasting using the mouth), and learning social communication.

b) Age 2 to 3 years

At this age, they explain the similarity of the same characteristics from the previous age where physical development experiences rapid growth, namely: very active in exploring objects around, actively starting the development of the ability to make material, and learning to develop emotional self..

c) Age 4 to 6 years

At this age, it has characteristics, namely: the physical development of children is very active in carrying out various activities, the ability in language development is more baba, cognitive development (thinking power) is very spicy and the form of the game is individual.

According to research conducted by (Nilawati, et al, 2017) Educational Game Tool is a media designed and created to assist the teaching and learning process of educators in the classroom and can help students to develop the potential that exists within themselves. Educational Game Tools are game tools that can be made with various materials such as materials that exist in the environment which we can also call environment-based APE. Guslinda and Kurnia (2018) argue that Educational Game Tools are various kinds of equipment or objects that can be used to play. Where the equipment or objects can stimulate and develop all children's abilities. Tedjasaputra (2001) revealed that educational game tools are game tools designed specifically for educational purposes. According to research conducted by (Nilawati, et al, 2017) APE and the tools used in assisting the development process for early childhood are useful for: developing physical aspects, language development, and developing cognitive aspects.

Environmentally Based Educational Game Tool is a game tool that is created or used as a medium for the teaching and learning process that comes from the surrounding environment. Materials from the environment that can be used as media in the teaching and learning process

are such as zoos, flower gardens, citrus fruit gardens and so on. While the tools used to create an APE from the environment are in the form of wood, bamboo, sand, clay and so on (Nilawati, et al, 2019). According to (Zikra Hayati, 2019) the conditions that need to be considered in choosing APE, are: easy and simple design, multifunctional, attractive, durable and according to needs, encouraging children to play together, and developing children's fantasy and imagination.

Kansei is a Japanese term used to express one‟s impression towards artefact, situation and surrounding. Deeply rooted in the Japanese culture, direct translation of Kansei to other language is rather difficult. Having various interpretations by different literature, Kansei is generally referred to sensitivity, sensibility, feeling and emotion (Nagamachi, 1992; Ishihara et al., 1993; Harada, 1998; Yoshikawa, 2000; Schutte, et. al. 2008). *Kansei* Engineering is considered to have advantages over other similar methods, because this method has the ability to translate consumer emotional needs into concrete design parameters through certain techniques. (Namagachi, 1995). According to (Khurrohmah, et al, 2017) Kansei Word is a method which is collected from the selection of Kansei words which represent the emotions of the respondents' emotional feelings towards the product, where it can be said that the application and selection of these words is done by people. the person concerned directly and understands about the product. *Kansei* Engineering often applies for both product design and product development. It is employed on automotive industry, for example Miata from Mazda (Nagamachi, 2002), steering wheel (Nagamachi, 2002), car interior (Jindo and Hirasogo, 1997; Tanoue et al., 1997) and other products such as bag, office chair (Park and Han, 2004), and washing machine (Ishihara, et. al., 2010).

The Kansei Engineering method is a type of technology that translates customer feelings into design specifications. The R&D team takes the customer's feelings, by the name of kansei; analyze data using psychological, ergonomic, medical, or engineering methods; and designing new products based on information analysis. Kansei affective engineering is the engineering technology and process from Kansei data into design specifications (Aryanny and Saputri, 2020). According to Yogasara and Valentino (2017). Kansei Engineering (KE) was first introduced by Mitsuo Nagamachi as a new ergonomic technology in product design (Nagamachi, 2011). The KE method translates consumer feelings into design specifications. Lokman (2010) suggests that the implementation of the EC principle involves many steps that allow the use of various tools and methods from various fields of study, such as marketing, psychology, and statistics. The product design process using KE includes: 1) Kansei data collection from consumers in a particular product domain using psychological (eg words, attitudes, behavior) or psychophysical measurements (eg Electroencephalogram (EEG) to measure muscle health, electromyography (EMG) to measure muscle health. and record the electrical activity of the brain using certain sensors, heart rate, eye movements, facial expressions 2) Analyze kansei data using statistical, medical, or engineering methods to clarify the kansei structure. 3) Interpret the analyzed data and transfer the data to the new product domain. 4) Designing new kansei products (Nagamachi, 2011 cited by Yogasara and Valentino, 2017).

3. Research Methods

This research methodology is a stage that must be made before conducting research where later this research can be arranged systematically. This is useful to make it easier for researchers to find out the steps or paths that will be taken to achieve the goals and final results of the research that has been done. The following is a form of the stages that will be carried out through the following flowchart explanation figure 2.

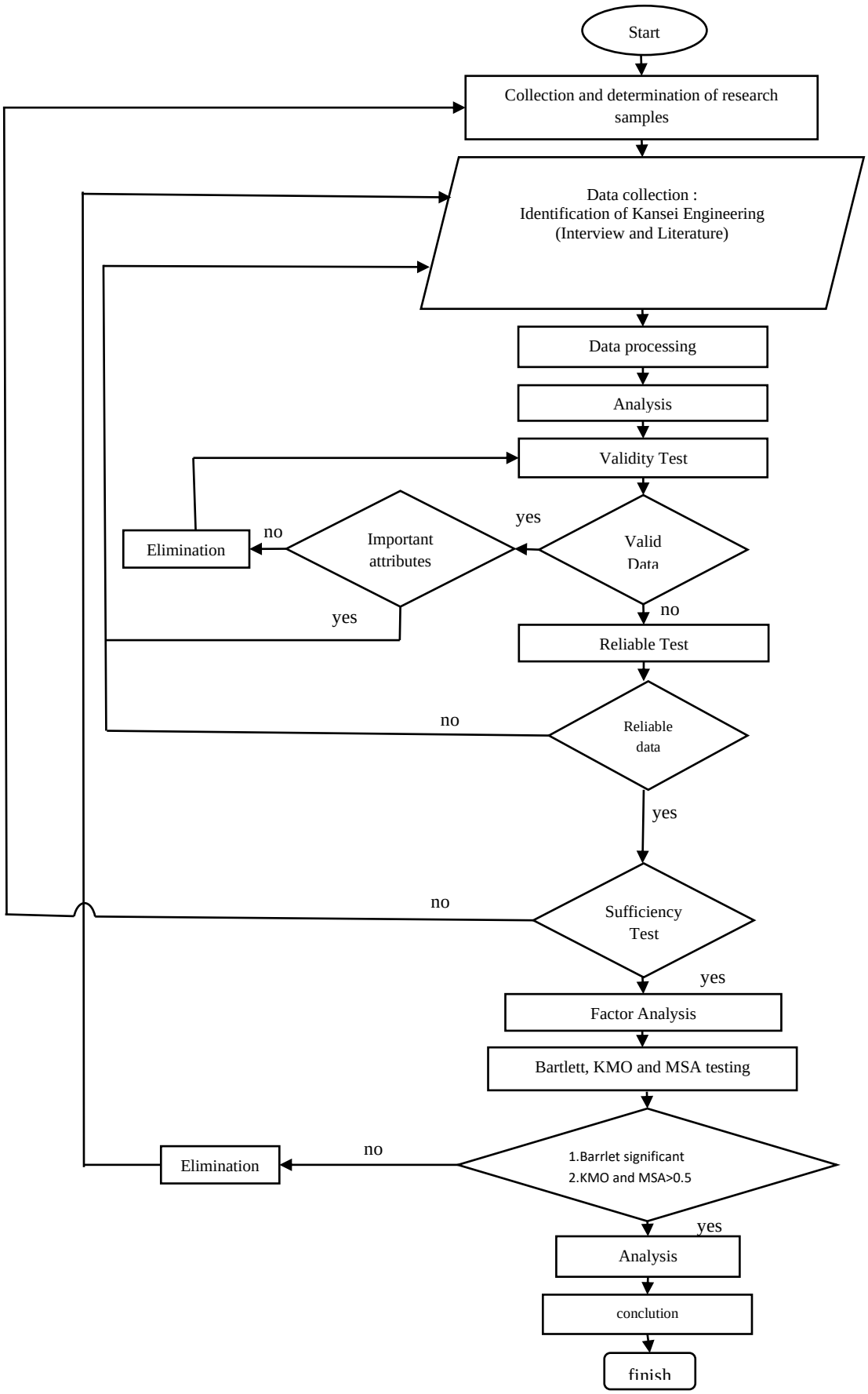

Fig. 2. Research Methodology Flowchart

4. Results

4.1 Data collection

Data collection is carried out in this method, namely the determination or identification of kansei words where in conducting a research it is necessary to have data in order to facilitate data processing later. Kansei is used as a way to express ideas obtained from consumers on one of the factors or reasons for consumers in choosing educational game tools, namely puzzles. Kansei word identification was carried out by conducting direct interviews with 10 respondents, namely teachers from PAUD to get kansei word opinions about the shape of the face puzzle educational game tool. This step is carried out with the aim of getting the kansei word where the answer comes from the respondent. The next step is to make a questionnaire with a level of importance (sematic differential).

Table 2 - Collection of Kansei Words

No.	Primary needs	Secondary need	Kansei Word
1	Form	Box Round	Unique shape
		Rectangular parallelogram	Simple Shape
2	Color	Highlighter Color Dark Color	Colored
		Many colors	
3	Security Products	Neat Shape Not Easy to Scatter	Neat
4	Product Price	Economical price	Decent Price
5	Product Price	Does not harm the environmen	Environmentally Friendly
6	*Acceptability*	Children acceptable	Child Friendly
7	Product display	Uneven Wavy Rough	Delicate Products
8	Product design	Colored Unique	Attractive Design
		Traditional Following the Trend (Modern)	Modern
9	Ease of storage	Practical	Easy to Carry
10	*Durability*	Durable Damaged easily	Durable
11	*User Friendly*	Multifunction Easy to rearrange	Easy to Use
12	Use	Multifunction One Function	Multifunction
13	Product material	Wood Board Plywood Wooden Beams	Standard Material

4.1.1 Identify Kansei Word

Kansei Word is obtained from the collection of questionnaires that have been distributed, where this questionnaire is addressed to respondents who have used and also purchased puzzle educational game tools. This is done with the aim of getting the best choice result that will be applied to the puzzle form. The following are the results of the interviews that have been conducted as follows table 2.

4.1.2 Grouping Kansei Words

After grouping kansei words, we will get the results from grouping kansei words from this educational puzzle game tool, namely: Unique shapes, simple shapes, colorful, neat, reasonable

prices, child-friendly environment friendly, delicate products, attractive designs, modern, easy to carry, durable, easy to use, multifunctional and standard materials.

4.2 Data processing

4.2.2 Validity dan Reability

The next step is data processing which is carried out to get perceptions from consumers later. Below is a presentation of the data from the semantive differential 1 questionnaire testing on 31 respondents through SPSS software. The data will be said to be valid if the value of r count > r table. The value of r table for the data of 31 respondents is 0.355 which is obtained from the value of df = N-2. From the statement of the calculation results of the processing table of the validity test results above, it is known that statement 14 (Multifunction) is declared invalid because the value of $R_{count} < R_{table}$, therefore data that has been declared invalid will be eliminated and then the validity test of the second iteration is carried out. From the statement of the calculation results of the processing table of the validity test results above, it is known that statement 11 (Easy to Carry) is declared invalid because the value of $R_{count} < R_{table}$, so from this it is the result of the third iteration validity test:

Table 3 - Recapitulation of 1 Iteration Validity Test Results

No	Statement No.	Statement	R count	R table	description
1	1	Unique Shape	0,389	0,355	Valid
2	2	Simple Shape	0,381	0,355	Valid
3	3	Colored	0,566	0,355	Valid
4	4	Neat	0,374	0,355	Valid
5	5	Decent Price	0,4755	0,355	Valid
6	6	Environmentally friendly	0,357	0,355	Valid
7	7	Child Friendly	0,369	0,355	Valid
8	8	Delicate Products	0,3953	0,355	Valid
9	9	Attractive Design	0,3805	0,355	Valid
10	10	Modern	0,483	0,355	Valid
11	11	Easy to carry	0,395	0,355	Valid
12	12	Durable	0,560	0,355	Valid
13	13	Easy to use	0,377	0,355	Valid
14	14	Multifunction	0,185	0,355	Invalid
15	15	Standard Material	0,471	0,355	Valid

After conducting the validity test above in iteration 3, 13 valid questions were obtained, where $R_{count} > R_{table.}$

From the statement from the calculation results in table 3 processing the validity test results above, it is known that statement 14 (Multifunction) is declared invalid because the value of $R_{count} > R_{table}$, therefore the data that has been declared invalid will be eliminated and then tested for the second iteration of validity. Table 4 is the result of the second iteration validity test.

Table 4 - Recapitulation of 1 Iteration Validity Test Results

No	Statement No.	Statement	R count	R table	description
1	1	Unique Shape	0,438	0,355	Valid
2	2	Simple Shape	0,397	0,355	Valid
3	3	Colored	0,5755	0,355	Valid
4	4	Neat	0,400	0,355	Valid
5	5	Decent Price	0,4087	0,355	Valid
6	6	Environmentally friendly	0,404	0,355	Valid
7	7	Child Friendly	0,380	0,355	Valid
8	8	Delicate Products	0,3908	0,355	Valid
9	9	Attractive Design	0,406	0,355	Valid
10	10	Modern	0,473	0,355	Valid
11	11	Easy to carry	0,337	0,355	Invalid
12	12	Durable	0,621	0,355	Valid
13	13	Easy to use	0,446	0,355	Valid
15	15	Standard Material	0,422	0,355	Valid

From the statement from the calculation results in table 5 processing the results of the validity test, it is known that statement 11 (Easy to Carry) is declared invalid because the value of $R_{count} > R_{table}$, so from this are the results of the third iteration validity test:

Table 5 - Recapitulation of 3 Iteration Validity Test Results

No.	Statement No.	Statement	R count	R table	description
1	1	Unique Shape	0,389	0,355	Valid
2	2	Simple Shape	0,381	0,355	Valid
3	3	Colored	0,566	0,355	Valid
4	4	Neat	0,374	0,355	Valid
5	5	Decent Price	0,4755	0,355	Valid
6	6	Environmentally friendly	0,357	0,355	Valid
7	7	Child Friendly	0,369	0,355	Valid
8	8	Delicate Products	0,3953	0,355	Valid
9	9	Attractive Design	0,3805	0,355	Valid
10	10	modern	0,483	0,355	Valid
11	12	Durable	0,560	0,355	Valid
12	13	Easy to use	0,377	0,355	Valid
13	15	Standard Material	0,471	0,355	Valid

After conducting the validity test above in iteration 3, 13 valid questions were obtained, where $R_{count} > R_{table.}$

The reliability test is carried out after the validity test can be seen, the next step is to test the reliability processing. Below are the results of the collection of 31 respondents who have been given with 13 valid questions carried out in the third iteration test.

Table 6. Results of the Reliability Test

Reliability Statistics		
Cronbach's Alpha	*Cronbach's Alpha Based on Standardized Item*	*N of Item*
0,662	0,662	13

The next step after doing the above test, we then do a factor test which is to determine the number of factors and factor rotation. The tests used are the kaiser mayer olkin formula and bartlett's test sphericity. The following are the results of the first iteration factor analysis test as follows:

Table 7 - Test Results of KMO and Bartlett's iteration 1

KMO and Bartlett's		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0,664
Bartlett's Test of Sphericity	*Approx. Chi-Square*	324,769
	Df	103
	Sig.	0,001

After processing the data above, the results of the KMO test of 0.664 are obtained where the data is more than sufficient for factor analysis, where the results are in the range from 0.6 to 0.7. Furthermore, in the calculation of the Bartlett's test, the Chi-Square result is 324.769 with a significance value of 0.00 <0.05, thus the variables used are correlated with other variables. Next is to do the MSA test, and the following are the results of the recapitulation of the MSA value test in iteration 1.

From the results of the MSA calculation above, it can be seen that in the MSA calculation there is 1 statement that is below 0.5, namely statement 14 (Multifunction) with a value of 0.470. The next step is to re-test KMO and MSA in the second iteration. Below are the results of testing data from the second iteration of KMO and MSA tests from table 6.

Table 8 - KMO and Bartlett's iteration test results 2

KMO dan Bartlett's		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0,672
Bartlett's Test of Sphericity	*Approx. Chi-Square*	305,262
	Df	98
	Sig.	0,000

After processing the data above, the results of the KMO test of 0.674 are obtained where the data is more than sufficient for factor analysis, where the results are in the range from 0.6 to 0.7. Furthermore, in the calculation of the Barlett's test, the Chi-Square result is 305.262 with a significance value of 0.00 <0.05, thus the variables used are correlated with other variables. Next is to do the MSA test, and the following are the results of the recapitulation of the MSA value test in iteration 2.

Table 9 - MSA Test Results iteration 2

No	Statement No.	Quation	MSA test	MSA test	description
1	1	Unique shape	0,630	0,5	Valid
2	2	Simple shape	0,680	0,5	Valid
3	3	Colored	0,679	0,5	Valid
4	4	Neat	0,607	0,5	Valid
5	5	Decent Price	0,635	0,5	Valid
6	6	Environmentally friendly	0,613	0,5	Valid
7	7	Child Friendly	0,663	0,5	Valid
8	8	Delicate Products	0,605	0,5	Valid
9	9	Attractive Design	0,617	0,5	Valid
10	10	modern	0,657	0,5	Valid
11	11	Easy to carry	0,620	0,5	Valid
12	12	Durable	0,689	0,5	Valid
13	13	Easy to use	0,624	0,5	Valid
14	15	Standard Material	0,663	0,5	Valid

From the results of the MSA calculation above, it can be seen that the MSA calculation of all 14 questions can be predicted by other statements with small errors that can be seen

5. Discussions

The results of interviews conducted by the author with PAUD teachers showed that children were very interested in the educational toys presented. Children are able to understand body parts well after using educational toys. This is in line with Jindo & Hirasago (1997) who say that the impression of the kesei engineering method can make it easier for the audience to remember the impression of the message offered. This educational game is also a new innovation in learning media. Aryanny & Saputri (2020) also conveyed the same thing about new innovations in the development of economical cake boxes. It is true that the games produced are able to answer the challenge of financing difficulties in procuring limited game equipment. however, with educational games that are inexpensive and have many benefits, all of these challenges can be overcome. Khurrohmah (2017) has proven this in his research on Redesigning Learning Facilities in Kindergartens Using the kansei engineering method, as well as Kusumaningtyas & Sediyono (2017) who have conducted research on customer satisfaction by making excellent land certificates. This is in line with the results of the author's research which has a positive impact on children's interest in the learning process by using the resulting educational game tools

6. Conclusion

After doing research, it can be concluded that in designing educational game tools this picture puzzle obtained from kansie words has a positive influence on children's interest in participating in learning. Meanwhile, from the Kansei engineering point of view, children easily remember and understand the meaning of the learning delivered. This is obtained based on the identification of a combination of kansei words and kansei engineering and data processing including: Unique Shapes, Colors, Neat, Environmentally Friendly, Child Friendly, Attractive Designs, Modern, Durable, Easy to Use, and Standard Materials.

References

Aryanny, E., & Saputri, C. P. A. (2020). Pengembangan Box Kue Yang Ergonomis Dan Inovatif Dengan Metode Kansei Engineering Dan Model Kano (Studi Kasus : Pedagang Kue Basah

di Wilayah Surabaya). *Tekmapro : Journal of Industrialis Engineering and Management*, 15(1), 68–80. https://doi.org/10.33005/tekmapro.v15i1.136

Cahyani, at al. (2016). Uji Validitas dan Reabilitas Terhadap Implementasi Aplikasi Penjualan dan Pembelian. *Information System For Educators and Professionals*, *1*(1), 21–34.

Ernawati, I, dan Sukardiyono, T. (2017). Uji Kelayakan Media Pembelajaran Interaktif Pada Mata Pelajaran Administrasi Server. *Elinvo (Electronics, Informatics, and Vocational Education)*, Universitas Negeri Yogyakarta, *2*(2), 204–210. https://doi.org/10.21831/elinvo.v2i2.17315

Fajar Tri Harjanto. (2019). Identifikasi Kebutuhan Konsumen Terhadap Kursi Antropometri Dengan Metode Kansei Engineering. *Program Studi Teknik Industri, Fakultas Teknik, Universitas Tanjungpura*, 27–31.

Guslinda & Kurnia, R. (2018). *Media pembelajaran anak usia dini.* Surabaya: CV. Jakad Publishing

Harada, A. (1998). On the Definition of Kansei. In Modeling the Evaluation Structure of Kansei Conference. Volume 2, page 22.

Hasanah, S. N. A., & Hindarto, H. (2018). Ekstraksi Ciri Sinyal Eeg Untuk Gangguan Penyakit Epilepsi Menggunakan Teknik Sampling. *Jurnal Informatika Polinema*, *5*(1), 1. https://doi.org/10.33795/jip.v5i1.127

Hasanah, U. (2019). Penggunaan Alat Permainan Edukatif (Ape) Pada Taman Kanak-Kanak Se-Kota Metro. AWLADY : Jurnal Pendidikan Anak, 5(1), 20. https://doi.org/10.24235/awlady.v5i1.3831

Hasyim, A., I. (2017). Peran Sampling Dan Distribusi Data Dalam Penelitian Komunikasi Pendekatan Kuantitatif. *Jurnal Studi Komunikasi Dan Media*, *21*, 111–126.

Ishihara S, Ishihara K, Nakagawa R, Nagamachi M, Sako H, Fujiwara Y, Naito M. (2010). Development and improvement of a washer-dryer with *kansei* ergonomics. *Proceedings of The International MultiConference of Engineers and Computer Scientists. Conference*.

Ishihara, S., Ishihara, K., Nagamachi, M. (1993). Analysis of Individual Differences in Kansei Evaluation Data Based on Cluster Analysis. Kansei Engineering International 1.1 : 49-58.

Jindo T, Hirasago K. (1997). Application studies to car interior of kansei engineering. *International Journal of Industrial Ergonomics 19*. 105-114.

Karim, A. (2019). Pengaruh Tagline Iklan Versi "Axis Hits Bonus" Dan Brand Ambassador Terhadap Brand Awareness Kartu Axis (Studi Pada Mahasiswa STIE Amkop Makassar). *Movere Journal*, *1*(1), 1–13. https://doi.org/10.53654/mv.v1i1.28

Khairi, H. (2018). Karakteristik Perkembangan Anak Usia Dini dari 0-6 Tahun. *Jurnal Warna* Vol. 2 , No. 2, Desember 2018. 15–28.

Khurrohmah, et al. (2017). Perancangan Ulang Fasilitas Belajar Pada Taman Kanak-Kanak Dengan Menggunakan Metode KANSEI ENGINEERING (Studi Kasus TK Islam Silmi Samarinda). *Seminar Nasional IENACO 2017*, 1–7.

Kusumaningtyas, J. A., Sediyono, E. (2017). Analisis Kepuasan Pelanggan Pembuatan Sertifikat Tanah Dengan Menggunakan Servqual Dan Kansei Engineering Berdasarkan Twitter Bpn Salatiga. Universitas Kristen Satya Wacana. *Jurnal Teknologi Informasi dan Ilmu Komputer (JTIIK)*, Vol. 4, No. 3.

Lokman, AM, (2010). Desain & Emosi: Metodologi Rekayasa Kansei. Malaysia Jurnal Komputasi (MJOC), 1(1), pp. 1-12

Nagamachi M. (2002). Kansei engineering as a powerful consumer-oriented technology for product development. *Applied Ergonomics 33*. 289-294.

Nagamachi, M. (1992). Kansei Engineering And Its Method. Management System, 2 (2), 97-105.

Nagamachi, M. (1995). Kansei Engineering: A new ergonomic consumer-oriented technology for product development, *International Journal of Industrial Ergonomics* Vol.15 No.1, pp 3-11.

Nagamachi, M., (2011). Kansei/Teknik Afektif dan Sejarah Kansei/Afektif Rekayasa di Dunia. Di: M. Nagamachi (Ed.), Kansei/Teknik Afektif, hlm. 1 12, New York: CRC Press

Nilawati, et al. (2017). Identifikasi Pemanfaatan Alat Permainan Edukatif (APE) dalam Mengembangkan Motorik Halus Anak Usia Dini. *Jurnal Pendidikan Anak*, Volume 6.

Nilawati, et al. (2019). Alat permainan edukatif berbasis lingkungan untuk pembelajaran saintifik tema lingkungan bagi guru paud korban gempa. *Jurnal Pendidikan Anak*, *8*(1), 1–6. https://doi.org/10.21831/jpa.v8i1.26760

Nurdin, Hamdhana, D., & Iqbal, M. (2018). Aplikasi Quick Count Pilkada Dengan Menggunakan Metode Random Sampling Berbasis Android. *E-Journal Techsi Teknik Informasi*, *10*(1), 141–154. https://doi.org/10.29103/techsi.v10i1.622.

Park J, Han SH. (2004). A fuzzy rule-based approach to modeling affective user satisfaction towards office chair design. *International Journal of Industrial Ergonomics 34*. 31-47. Product

Schutte, S., Eklund, J., Ishihara, S., & Nagamachi, M. (2008). "Affective meaning: the Kansei engineering approach" in Schifferstein, H.N.J. and Hekkert, P. (Eds.), Product Experience, Elsevier Ltd, Oxford, UK, pp.477- 496.

Sumardi, et al. (2018). Peningkatan Kemampuan Motorik Halus Anak Usia 5-6 Tahun Melalui Penggunaan *Play Dough*. *Jurnal Paud Agapedia*, 2(1), 89–99. https://doi.org/10.17509/jpa.v2i1.24392.

Tanoue C, Ishizaka K, Nagamachi M. (1997). Kansei engineering: A study on perception of vehicle interior image. *International Journal of Industrial Ergonomics 19*. 115-128.

Tedjasaputra, M. S. (2001). *Bermain, mainan dan permainan.* Jakarta: PT Grasindo

Yogasara, T., & Valentino, J. (2017). Mewujudkan Mobil Nasional Indonesia: Desain 4×2. Jurnal Teknologi Internasional (2017) 2: 338-351 ISSN 2086-9614. *Jurusan Teknik Industri, Universitas Katolik Parahyangan, Jl. Ciumbuleuit 94, Bandung 40141, Indonesia*. 2: 338-351 ISSN 2086-9614.

Yoshikawa, A. (2000). Subjective information processing: Its foundation and applications. Biomedical Soft Computing and Human Sciences, Vol. 6(1), 75-83.

Zikra Hayati. (2019). Penggunaan Alat Permainan Edukatif (Ape) Dari Botol Plastik Dan Koran Bekas Untuk Meningkatkan Kreatifitas Aud. *AWLADY : Jurnal Pendidikan Anak*, *5*(1), 56. https://doi.org/10.24235/awlady.v5i1.3457.