The effect of Kumon learning model on mathematics learning outcomes in cognitive style view

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Abstract. This study aimed to determine the effect of Kumon learning model on mathematics learning outcomes in cognitive style view in the Eighth grade students of SMPN 21 Makassar. The research design was quasi experiment with factorial design. The population of this study was the Eighth grade students of SMPN 21 Makassar and the sample technique used was random sampling. The instruments of this study were mathematics learning achievement test, which was divided into pretest and posttest, and GEFT (Get Embed Figure Test) which aimed to categorize the students into two types, FI (field independent) and FD (field dependent). The results indicated that the average improvement of mathematics learning outcomes by applying Kumon model in experimental class increased 34.06% and only 28.83% for control class in the eighth grade students of SMPN 21 Makassar. It could be concluded that the students with FI cognitive style using Kumon model had higher learning outcomes than the students with FI cognitive style taught without Kumon model. And the researcher did not find any significant differences on the students' learning outcomes of FD cognitive styles in experimental class and control class. Therefore, it could be concluded that Kumon learning model affected the mathematics learning outcomes in cognitive style view in the Eighth grade students of SMPN 21 Makassar.

1. Introduction
Education has important role in forming human quality. When we look at the facts in the reality, many uneducated people fall into poverty because of the limited knowledge and understanding that he/she has. According to Muhibbin Syah, education is a process with certain methods so that we can obtain knowledge, understand and behave as our need [1].

Education is human necessities without exception. Everyone has the right to proper education so that she/he does not become stupid, poor and enslaved. Education was chosen as the main thing in developing the culture and character of the nation. Because of education is a means of creating a new generation of the nation's future, it is expected to improve the quality of the younger generation to be able to minimize various cultural and national character problems [2].

Education is a process in order to influence students applying what they have learn to the environment and they are expected to change themselves and their family in good terms. Education aims to direct and to guide the activities of educators and students to participate in learning process. Because there are clear objectives, all efforts and thoughts of educators are focused to get the goals. If there are no clear objectives, the activities will not produce good results [3].
Mathematical lessons are needed by the students in elementary and secondary schools to equip them with the ability to think logically, analytically, systematically, critically, creatively, accurately, effectively and efficiently as well as the ability to work together in problem solving. Because mathematics is one field of science that has an important role in the development of science and technology, whether as a tool in the application of other fields of science or in the development of Mathematics itself [4].

In learning Mathematics, the students are expected to be active in order to have an impact on students' memories to remember what they have learned. A concept will be easily understood by students when it is presented precise, clear and interesting procedures and steps. One of the factors that influence students' success is the activeness of themselves [5].

The effectiveness of Mathematics learning is determined from various methods in improving students' abilities to solve mathematical problems. one of the schools that became the focus of observation for several researchers was SMPN 21 Makassar. Based on the observations, many students of the 8th grade of SMP Negeri 21 Makassar had score below the Minimum Standar Criteria (KKM) or 65 points. From the total of the 8th grade students of SMPN 21 Makassar 2017/2018, there are 55% or around 170 students who got scores below KKM. According to one of the Math teachers, there were several students who had difficulty in understanding Mathematics which had impact to the decrease of mathematical achievement in the school. The students still had obstacles using symbols in learning Mathematics. Based on a research conducted by Pangabean, there was an effect of Kumon learning model toward the students' Mathematics learning outcomes on integer lessons [6].

Kumon learning model is a learning that combines concepts, skills, individual work, and maintains a comfortable and pleasant learning atmosphere. Kumon learning not only teaches how to count, but also can improve students' ability to focus more on doing things and self-confidence. Learning theory is also very important in the learning process. One learning theory that fits Kumon model is cognitive learning theory. It is more concerned to the process than the outcome [7].

Cognitive style is the way a person processes, stores or uses information to respond to a task. Cognitive style is divided into 2 types namely Field Dependent and Independent Field. The most fundamental difference in these two types of cognitive style is the way of solving the problem where the Independent Field is more analytic in viewing problems than the Dependent Field [8].

Lack of mathematical understanding can hamper the learning process in the classroom. Because the learning process in the classroom is still delivering information from educators to the students (one-way), it is expected by using Kumon model the students' mathematical understanding can be better so that the learning outcomes also improve.

2. Method

The approach of this study was quantitative approach by using quasi experimental and factorial design. This design consisted of 2 group; experimental class and control class. Experimental class is a class that applied Kumon learning model while the control class was a class that did not apply it. GEF (Get Embed Figure Test) aimed to categorize the students' cognitive style into two types, FI (field independent) and FD (field dependent). This research was conducted at SMP Negeri 21 Makassar, South Sulawesi Province. The population was the Eighth grade students of SMPN 21 Makassar and the sample technique used was random sampling. To ensure the initial state of the two classes studied by researchers give a pretest. After giving a pretest the learning outcomes are analyzed and found that class VIII A and VIII B have the same characteristics in its initial state in terms of learning outcomes. Then VIII A was chosen as the experimental class and VIII B as the control class.
The samples of experimental class were class VIII consisted of 32 students and class VIII B consisted of 34 people as the control class. The instrument used in this study was the form of essay test.

Research data were analysed using descriptive and inferential statistics. Descriptive statistical analysis was used to determine the general description of the students' learning outcomes and inferential statistical analysis was used to test the research hypotheses using the ANOVA test. However, the normality test and homogeneity test must be done first as a pre-requisite test [9]. Descriptive analysis for the pretest and posttest tests in the experimental class and the control class, descriptive to describe the mean, range, maximum, minimum, standard deviation and variance in each class. Furthermore, the data are grouped into categories of high, medium, and low mastery levels [10], so that it can be seen the comparison of abilities of each class and proceed with descriptive of the categorization of the cognitive styles of FD and FI in each class.

3. Result and discussion

3.1. Description of the students' mathematics learning outcomes using Kumon model in the VIII A class of SMPN 21 Makassar as experimental class.

The following table compared learning outcomes before and after implementing Kumon model.

| Level of Mastery | Classification | Pretest Experimental Class | Posttest Experimental Class |
|------------------|----------------|---------------------------|-----------------------------|
|                  | Frequency      | Percentage (%)            | Frequency                   | Percentage (%) |
| 0-36             | 6              | 19                        | 0                           | 0              |
| 37-65            | 26             | 81                        | 0                           | 0              |
| 66-100           | 0              | 0                         | 32                          | 100            |
| Total            | 32             | 100                       | 32                          | 100            |

Based on the Table 1, it described that the posttest result of learning by applying Kumon model had better scores than the pretest. The highest percentage of the experimental class before being treated was in the low category, while after being given the treatment using Kumon model it was in the high category.

3.2. Description of the students’ Mathematics learning outcomes using Kumon model in the VIII B class of SMPN 21 Makassar as control class.

The following table compared learning outcomes of pretest and posttest in VIII B class.

| Level of Mastery | Classification | Pretest Control Class | Posttest Control Class |
|------------------|----------------|-----------------------|------------------------|
|                  | Frequency      | Percentage (%)        | Frequency              | Percentage (%) |
| 0-36             | 18             | 53                    | 0                      | 0              |
| 37-65            | 16             | 47                    | 0                      | 0              |
| 66-100           | 0              | 0                     | 34                     | 100            |
| Total            | 34             | 100                   | 34                     | 100            |
In Table 2, it was found that before being given a treatment (Pretest) there were 18 students (53%) in low category, 16 students (47%) in pair category, and there was no student (0%) in high category whereas after treatment (Posttest) there was no student (0%) in low category, no student (0%) in pair category, and all students (100%) are in the high category. So it could be concluded that the largest percentage of the control class before having treatment was in the low category while after treatment was in the high category.

3.3. Description of the students’ mathematics learning outcomes in experimental class with FD and FI cognitive style

Based on the results of the GEFT test and mathematics learning outcomes in the experimental class, it can be categorized for the independent and dependent field cognitive styles.

| Description  | N  | Range | Min | Max | Mean | Std. Deviasi | Varian |
|--------------|----|-------|-----|-----|------|--------------|--------|
| FI Pretest   | 12 | 35    | 35  | 70  | 53.33| 11.547       | 133.333|
| FI Posttest  | 12 | 25    | 75  | 100 | 87.08| 7.525        | 56.629 |
| FD Pretest   | 20 | 50    | 20  | 70  | 46.00| 11.630       | 155.789|
| FD Posttest  | 20 | 25    | 70  | 95  | 80.25| 6.382        | 40.724 |

Based on the table above, it can be concluded that learning by using the kumon model on students with FD and FI cognitive styles has better posttest scores than pre test scores.

3.4. Description of the students’ mathematics learning outcomes in control class with FD and FI cognitive style

Based on the results of the GEFT test and mathematics learning outcomes in the control class, it can be categorized for the independent and dependent field cognitive styles.

| Description  | N  | Range | Min | Max | Mean | Std. Deviasi | Varian |
|--------------|----|-------|-----|-----|------|--------------|--------|
| FI Pretest   | 13 | 45    | 20  | 65  | 39.23| 12.391       | 123.526|
| FI Posttest  | 13 | 15    | 70  | 70  | 76.92| 5.965        | 35.577 |
| FD Pretest   | 21 | 30    | 25  | 55  | 38.57| 5.804        | 33.690 |
| FD Posttest  | 21 | 20    | 70  | 95  | 78.10| 5.804        | 33.690 |

Based on the table above, it can be concluded that learning without using a kumon model on students with FD and FI cognitive styles has better posttest scores than pre test scores.

3.5. Learning outcome differences of mathematics in experimental class and control class of the Eight grade students based on the cognitive style view

| Description  | Sum of Squares | Df | Mean Square | F     | Sig. |
|--------------|----------------|----|-------------|-------|------|
| Between Groups| 439.845        | 1  | 439.845     | 9.847 | 0.003|
| Within Groups | 2858.640       | 64 | 44.666      |       |      |
| Total        | 3298.485       | 65 |             |       |      |
Table 5 illustrated the value of $p \cdot \text{sig} < \alpha = 0.003 < 0.05$, then $H_0$ was rejected so that it could be concluded that there was difference between the class which applied Kumon model and did not apply it to the learning outcomes of Mathematics.

**Table 6.** Anova test of learning outcome differences of mathematics which had Field Independent (FI) cognitive style in experimental and control classes

|                | Sum of Squares | Df | Mean Square | F     | Sig. |
|----------------|----------------|----|-------------|-------|------|
| Between Groups | 644.160        | 1  | 644.160     | 14.112| 0.001|
| Within Groups  | 1049.840       | 23 | 45.645      |       |      |
| Total          | 1694.000       | 24 |             |       |      |

Table 6 described the value of $p \cdot \text{sig} < \alpha = 0.001 < 0.05$, then $H_0$ was rejected so that it could be concluded that there was difference between learning outcomes of Mathematics in experimental class which applied Kumon model and had Field Independent (FI) cognitive style and control class which did not apply it.

**Table 7.** Anova test of learning outcome differences of mathematics which had Field Dependent (FD) cognitive style in experimental and control classes

|                | Sum of Squares | Df | Mean Square | F     | Sig. |
|----------------|----------------|----|-------------|-------|------|
| Between Groups | 47.562         | 1  | 47.562      | 1.281 | 0.265|
| Within Groups  | 1447.560       | 39 | 37.117      |       |      |
| Total          | 1495.122       | 40 |             |       |      |

Table 7 described the value of $p \cdot \text{sig} > \alpha = 0.265 > 0.05$, then $H_0$ was accepted so that it could be concluded that there was not difference between learning outcomes of Mathematics in experimental class which applied Kumon model and had Field Dependent (FD) cognitive style and control class which did not apply it.

**Table 8.** Anova test of the interaction between learning models and cognitive styles on learning outcomes

| Source                  | Type III Sum of Squares | Df | Mean Square | F      | Sig.  |
|-------------------------|--------------------------|----|-------------|--------|-------|
| Corrected Model         | 801.086a                 | 3  | 267.029     | 6.629  | .001  |
| Intercept               | 402948.718               | 1  | 402948.718  | 1003.535| .000  |
| Group                   | 588.112                  | 1  | 588.112     | 14.600 | .000  |
| Cognitive Style         | 124.280                  | 1  | 124.280     | 3.085  | .084  |
| Group * Cognitive Style | 248.523                  | 1  | 248.523     | 6.170  | .016  |
| Error                   | 2497.399                 | 62 | 40.281      |        |       |
| Total                   | 427300.000               | 66 |             |        |       |

Based on table 8, it illustrated the value of $p \cdot \text{sig} > \alpha = 0.016 > 0.05$, then $H_0$ was rejected so that it could be concluded that there was an interaction between learning models and cognitive styles towards learning outcomes in Mathematics.
The normality test results of the pretest and posttest in experimental and control classes showed that the overall data was normally distributed. Furthermore, homogeneity test results indicated that the data was homogeneous.

This section answered the first hypothesis. There was difference between the class applying Kumon model and did not apply it on students' learning outcomes. Kumon learning model was a learning model that focused on the students where the teacher explained the basic concepts and then provided exercises to them. As generally in understanding Mathematics, the students must practice answering the exercises frequently. While the class which did not implement Kumon model was taught using direct learning model in which the teacher had role as the center of the learning process so the students did not get the concepts from Mathematics itself.

Referring to the previous finding conducted by Dina Apriana in 2014, the results showed that the implementation of Kumon learning model of mathematical learning in the aspect of number division could increase the students' successful. So it can be concluded that the Kumon model affected the students' Mathematics learning outcomes [11]. Based on cognitive theory, learning not only involved the relation between stimulus and response, but one's behavior was determined by his/her perception and understanding of situations related to his learning goals. The theory supported that understanding was very important in achieving learning objectives and comprehension of Mathematics which meant that the students really needed exercises in solving Math problems. This indicated that using Kumon learning model improved the students' learning outcomes of Mathematics.

This section answered the second hypothesis. There was difference between learning outcomes of Mathematics in experimental class which applied Kumon model and had Field Independent (FI) cognitive style and control class which did not apply it. The students who had FI cognitive style were them who have a high level of analysis where they could answer the questions correctly without help or guidance from the teacher. Kumon model was very suitable for the students who had FI cognitive learning style because they were the main focus and played a large role in the learning process. This was also supported by the research results of Karyanti, he concluded that the students with FI cognitive style gained better performance compared to them who had FD cognitive style [12]. Based on Constructivism theory, learning methods focused on the process and freedom in seeking knowledge and efforts in constructing experience. In other words, this theory emphasized the activeness of the students to learn and to find their own competencies, knowledge or technology, and other things needed to develop themselves. In the learning process, it gave the students opportunity to express their opinions in their own language and to think about their experiences so that the students became more creative and imaginative and could create a conducive learning environment. The students who had high level of analysis could solve mathematical problems because of the questions in Math required high analysis and more practices both at school and at home. From the description, it could be concluded that the students with FI cognitive style using Kumon model had higher learning outcomes than the students with FI cognitive style taught without Kumon model.

This section answered the third hypothesis. There was difference between learning outcomes of Mathematics in experimental class which applied Kumon model and had Field Dependent (FD) cognitive style and control class which did not apply it. FD cognitive style has a lower level of analysis than FI cognitive style. The students with FD cognitive style understood the material provided by the teacher so that those students would depend on the teacher's guidance. In this analysis, the researcher did not find any significant differences on the students' learning outcomes of FD cognitive styles in experimental class and control class. That happened because the students with FD cognitive style were very dependent on the teacher's guidance which was very different from the FI cognitive style who had capability to solve problems so that they did not depend on the teacher's guide. The students with FD cognitive style was contrary to the constructivism learning theory which made the students to think, to solve their own problems, to look for ideas, and to make decisions. According to the researcher' observation, if the students depended on the learning provided by the teacher, they would be very difficult to increase the students' understanding. They must improve their knowledge
aside from the teacher. They could read books in the library, learn through the internet with reliable sources, and study together with friends who had more information.

To improve Mathematics learning outcomes, it needed to choose the right learning model to fit the characteristics and abilities of the students. Generally in Mathematics learning, Kumon model was proven better than direct learning model in teaching mathematical concepts to the students. Mathematics learning fitted Kumon model because it more activated the students by providing exercises. The students in experimental class tended to gain high Math scores, this indicated that there was an influence of Kumon model on mathematics learning outcomes in terms of cognitive style so that Kumon learning model interacted with the cognitive style toward learning outcomes. It meant that the learning model and cognitive style had effect on learning outcomes. In applying the learning model, it was necessary to care the students' cognitive style so that the maximum learning outcomes could be reached.

4. Conclusion
The conclusions of this study were: 1) There was the students' learning outcome difference of Mathematics in experimental class which applied Kumon model and control class which did not implement it. 2) There was the students' learning outcome difference of Mathematics with FI cognitive style in experimental class and control class. 3) There was not the students' learning outcome difference of Mathematics with FD cognitive style in experimental class and control class. 4) There was an interaction between learning model and cognitive style on learning outcomes of Mathematics.

References
[1] M. Syah, *Psikologi Pendidikan*. Bandung: Remaja Rosda Karya, 2014.
[2] N. Rubiyanto, *Strategi Pembelajaran Holistik di Sekolah*. Jakarta: Prestasi Pustaka, 2010.
[3] O. Hamalik, *Psikologi Belajar dan Mengajar*. Bandung: Sinar Baru. Algensindo., 2004.
[4] A. Hamzah and Muhlisrarini, *Perencanaan dan Strategi Pembelajaran Matematika*. Jakarta: Raja Grafindo Perkasa, 2014.
[5] N. N. I. Ningsih, “Penerapan Pembelajaran Kooperatif Model kumon untuk Meningkatkan Keaktifan Siswa pada Pelajaran Matematika,” 2010.
[6] S. Pangabean, “Pengaruh Model Kumon Terhadap Hasil Belajar Matematika Siswa Kelas VII SMP Laks. Martadinata Medan,” *Kaji. Penelit. dan Pengambangan UM Mataram*, vol. 8, no. 2, 2017.
[7] Sutarto, “Teori Kognitif dan Implikasinya Dalam Pembelajaran,” *J. IAIN Curup*, vol. 1, no. 02, pp. 1–26, 2017.
[8] A. S. Nur and M. Palobo, “Profil Kemampuan Pemecahan Masalah Matematika Siswa Ditinjau dari Perbedaan Gaya Kognitif dan Gender,” *J. Mat. Kreat.*, vol. 9, no. 2, pp. 139–148, 2018.
[9] Suharti, N. K. Latuconsina, Tasril, A. Sriyanti, and A. Halimah, “The Effect of the Realistic Mathematical Approach Towards the Result of Learning Mathematics Reviewed from the Ability of Numerical Students The Effect of the Realistic Mathematical Approach Towards the Result of Learning Mathematics Reviewed from the Afi,” *J. Phys. Conf. Ser.*, 2018.
[10] E. P. Widoyoko, *Evaluasi Program Pembelajaran*. Yogyakarta: Pustaka Belajar, 2013.
[11] D. Apriana, “Implementasi Model Kumon dalam Pelajaran Matematika pada Kelas Rendah di SDN 2 Sukamulia,” *J. Educ. STKIP Hamzanwadi Selong*, vol. 9, no. 1, 2014.
[12] Karyanti, “Pengaruh Model Pembelajaran Kumon terhadap Pemahaman Matematis ditinjau dari Gaya Kognitif Peserta Didik pada Mata Pelajaran Matematika Kelas VIII SMP Pesawaran,” Universitas Islam Negeri Raden Intan bandung, 2013.