LEARNING THE CRITICAL POINTS FOR ADDITION IN MATEMATIKA GASING

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Abstract

We propose learning Matematika GASING to help students better understand the addition material. Matematika GASING is a way of learning mathematics in an easy, fun and enjoyable fashion. GASING is short for GAmpang, aSyIk, and menyenaNGkan (Bahasa Indonesia for easy, fun and enjoyable). It was originally developed by Prof. Yohanes Surya at the Surya Institute in Indonesia to improve the mathematics education in Indonesia. In Matematika GASING, there is a step called "the critical point" that needs to be mastered for each topic. The focus of our research is the critical point for addition, that is addition of two numbers between $1 - 10$ with a sum less than 20. The subject is a matriculation class at STKIP Surya and the research method used is Classroom Action Research. The statistics obtained is described using Qualitative Descriptive Statistics.

Keyword: Matematika GASING, Addition, Critical Points, Classroom Action Research.

Abstrak

Kami mengusulkan belajar Matematika GASING untuk membantu siswa lebih memahami materi penjumlahan. Matematika GASING adalah cara belajar matematika dengan cara yang gampang, asik, dan menyenangkan. GASING adalah singkatan dari GAmpang, aSyIk, dan menyenaNGkan. Matematika GASING pada awalnya dikembangkan oleh Prof Yohanes Surya di Surya Institute di Indonesia untuk meningkatkan pendidikan matematika di Indonesia. Dalam Matematika Gasing, ada langkah yang disebut "titik kritis" yang perlu dikuasai untuk setiap topik. Fokus penelitian kami adalah titik kritis untuk penambahan, yaitu penambahan dua angka antara 1-10 dengan jumlah kurang dari 20. Subjek penelitiannya adalah kelas matrikulasi di STKIP Surya dan metode penelitian yang digunakan adalah Penelitian Tindakan Kelas. Statistik yang diperoleh dijelaskan menggunakan statistik kualitatif deskriptif.

Kata Kunci: Matematika GASING, Penjumlahan, Titik Kritis, Penelitian Tindakan Kelas

As prospective teachers, students with an educational background are expected to properly master the teaching materials. This is to ensure that they will be able to correctly deliver the material to their students once they become teachers. The material being taught has actually been obtained since the student was in elementary school, but that does not guarantee that he or she has mastered the teaching material, for example the addition topic covered in this research. At the beginning, many students still made mistakes doing simple addition problems such as $\ldots + 8 = 17, 7 + 8 = \ldots$ etc. From 100 questions given, the average time to do the problems was 5.26 seconds. This indicates that they have not got a meaningful learning while in elementary school. According to Jensen [2], a meaningful learning will not be achieved if the learning does not involve deep meaning which leaves a deep impression on the students.

A meaningful learning will be more easily achieved if the learning is done in an enjoyable fashion. Surya and Moss [4] say that, there is no children who can not learn mathematics, what there is are children who do not have opportunities to learn mathematics in a fun and meaningful manner. As a result, Prof. Yohanes Surya, Ph.D at the Surya Institute in Indonesia has developed a method for teaching mathematics, called *Matematika GASING*, to improve the quality of mathematics education in the country. Using the method, the Surya Institute has managed to train mothers and children from Papua, a region in Indonesia that is considered most "left behind".

A key feature of *Matematika GASING* is its emphasis on a step by step process of learning, so that students can easily understand a new material by building on their understanding of the materials taught at the previous steps. For each topic, there is a step called "the critical point" that needs to be mastered in order for the students to be able to solve problems in that topic easily. This is consistent with the research done by Wiyanti and Wakhyuningsih [5] on the topic of addition. They found that students who had mastered the critical point for addition were better at solving addition problems than those who had not mastered it. Motivated by this, in this research we focus on mastery of the critical point for addition in *Matematika GASING*.

The problems addressed in this research are (1) Is there an increase in the students' skill in the *GASING* critical point for addition after a learning with *Matematika GASING*? and (2) Can the students teach the *GASING* critical point for addition after a learning with *Matematika GASING*? The research is focused on the *GASING* critical point for addition, that is addition of two numbers (between $1-10$) whose sum is less than 20. The research was done on 17th– 24th September 2013. The participants of the research were STKIP Surya's students in 2013 FIS1 matriculation class, who came from eastern part of Indonesia (Papua and Ambon). STKIP Surya is a teacher's college located in Tangerang, Indonesia.

METHOD

The research method used was Classroom Action Research that was done collaboratively. According to Lewin on Hamid [1], the basic concepts of Classroom Action Research are Planning, Acting, Observing, and Reflecting.

The Success Indicator

The minimum passing grades for the mastery of the *GASING* critical point for addition in this research are:

1. The written test of addition skill (100 short-answer questions) is finished within 3.5 minutes with a score at least 95 (out of 100).

2. The mental calculation test of addition skill has a grade of "Satisfactory" or "Excellent". To obtain these grades, the students need to answer the questions given almost instantly, within $1-2$ seconds, without using paper and pencil.

3. The written test of the *GASING* teaching knowledge has a grade of "Satisfactory" or "Excellent".

The test asks for knowledge about *Matematika GASING* and its step by step process of learning on the critical point for addition.

4. The microteaching test has a grade of "Satisfactory" or "Excellent". In this test, the student does a short mock teaching on the *GASING* critical point for addition.

RESULTS AND DISCUSSION

Matematika GASING is a way of learning mathematics in an easy, fun and enjoyable fashion. *GASING* is short for **GA**mpang, a**Sy**Ik, and menyena**NG**kan (*Bahasa Indonesia* for easy, fun and enjoyable). *Gampang* (easy) means that concepts are explained using logic and reasoning that is very easily understood and remembered. *Asyik* (fun) means that students are eager to learn continuously without being pressured. *Menyenangkan* (enjoyable) means that students feel happy, can laugh, and their curiosities are satisfied. In the *GASING* learning process, whenever new concepts are introduced, students are first invited to explore and play with concrete objects before being guided to the abstract symbols,as stated by Surya and Moss [4]. In *GASING* most calculations are done mentally, without using paper and pencil.

A key feature of *Matematika GASING* is its emphasis on a step by step process of learning, so that students can easily understand a new material by building on their understanding of the materials taught at the previous steps. For each topic, Surya [3] there is a step called "the critical point" that needs to be mastered in order for the students to be able to solve problems in that topic easily. For the topic of addition, the critical point is additionof two numbers (between $1 - 10$) whose sum is less than 20. The step by step process to achieve that critical point is:

1. Recognizing numbers $1 - 10$.
2. Addition of two numbers whose sum is between $1 - 10$.
3. Recognizing numbers $11 - 19$.
4. Addition of two numbers whose sum is between $11 - 19$.

The class activities consist of one cycle as follows:

1. Planning

   In the planning stage, learning tools needed were prepared which consist of the learning design, the written test of addition skill, the mental calculation test of addition skill, and the written test of the *GASING* teaching knowledge on the critical point for addition. Visual aids in the form of black and white cards were also prepared.

2. Acting

   In the first meeting, the students' addition skill were observed. They were given the written and the mental calculation tests of addition skill. Many of them did not achieve the minimum passing grade. The students were also given the written test of the *GASING* teaching knowledge on the critical point for addition. It turned out that they had not had previous exposure to *Matematika*

GASING. The learning continued with going over the step by step process in *GASING*.

a. Recognizing numbers $1 - 10$

The teacher guided the students on how to teach the topic of addition according to *Matematika GASING*. The first topic was recognizing numbers $1 - 10$. The teacher began by introducing numbers $1 - 10$ using concrete objects. She showed one book and said "this is one book", then she added another book and said "these are two books", and so on until ten books. After that she introduced the abstract symbols "1", "2", until "10". The students practised writing and saying the numbers 1 - 10. They also practised mock teaching. Some students did not teach correctly; for example a student used different objects in introducing numbers: showing two books and one pencil to introduce the notion of "three".

The students also learned on how to introduce numbers using fingers.

Example 1. The teacher showed one index finger, and said "this is one, written as 1". Then the teacher asked "is one only like this?". The students said "no, it can also be one thumb, one little finger, etc".

Example 2. The teacher introduced the notion of "two" by showing 1 index finger and 1 middle finger, or showing 1 index finger and 1 little finger, or other variations. The teacher stressed that various combination of fingers should be used.

Figure 1. Illustration of Recognizing Numbers 1-10 Using Fingers

To introduce the notion of "six", the teacher showed 5 fingers on the left hand and said "five", then showed 1 thumb on the right hand and said "one". After that she put all those fingers together and said "six". Then she did the other variations; for example she showed 6 fingers (5 fingers on the left hand and 1 thumb on the right hand) and said "six". Then she folded the 2 thumbs, showing 4 remaining fingers and said "four". Back to the six fingers she said "six" and then she folded 4 fingers and showed the remaining 2 thumbs and said "two". This was done repeatedly: "six, four, six, two, six, four, six, two, ...". The purpose of doing this was so that later students recognized six as four plus two. The teacher went through a similar process

until the number 10.

To practise their abilities in recognizing numbers, the students called out the numbers represented by the fingers shown by the other students. They   automatically called out the numbers without counting one by one.

b. Addition of two numbers whose sum is between $1 - 10$

After recognizing numbers 1-10, the next step was adding two numbers whose sum is between 1-10.

- **Adding two numbers whose sum is between 1-5.**

  This step is easy once the students have mastered recognizing numbers earlier.

  Example 2.3. The teacher showed 2 fingers on the right hand and said "these are two fingers". Then she showed 1 finger on the left hand and said "this is one finger". Next, she put the fingers on both hands together and said "these are three fingers" so "two plus one is equal to three". Then the students learned how to write that fact in abstract symbols: $2 + 1 = 3$.

- **Adding two numbers whose sum is between 6-10.**

  This is the continuation of the previous process.

  Example 2.4. The teacher showed 4 fingers on the right hand and said "these are four fingers". Then she showed 2 fingers on the left hand and said "these are two fingers". Next, she put the fingers on both hands together and said "these are six fingers" so "four plus two is equal to six". Then the students learned how to write this fact in abstract symbols: $4 + 2 = 6$. All various combination of addition were taught in order from 6 to 10.

  For the 10-sum, the students were guided to discover that $10 = 1 + 9 = 2 + 8 = 3 + 7 = 4 + 6 = 5 + 5$. Then they were taught a novel way to memorize this fact by noticing that the first letters of the numbers (in Indonesian) that were added (so called 10-pairs) matched up. For example, in Indonesian "one" is "*satu*" and "nine" is "*sembilan*" so both start with an "S". They were also taught a song to help them memorize. The rythm of the song is from a popular Indonesian folk song called "*bertamasya*" while the lyrics is as follows:

  > *SS Satu Sembilan, DD Dua Delapan*
  >
  > *TT Tiga dan Tujuh, EE Empat dan Enam*
  >
  > *LL Lima dan Lima, semua jumlah sepuluh*
  >
  > *SS, DD, TT, EE, LL*

  The teacher also taught a game using fingers as another fun way to learn: one person shows three fingers and says "seven"; the other person shows four fingers to indicate that the answer to $3 + ... = 7$ or $... + 3 = 7$ is 4. Some students had a lot of difficulties with this type of addition problem. The students were also guided to observe that addition is commutative, for example $2 + 1 = 1 + 2$.

c. Recognizing numbers $11 - 19$

In this step, visual aids in the form of white cards and black cards were used. The white card is simply a small card colored white. The black card is 10 times the size of a white card, one side of which is colored black while the other side is a 5 x 2 grid colored white (see figure 2.2). White cards represent the units while the black cards represent the tens.
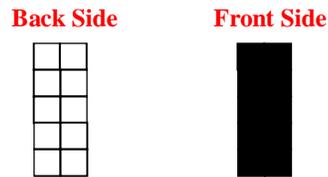
Back Side   **Front Side**

Figure 2. The black card visual aid

Example 2.5. The teacher showed 1 black card and said "this is ten". Then she showed 1 white card and said "this is one". Next, she showed the two cards together and said "this is eleven". The students had the image that eleven consisted of ten and one.
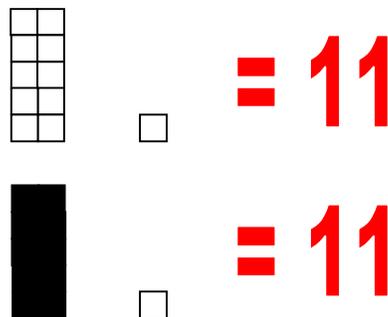
$= 11$

$= 11$

Figure 3. Illustration of recognizing the number 11

The teacher went through a similar process until the number 19, using 1 black card and 9 white cards. The students practised writing and saying the numbers 11 - 19.

d. Addition of two numbers whose sum is between $11 - 19$

This step consists of addition of the types $10+, 9+, 8+, 7+,$ and $6+$. Taking advantage of the commutativity of addition, once $9 + 8$ is learned then $8 + 9$ is automatic for example. The additions that are really needed to be learned are shown in Table 1.

Table 1. Addition of Two Numbers Whose Sum Is Between 11 − 19

10 +	9 +	8 +	7 +	6 +
10 + 1 =				
10 + 2 =	9 + 2 =			
10 + 3 =	9 + 3 =	8 + 3 =		
10 + 4 =	9 + 4 =	8 + 4 =	7 + 4 =	
10 + 5 =	9 + 5 =	8 + 5 =	7 + 5 =	6 + 5 =
10 + 6 =	9 + 6 =	8 + 6 =	7 + 6 =	6 + 6 =
10 + 7 =	9 + 7 =	8 + 7 =	7 + 7 =	
10 + 8 =	9 + 8 =	8 + 8 =		
10 + 9 =	9 + 9 =			

The learning started with addition of the type 10+, where students added 10 with another number from 1 until 9.

Example 2.6. The teacher showed 1 black card and said "this is ten". Then she showed 1 white card and said "this is one". Next she combined the two cards and said "ten combined with one becomes eleven". Abstractly "ten plus one is equal to eleven" or in abstract symbols: $10 + 1 = 11$.

Example 2.7. To do addition of the type 9+, the teacher started by showing the 5×2 grid side of a black card and making sure that the students knew that this represented 10. Then she removed one cell and made sure the students automatically knew that there were 9 cells left which represented 9. To add the 9 with 2, the teacher took 2 white cards and asked "nine plus what becomes ten?" and the students answered "one". So the teacher took 1 white card from the 2 white cards and put it to complete the 9 cells. Now there were 10 and 1 so the result of 9 + 2 was 11.
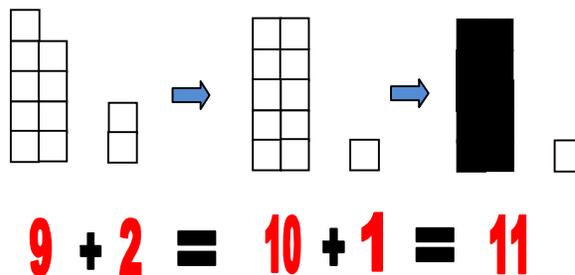

Figure 4. Illustration for $9 + 2 = 11$

After the students knew how to add using visual aids (concrete), they learned how to do it abstractly: $9 + 2 = (9 + 1) + 1 = 10 + 1 = 11$. The other additions were similar.

Example 2.8. The students also learned how to use the notion of 10-pair to add fast. For example, to add $8 + 3$, they first remembered 8 in the head and showed 3 fingers on their hand. Since the 10-pair of 8 is 2, they then folded 2 fingers among the 3 fingers and imagined the "two" went into the head so they had 10 in the head and 1 on the hand, so the result was 11.

In this learning step, there were students who were slow at doing addition of the type $7 +$ and $6 +$. Some students were also slow at solving addition problems in which the second number was greater than the first number; for example $3 + 8$ and $5 + 7$. To handle this problem, the teacher reminded the students that the commutative law holds for addition so $3 + 8 = 8 + 3 = 11$ for example.

Throughout the whole learning process with *Matematika GASING*, the students were given written and mental calculation exercises. They also practised microteaching on the *GASING* critical point for addition.

3. Observing

Based on observations and test results, the learning with *Matematika GASING* in this research can be said successful from the addition skill and the teaching ability aspects. From Figure 5, it can be seen that after the learning with *Matematika GASING* the result of the written test of addition skill improved in terms of both the score and the time aspects. Before the learning many students did not achieve the minimum passing grade but after the learning 78.57% passed. For the mental calculation test of addition skill all students passed after the learning and there were increase of 1 grade from "need improvement" to "Satisfactory" and 5 grades from "Satisfactory" to "excellent". For the microteaching, only one student did not pass after the learning because during the microteaching, the student was very nervous so she did not finish the microteaching. After the learning, all students passed the written test of the *GASING* teaching knowledge on the critical point for addition.

No	Name	Written Test for Addition Skill				Mental Calculation Test		Written Test of Teaching Knowledge	Microteaching Test
		Score		Times					
		Early Observation	Learning Result	Early Observation	Learning Results	Early Observation	Learning Results		
1	Bansalina S. Rumbarak	99	99	6.17	2.3	S	E	E	S
2	Elisabeth Alisia Oktavia	99	100	3.56	2.37	E	E	E	S
3	Handry Alfred Fonataba	100	100	4.18	2.37	S	E	E	S
4	Lina Majefat	98	89	9.15	5.1	S	S	S	S
5	Lisa Iwanggin	100	100	5.12	2.37	S	E	E	S
6	Monic Trully Haumahu	99	100	4.26	2.35	S	E	E	S
7	Nurussyfa A. Tuasamu	99	100	3.48	2	E	E	E	E
8	Obet Gulit Wempi K	89	100	5.58	4.24	Ni	S	S	S
9	Oktovina Fransina Huwae	100	100	3.25	2	E	E	E	S
10	Rahel Udaira	100	100	7.09	3.4	S	E	S	S
11	Senny S Woriasi	98	98	7.56	4.24	S	S	E	S
12	Sonya Liske Rumbewas	99	99	4.45	2.24	E	E	E	Ni
13	Yunus Wona	99	100	4.53	2.53	E	E	E	S
14	Feronika manyakori	-	99	-	3.26	-	S	E	S

Notes:
E : Excelent
S : Satisfactory
Ni : Need Improvement
- : did not participate

Figure 5. Test Results

4. Reflecting

Based on observations and test results, most students had mastered the *GASING* critical point for addition, so the cycle was ended.

CONCLUSION AND SUGGESTION

Many students conveyed that the learning with *Matematika GASING* was something new, easy, and fun. This is consistent with the test results.

Conclusion

The conclusion of this research is as follows:

1. There is an increase in the students' skill in the *GASING* critical point for addition.
2. Most students can teach the *GASING* critical point for addition after a learning with *Matematika GASING*.

Suggestion

Based on the conclusion above, the following are recommended:

1. Matematika *GASING* is a good option for teaching mathematics.
2. Future researches on *Matematika GASING* are recommended, for example on the addition of two-digit numbers.

ACKNOWLEDGEMENT

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