

IMITATING FAILURES IN COMMUNICATING SOLUTION OF MATHEMATICAL PROBLEM SOLVING OF ELEMENTARY SCHOOL STUDENTS

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Abstract

Imitating performance is not a mediocre element, yet it is a unique ability possessed by humans. Researches concerning on imitating performance has been widely conducted in early childhood education and in adults educations. However, imitating performance studies related to elementary school context is rarely explored. This study was intended to figure out the imitating performance of 5th grade student. This study was analyzed qualitatively where the researcher involved in all stage of the research. The results of the research indicated that there were few imitating performance indicators that were not fullfiled. The students were not able to apply the examples in the new context, in other words the students had failed in applying the examples. Consequently, they faced difficulties in communicating the solutions of mathematical problems. Instead of helping the students, the key words provide by a teachers make the students confuse in resolving different problems.

Keywords: Imitating, communication, mathematical problem solving

Imitating is discernible from various scientific perspectives such as psychology, neurology, cognitive, artificial intelligence, animal studies, anthropology, economics, social, and philosophy (Hurley, Chater, Pp, Pp, & Ewen, 2007; Hurley et al., 2007; Meltzoff & Decety, 2003; Shea, 2009; Mcguigan & Marshall-pescini, 2009). But most of the researches that have been done are related to infants or toddlers and children with autism. While the studies on ordinary children of school ages and students of higher education are still rarely found.

Imitating is necessary and important for socio-cognitive ability, therefore, imitating can serve as a tool in learning and provide students with profuse learning opportunities (Meltzoff, Kuhl, Movellan, & Terrence, 2009). Previous research have found that imitating is an effective and efficient way to learn, and been identified to have several factors that can affect imitating effectiveness in the learning process of infants and children (Meltzoff & Decety, 2003; Meltzoff et al., 2009; Seattle, 2014). Long-term memory has an influence on imitating (Hurley et al., 2007). The process of imitating requires high level of cognitive ability since it involves not only the language but also the understanding of other people's thinking.

Imitating involves complex cognitive capacities and plays an important role in human learning (Hurley et al., 2007). Several studies have focused on imitating in adults (Cook & Bird, 2012; Press, 2008), unfortunately there have been few studies focusing on the effects of imitating on adult learning. (Jiang-yuan, Wei, Zhou, & Zhou, 2012; Zhou, 2012) argued when students imitate their teacher in terms of habitual interaction between students and teacher, it positively impacts upon teacher-students relationship and learning outcome. A research by (Zhou & Guo, 2016) state that imitating has a positive

impact on adults learning process (male and female students). Imitating can be employed as a medium in the teaching and learning process. In the learning process, the teacher acts as the model that becomes the center of attention for all students. Students in the learning process both outside and inside the classroom, formally and non-formally can be regarded as observers. It is not strange that the subject will be observed both in the conscious and unconscious conditions. It indicates that imitating can not be separated in the learning process. Based on the aforementioned opinions, imitation in this research means to imitate and process information from the recipients' senses so that it can develop their cognitive and social capabilities and by understanding the purpose of the emulated person, they can perform other ways to achieve the same goal.

Imitating has an important role in learning (Hurley et al., 2007). Learning is the uttermost importance of students. In the learning activities, problems are inevitable and inseparable. Their success or failure is evident from their ability to solve the problems. They study mathematics in school to be a well trained and be able to think consistent, creative, active, and independent and have the ability to solve problems both in personal and social life. (Is, n.d.) puts problem solving skills as one of the goals of mathematics education and serves as the focus of learning in school. Suherman, et al (2003) state that through problem-solving activities, students can develop some important aspects of ability such as, pattern discovery, generalization, application of rules on non-routine issues, and communicating math. According to some aforementioned opinions regarding problem-solving, the purpose of problem solving in this study is a complex cognitive activity as a process to determine various approaches of solutions and find techniques or strategies to solve problems.

Problems solving by students is a form of mathematical communication of ideas. Sfard (2002) states mathematical communication is a process in conveying mathematical ideas both verbal and written form. NCTM (2000) defines mathematical communication as a way for students to explain, organize, articulate, and consolidate their mathematical thinking. In communicating their ideas, students can state in a verbal or written form. In the research conducted, the communication was in the form of delivering student's ideas in a written form.

Research concerning on imitation performance have been conducted in various fields of science. In the field of education, imitating is discussed more in early childhood. One study conducted by (Zhou & Guo, 2016) on imitating, stated that imitating has a positive effect on learning among adult students. Imitating is an interesting issue to be examined since it is not only done by early childhood. In the process of learning, humans cannot be separated from imitating process. Additionally, it is important to solve mathematical problems for students in order to be applied in social life. Indicators of students imitating teachers are: using the same method as the given examples, using the same steps as the given examples, applying the examples in a new context, preferring teachers to explain in classrooms, preferring teachers to demonstrate on the boards, preferring to listen to lectures rather than read

textbooks (Zhou & Guo, 2016). Based on the explanation above, the researchers want to scrutinize imitation on 5th grade elementary school student.

METHOD

This study was qualitative research with descriptive approach. The research subjects were the fifth grade students in one of the State Elementary Schools in Pasuruan consisting of 33 students in the academic year 2016/2017. The data sources in the research were obtained from students and teacher works, recorded interview, and field notes. The author transcribed all the supporting instruments used in the form of worksheets related to solving mathematical problems, interviews, and audio-visual recording, as well as field notes.

Data collection was done by giving worksheets to all subjects about problems solving. After the subjects completed the tasks, the results of the subjects' work were carefully examined to be selected as the subjects that match the criteria for the interview. The subjects chosen were the subjects that could answer exactly as well as the subjects who could communicate fluently when asked for a question and answer. The aim was the researchers were able to obtain complete information related to research. The researchers also asked the classroom teacher's to answer the problems similar to those done by the students. The aim was to see the similarity of the teacher's answers and the students' as a form of imitating. The interview was conducted using audio-visual recordings to obtain accurate data.

The technique of data analysis was done by careful reading of the data obtained to be encoded. Imitation was identified by comparing the time and categories of both the teacher and students' nonverbal behaviors in the interactions. One imitation was counted when both the teacher and student fit the same behavioral category and the teacher's behavior followed the student's behavior within 5 s. Further, after the data were encoded, they were grouped by correct and wrong answer category. Then, existing data were described to be presented and interpreted, and finally made a conclusion.

RESULT AND DISCUSSION

Based on the data of students' work, the researchers tried to find out whether the students did imitating or nor by seeing and comparing between the students' answers and the teacher's answers. Consists of the 33 students, there were 28 students who answered correctly, while 5 students answered incorrect. Consists of the 28 students who answered correctly, there were two students selected as the subjects of the research. The selection was in accordance with the criteria i.e. they were confident. It was expected that when they were interviewed, they could provide information as expected by the researchers. The following were the results of the work of the teacher and students of the two works compared to seeing what the students imitated.

Table 1. Answer number 1

Subject	Solution
1. Dina's money is $\frac{2}{7}$ of Bunga's. If their sum money is Rp.81, 000 what is the difference between the money owned by Dina and Bunga?	
SD1	<p>Answer</p> <p>1. $2+7=9$ $= 81.000,-$</p> <p>uang Dina $\frac{2}{9} \times 81.000,- = 18.000,-$</p> <p>uang Bunga $\frac{7}{9} \times 81.000,- = 63.000,-$</p> <p>Jadi selisih uang Dina dan Bunga adalah $\cdot Rp 45.000,-$</p>
SD2	<p>① uang Dina $\frac{2}{9}$ uang Bunga</p> <p>uang Dina : 2</p> <p>uang Bunga : 7</p> <p>$= 2+7=9$</p> <p>uang Dina $\frac{2}{9} \times 81.000,- = 18.000,-$</p> <p>uang Bunga $\frac{7}{9} \times 81.000,- = 63.000,-$</p> <p>selisih uang yg dimiliki Dina dan Bunga ialah $45.000,-$</p>

Translation from text in the box:

Uang Dina : Dina's money

Uang Bunga : Bunga's money

Selisish uang Dina dan Bunga : difference Dinas money and Bunga

Jadi selisih uang Dina dan Bunga adalah : So the difference between Dina and Bunga money is

The information that the researchers could draw from the data in table 1 was that there was a similarity between the way done by the teacher and the students. Based on the information obtained, the subjects stated that they had never done the same problem, but in the previous semester they had worked on the problems similar to those done in the research. The researchers set some indicators to check whether students were said to imitate or not. If the solution of the problem solving using the same method with the example, using the same steps as the given example, applying the example, in a new context, preferring the teacher to explain in the classroom, following the teacher's behavior, preferring demonstration on the board, preferring to listen to lectures rather than read textbooks it were considered as imitating.

The answers of problems 1 and 2 generated by S1 and S2 had similarities, as well as the completions of S1 and S2 used the same ways as the completion of the teacher. Based on the information obtained from the interview activity of S1 and S2, the students found the reason to solve problem

number 1 was based on examples of problems once given by the teacher. The following were the excerpts of the interview conducted by the researchers to S1 and S2.

Q : Have you ever worked on a problem like this?

S1 : Mmmmm... No (retreating expression)

S2 : No.

Q : Have you ever been given an example of a problem or exercise similar to the one you work on?

S1 : Once, my teacher gave an example on the board,

S2 : Yeah, but it was last semester material. Oh.. Mm.. I think there was a similar problem in the book.

Q : If the example is already in the book, but your teacher does not explain it, do you understand it or not?

S1 : No Ma'am. I understand better if it is presented to the board.

S2 : It's better if my teacher explain it again.

Q : Why?

S1&S2 :... (Silent, no answers, while smiling).

Based on the above interview excerpts, it was similar to the opinion that says infants and children have a strong tendency to identify and imitate models in the learning process. S1 and S2 in this case had met the imitating indicator i.e.: They used the same method with the examples and used the same steps in the examples, but they were unable to apply the examples in a new context which means imitating is not always at a low level and not always in non-cognitive terms (Hurley et al., 2007) and imitating has a flexible relationship between observed behaviors, and undertaken behaviors as the core of the cognitive social part including empathy, communication, and inter-subjectivity. Imitating is seen as a unique human capability (Meltzoff & Decety, 2003). In the research, the example was the example of a problem once given by the teacher in the previous semester. S1 and S2 preferred the teacher to explain in the classroom, demonstrate on the board, listen to lectures rather than read textbooks. The following was the table of students' answers of problem number 1 and 2.

Table 2. Answer number 1 and 2

SD1's Answer	SD2's Answer
1. Dina's money is $\frac{2}{7}$ of Bunga's. If their total money is Rp.81, 000 what is the difference between the money owned by Dina and Bunga?	

SD1's Answer	SD2's Answer
<p>Answer:</p> <p>1. $2+7=9 = 81.000,-$</p> <p>Uang Dina $\frac{2}{9} \times 81 = 18.000,-$</p> <p>Uang Bunga $\frac{7}{9} \times 81 = 63.000,-$</p> <p>Jadi selisih uang Dina dan Bunga adalah Rp 45.000,-</p> <p>Selisih uang yang dimiliki Dina dan Bunga adalah : So the difference between Dina and Bunga money is Rp 45.000,-</p>	<p>Uang Dina : Dina money</p> <p>Uang Bunga : Bunga money</p> <p>Selisih uang yang dimiliki Dina dan Bunga adalah : So the difference between Dina and Bunga money is Rp 45.000,-</p>

2. Dina's money is $\frac{2}{7}$ of Bunga's. If the difference of their money is Rp.45, 000, how much money owned by Dina and Bunga?

<p>First answer</p> <p>$2+7=9$</p> <p>$\frac{2}{9} \times 45 = 10.000,00$</p> <p>$\frac{7}{9} \times 45 = 35.000,00$</p> <p>Jadi jumlah uang Dina dan Bunga adalah Rp.45.000,</p> <p>Corecting answer</p> <p>$7-2=5$</p> <p>$\frac{2}{9} \times 81 = 18.000,00$</p> <p>$\frac{7}{9} \times 81 = 63.000,00$</p> <p>Jadi jumlah uang Dina dan Bunga adalah Rp 81.000</p> <p>Jadi jumlah uang Dina dan Bunga adalah Rp 81.000,- : So the amount of Dina and Bunga money is Rp. 81,000</p>	<p>$2+7=9$</p> <p>$\frac{2}{9} \times 45.000 = 10.000,00$</p> <p>$\frac{7}{9} \times 45.000 = 35.000,00$</p> <p>$Rp.35.000$</p> <p>$Rp.10.000$</p> <p>$\frac{45.000}{9}$</p> <p>$2+7=9$</p> <p>$9 \times 2 = 18$</p> <p>$9 \times 7 = 63$</p> <p>$Rp.81.000$</p>
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Based on the research data in table 2, the researchers needed to clarify $2 + 7 = 9$ written by the subject in completing the problem number 1 and number 2, so an interview was conducted. The researchers started the conversation by asking the subjects to read back the problems and check S1 understanding. The following were the excerpts of the interview between the researchers and S1.

Q : What elements are known from the problem?

S1 : The thing known is the amount of Dina's money

Q : Dina's money. How much is Dina's money?

S1 : Dina's Money is $\frac{2}{7}$ of Bunga's Money

Q : Heeh.. Go on. What else are known?

S1 : The total. Their total money is Rp. 81,000

Q : Then?

S1 : What is the difference between Dina's and Bunga's money?

Based on the dialogue between S1 and the researchers, it appears that S1 had already understood the purpose of the problems, although S1 did not write on the answer sheet the elements that were known, asked, and answered respectively based on the steps of problem solving. The next dialogue was done to explore further the subject, S1. The following were the excerpts of the interview between researchers with the subject, S1.

Q : Based on the information that is known from the question, roughly without counting, who has more money, Dina or Bunga?

S1 : Em, ... Dina has more money. Eh ... Bunga or Dina?

Q : Who has more money Dina or Bunga?

S1 : Dina, maybe (smiling)

Q : How can you know if Dina has more money?

S1 : The question is about the difference between Dina and Bunga's money, in which Dina is mentioned first. It means that Dina's money minus Bunga's money. So Dina has more money.

Q : Ok, check the answer!

S1 : Hehehe, It's wrong... Bunga has more (smiling)

Based on the interview excerpts, the subject, S1, still had not understood the meaning of $\frac{2}{7}$. S1 was classified as sharp (careful) observant in seeing the sentence of the problems. However, S1 still did not understand the concept. The next dialogue was related to how the S1 signified $2 + 7 = 9 = 81,000$. The following were the dialogue excerpts.

Q : Then, how to solve it?

S1 : Two plus seven equals nine.

Q : Why is there two plus seven. Mmm ... How can there be two plus seven as this (pointing to the answer)?

S1 : Because Dina's money is $\frac{2}{7}$

Q : Dina's money is $\frac{2}{7}$, two, what does it mean? Why did you write two (point to the answer sheet on which S1 wrote $2 + 7 = 9 = 81,000$)?

S1 : Two is the numerator (smiling shyly)

Q : The numerator. What about 7?

S1 : *The denominator (smiling)*

Q : *The denominator. What does it relate to Dina's money?*

S1 : *... (smiling)*

Q : *Em, ... How can this be written, two plus seven equals nine, what does this sign mean (showing the answer), this one?*

S1 : *The equal sign, the total*

Q : *Em, ... How can it be written, two plus seven equals nine equals eighty one thousand rupiah?*

S1 : *The total, their total money*

The excerpts of the interview between the researchers and the subject of S1 showed that the subject was still not accurate about the meaning of $2/7$. It was indicated when the subject said that 2 was the numerator and 7 was the denominator. Related to the assumption that the subject imitated her teacher, the following was the comparison between the subject, S1 and the teacher answers

After the researchers clarified the meaning of $2 + 7$, the researchers clarified the way to solve the given problem. The following were the excerpts of the interview between the researchers and the subject, S1.

Q : *Then, how to solve it?*

S1 : *Dina's money is $2/9 \times 81,000 = 18,000$*

Q : *he'eh, ... Why is it $2/9$?*

S1 : *Because the amount of Dina's money has to be found*

Q : *Dina's money has to be found, then how did you get 9?*

S1 : *It's gotten from two plus seven*

Q : *Why is it two plus seven?*

S1 : *.... (smiling)*

S1 : *I'm confused (laughing while covering the mouth with her hands)*

Q : *Huh, ... confused ...? Yesterday, how did you work with the problem?*

S1 : *Directly added (laughing)*

Q : *Directly added, why added? Why wasn't it subtracted, multiplied or divided?*

S1 : *No.... (shaking her head)*

Q : *No, why?*

S1 : *Because two sevenths, there is 81 that can be divided by 9.*

Q : *Because it's two sevenths. What if, for example, two fifths?*

S1 : *Two plus five*

Q : *Why did you use addition, instead of subtraction?*

S1 : *.... (looking to the right and left, playing her scarf) because looking for the tot .. (soft voice) because looking for the difference (smiling)*

Q : *Oh, if it is to find the difference means added, isn't it?*

S1 : ... No (shaking her head and smiling) subtracted

Q : But, this was added, how does this (pointing to the answer)

S1 : Ha ... heee wrong (laughing)

Based on the interview excerpts between the researchers and the subject, S1, there were interesting things as the focus that S1 interpreted $2 + 7$ was related to the known elements, and recalled the procedures of solving the problem. What she did was multiplying the fraction with the known elements. Because the known element was 81,000, she needed to add 2 and 7.

The subject of the research, S2, in interpreting $2 + 7 = 9$ did not differ greatly from those expressed by S1. This is indicated by the following interview excerpts.

Q : Why is it added, is it okay if seven minus two?

S2 : No, (holding her chin) because it should be added, so that eighty-one thousand can be divided by nine.

In the process of the problem solving, the research subjects, S2, did the same as that was done by S1. Both the research subjects answered the problems correctly. Based on the results of the interview conducted, the research subjects asked to work on problem number 2 at different times. Problem number 2 was the opposite of problem number 1. It means that the ones were known in problem number 1 were asked in problem number 2. The reason the researchers needed to give problem number 2 was to examine the communication of the solutions of mathematical problems of research subjects (S1 and S2).

Based on the research data, the research subjects, S1 and S2 in communicating mathematical problem solving of problem number 1 and number 2, they had the same way that was by adding $2 + 7$. The work of the research subjects, S1 and S2, showed two different results. To clarify the intentions, it was necessary to conduct interview to S1 and S2. The following were the excerpts of the interview conducted.

Q : why there are two answers?

S1 : Emm... the upper is wrong Ma'am

S2 : The right is the lower Ma'am

Q : Why can you say if the wrong one is the upper, and the correct one is the lowest?

S1 : Because the problem is different, the way to work is different. It is not $2 + 7$, but subtracted. My teacher said if the total is known, it is added, if it's the difference, it means subtracted.

S2 : After counting, the result of the amount of the money is 45,000, but on the problem 45,000 is the difference Ma'am.

Q : Why 9 times 2 and 9 times 7?

S2 : The result of 9 times 2 is 18, and 9 times 7 equals 63. Because the total is asked, it means $18 + 63$. Problem number 2 is actually the same as problem number 1. If the difference is already known that is 45,000, it means the total is 81.000 as stated in problem number 1

The results of the interview between the researchers and the research subjects, S1 and S2 revealed that actually the subjects did not fully understand how to communicate mathematical problem solving. This was indicated by the data of the research subjects when they were asked to do the problems of numbers 3 and 4. Problem number 3 and 4 were similar to problem number 1 and 2, but the numbers contained in the problems were not easy to do the division as easy as in problem number 1 and 2. The following is table 4 which shows the work of the subjects, S1 and S2.

Table 3. Answers of number 3 and 4

SD1's Answer	SD2's Answer
<p>3. Dina's money is $\frac{1}{3}$ of Bunga's money. If the difference between their money is Rp.81,000, how much is the total of Dina and Bunga's money?</p>	
<p>First Answer :</p>	
<p>Corecting Answer:</p>	
<p>Jadi total uang mereka adalah : So their total money is:</p>	
<p>4. Dina's money is $\frac{1}{3}$ of Bunga's money. If their total money is Rp.162,000, what is the difference between Dina and Bunga's money?</p>	
<p>First answer</p>	
	<p>Corecting answer</p>
<p>first answer</p>	
<p>Corecting answer</p>	

2. $3-1=2$

$\frac{1}{2} \times 81 = 40.500,00$
 $\frac{3}{2} \times 81 = 121.500,00$

$\frac{1}{2} \times 243 = 121.500,00$
 $\frac{3}{2} \times 243 = 364.500,00$

Jadi selisih uang mereka adalah 162.000,00

Jadi selisih uang mereka adalah : So the difference in their money is

$3-1=2$
 Uang Dora $\frac{1}{2} \times 81 = 40.500$
 Uang Bungo $\frac{3}{2} \times 81 = 121.500$
 $121.500 - 40.500 = 81.000$
 $364.500 - 121.500 = 243.000$
 $243.000 - 81.000 = 162.000$

Problem number 4 was done by the participant of the research at different times and days with the previous interview activities. Based on the data of the research subjects, S1 and S2 were false in answering problem number 3 and 4. In problem number 3, $1 + 3$, while in problem number 4, $3 - 1$. To obtain the explanation of the reasons why the subjects added or subtracted, the following were the excerpts of the interview between the researchers and the subjects of the study.

- Q In problem number 3, why did you write $1 + 3$?
- S1 In the case, there was the total, so $\frac{1}{3}$ is written $1 + 3$
- S2 emm ... in order that it can be divided, Ma'am
- Q Was it checked again or not?
- S1&2 Yes Ma'am.
- Q After you checked it again, was the answer correct or not?
- S1&2 Did not know, hehehe ...
- Q Ok, now let's see number 4. Why the answer of number 4 was $3 - 1$?
- S1 My teacher said if there is a difference means it is subtracted Ma'am.
- S2 In the problem, it was asked the difference, so it was subtracted.
- Q Still $3 - 1$, why?
- S1 81,000 can be divided by 2 Ma'am.
- S2 To make it easy to calculate (smiling)
- Q Check problem number 3 and number 4. Read them again carefully
- S1&2 The problems are the same, just reversed them (whispering each other)
- Q How, have you already got the solution or not?
- S1 My answer was wrong Ma'am, hehehehe ...
- S2 Number 3 the total should be 162,000, and number 4 the answer is 81,000
- Q Well, you know the results. Can you work in the right way?

Based on the interview excerpts between the researchers and the research subjects, the answers of problem number 3 and number 4 without writing the way to get the results they found the answers, but when they communicated written solution of the problem solving the subjects met with difficulties.

The findings of this study indicated that communicating written ideas was not easy and the students met difficulties in understanding other's ideas (the teacher's) both written and oral. Imitating involves complex cognitive capacities and plays an important role in the human learning process (Hurley et al., 2007). Because it involves rhythmic cognitive capacities, students may experience barriers in the imitating process.

The research suggested that not all imitating indicators were met. From the predetermined indicators i.e.: using the same method with the example, using the same steps as the example, being able to apply the example in a new context, preferring the teacher to explain in the classroom, following the teacher's behavior, preferring demonstrations on the board, preferring listening to lectures rather than reading textbooks (Zhou & Guo, 2016), the unfulfilled indicators was inability to apply the example in the new context. The subjects imitated in communicating mathematical problem solving, but if the imitating was done imperfectly, it could have a bad impact on the unsuccessfulness in solving mathematical problem. In this case it means the imitating can be categorized as a failure. Imitating is not a simple thing as it is thought because it needs the high cognitive capacity and requires unique abilities (Meltzoff & Decety, 2003; Meltzoff et al., 2009).

CONCLUSION

Keywords provided by the teacher made the students confused and mistaken in applying them, so the completion steps copied were not appropriate. Imitating can develop communication skills, as there was a failure in imitating it resulted in an inability in terms of communication. Based on the results of the research, it can be concluded that there was an imitating failure of the students in communicating the solution of mathematical problems. Suggestion for further researchers is they are able to examine the impact / effect of imitating that occurs in students of junior high school, senior high school or even students of higher education because up to now there are still rare researches related to imitating that occurs in adults.

The results of the research indicated that there were few imitating indicators that were not met. The students were not able to apply the examples in the new context, in another words the students had failed in applying the examples. Consequently they faced difficulties in communicating the solutions of mathematical problems. Imitating is not a simple thing, but it is a unique ability possessed by humans. Instead of helping the students, the key words provide by a teachers make the students confuse in resolving different problems.

Based on learning theory, imitation has a tendency in behavioristic and social constructivist learning theories. Imitation in learning activities is included in social constructivist learning theory. Basically, children always imitate what is done by adults. So that teachers in learning activities are not only as models to be imitated by students, but also must be able to provide inspiration that can develop students' knowledge.

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