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CONTEXTUAL GAME LEARNING (CGL) AS A MEANS OF IMPROVING ELEMENTARY SCHOOL STUDENTS' ABILITIES IN LEARNING MATHEMATICS IN SPECIAL SERVICE CLASS (RETRIEVAL-REMEDIAL) PROGRAM IN INDONESIA

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***Abstract* – Special Service Class (SSC) or Retrieval Remedial (RR) is an educational program in elementary school which is implemented as an effort to provide learning readiness for students who drop out or have never attended formal education. Special Service Class (SSC) or Remedial Retrieval (RR) is primarily a teaching program implemented in special classes. Until recently, special education that is being developed is an education for children with physical or psychological problems. The development of educational problems that becomes more complex arises various development of terms for children with learning disorder. It is not only due to the physical but also psychological and social condition. One of the problems that arise today is children with disabilities caused by social factors including the economic situation in the family, which hereinafter referred as SSC students. SSC students are associated with those who fail classes or drop out of school because of economic problems in the family or the environment.**

Some constraints relating to students that are encountered in implementing SSC program or RR, are: • student's attendance and interest which is not optimal; • Children who have work in the morning are not willing to be transferred to the morning class (regular); • SSC or RR students prefer to learn in a short time (2 hours); • Students always feel quickly bored and are sluggish in learning; • The student's concentration is still unstable and quickly disturbed oftentimes; • The desire to learn is low, the lack of confidence that is very disturbing in the absorption of the lesson • lesson materials which are unattractive and boring made students reluctant to go to school.

In general, the problems encountered by SSC or RR students are psychological problems in learning. In solving these problems, SSC teachers in elementary school are required to have an ability in developing learning techniques, a patience, and an ability of teaching by using enjoy-learning method (learning is fun) so that it is possible to overcome the problems in learning activities in class. The psychological and sociological intervention which is integrated in every subject is essential to emphasize in Special Service Class (SSC) learning or Retrieval Remedial (RR) in order to prepare the students to follow the lessons in regular class, including in mathematics subject.

One common problem in mathematics education in Indonesia is the low interest towards mathematics because students feel that learning mathematics is a learning to memorize formulas which are used later to solve mathematical problems. For elementary school children, to learn like this will be very boring and meaningless because it is far from their characteristics that prefer to play especially for students with special needs in SSC or RR themselves. This paper will discuss the contextual learning that can be implemented in learning mathematics which relates to Indonesian Realistic Mathematics Education so that mathematics will no longer be a horrifying subject for elementary school children yet as a fun subject to learn because the children can learn mathematics in their games. Studies have found that strategies in games are effective in motivating children to learn math and also make the learning more meaningful. The focuses of this paper are examples in games that can support the process of learning mathematics and the role of teachers in facilitating students to learn math meaningfully which is indirectly integrated in the games.

Keywords: Elementary Education, Dropouts, Special Service Class, Contextual Learning, Indonesian Realistic Mathematics Education, Game-based Learning.

I. INTRODUCTION

One of the common problems in mathematics education in Indonesia is the low interest in learning math that affects the low result in students' mathematics learning. The result is not only the aspect of understanding mathematics as a knowledge, but also the aspect towards mathematics itself. The problem is due to the assumption in society that states mathematics subject is a difficult subject to understand. Most of the students feel that learning mathematics is a learning to memorize formulas because in school what they gained is merely various kinds of formulas that are found by the scientists, so that students only need to memorize them to solve the problems later on.

Another things that cause mathematics to be a horrifying subject for students are: (1) mathematics teaching that emphasizes on memorizing formulas, (2) mathematics teaching that emphasizes on the speed in resolving a problem, (3) mathematics teaching that emphasizes students to work alone, (4) authoritative way of teaching and (5) the lack of variation in the process of teaching and learning.

The saturation that is perceived by students affected their lack of interest in learning mathematics. Many mathematical learning only focused on algorithms or procedures in solving a problem in the formal level of mathematics. However, in fact students have problems in understanding the concept of mathematics in the formal level. Therefore, it will be better to initiate mathematical learning from the base/concept, not from the formal level.

The most appropriate learning method to instill the concepts in students is contextual learning. Contextual learning can be described as a learning method which recognizes and shows the natural condition of knowledge. Through the relation inside and outside the class, a contextual learning approach makes learning more relevant and meaningful for students in building their knowledge that they will apply in their lifelong learning. Contextual learning provides a concept which associates subject materials learned by students with the context of material itself, and the relation on how one learned or the way student learned. Thus, in the learning activity it is needed to make the students learn more easily, simply, meaningfully, and pleasingly so that the student will be able to easily receive an idea, understand the problem and knowledge, and construct their own new knowledge actively, creatively, and productively. Through this contextual approach, students are expected to learn by experiencing instead of memorizing.

Freudenthal, 1991 cited in Ariyadi Wijaya, 2009 states that mathematics is a human activity instead of a science or knowledge that needs to be transferred from teacher to student. Later on, the Freudenthal's view becomes a basis in the development of Realistic Mathematics Education (RME). The main principle of RME is that mathematics should be meaningful for students. Meaningful mathematics can be reached by giving contextual problems as the starting point in learning mathematics. The word "realistic" does not mean that the problems that are employed have to be found in the daily life. The word "realistic" means that the problems that are employed need to be meaningful and possible for students to imagine. During the process of learning, students must be motivated to find and develop strategies and ideas. Students' various strategies and ideas should be led to the formation and understanding of mathematical concepts as the ultimate goal of learning.

Teaching the concepts of mathematics should be from the beginning when children start to recognize mathematics so that children will gain a pleasing first impression from mathematics. Therefore the children will not consider mathematics as an enemy. Children's world is a world of games. Games are the contextual situation for children which therefore can be used as the starting point of learning process. In Indonesia there are various kind of games that contain mathematical concepts. Thus, these games can be used to learn mathematics.

So, how do we create a playing situation to teach the concepts of mathematics for children and what games support the development of mathematical concepts in children?

This paper is aimed to open up our horizon as parents as well as teachers regarding how to instill basic mathematical in a conventional way through regular presentations and parables, as well as to introduce traditional games that are educative, affordable, environmentally friendly, and possible to teach mathematical skills in children that nowadays have almost been defeated by modern, sophisticated games. In particular, this paper aims to overcome students' psychological problems in learning in Special Service Class (SSC) or Retrieval Remedial (RR), in which the teachers are required to have an ability in developing learning techniques, patience, and skills in teaching by using enjoy-learning method (learning is fun) so that they will be able to overcome many kind of problems in the learning activity in class. Psychological and sociological intervention integrated in every subject had to be emphasized in the learning process in Special Service Class (SSC) or Retrieval Remedial (RR) in order to prepare the students to follow the lessons in regular class. This method of CGL is expected to overcome the constraints of student's learning in Special Service Class or RR.

Here are some constraints relating to students that are often encountered in implementing the Special Service Class program or RR, namely: • student's attendance and interest which is not optimal; • Children who have work in the morning are not willing to be transferred to the morning class (regular); • SSC or RR students prefer to learn in a short time (2 hours); • Students always feel quickly bored and are sluggish in learning; • The student's concentration is still unstable and quickly disturbed oftentimes; • The desire to learn is low, the lack of confidence that is very disturbing in the absorption of the lesson • lesson materials which are unattractive and boring make students reluctant to go to school.

II. DISCUSSION

A. Characteristics of Special Service Class program or Retrieval Remedial (RR)

One of the strategic programs in the Ministry of Education and Culture is compulsory education for nine years (six years in Elementary School and three years in Junior High School). This program includes the level of Elementary School aged 7-12 years, and the level of Junior High School aged 13-15. In order to support the implementation of compulsory education in Elementary School, strategic efforts are needed, one of which is by reducing the number of elementary school children that drop out or never attend elementary school. This effort is conducted by persuading the dropouts, so that they will be able to go back to school and therefore finish their education in Elementary School, such as through the Special Service Class program. Special Service Class program starts since the school year of 2003/2004 which in the school year of 2010/2011 becomes Retrieval-Remedial (RR) program. The purpose of the implementation of the program is to prepare elementary school children who drop out or have not started school yet (7-12 years old), because of various kinds of reason, to be able to continue or gain a formal education in Elementary School until they graduate and to be able to continue their education up to the higher level of education.

This program is an educational program that is implemented as an effort to provide a learning readiness for children who drop out of school. The problem of learning readiness is a result of school dropouts or having not attended formal education yet. The readiness becomes an academic, psychological, and social ability which will support these children to follow the lesson in regular class.

Special Service Class (SSC) program is essentially a learning program that is implemented in special classes. Until recently, special education that is developed is an education for children that have physical or psychological problems. The development of educational problem that becomes more complex caused various development of terms regarding children with learning disorder. It is not only caused by physical situation, but also by psychological and social situation. One of the problems that arises today is children with disorders as a social effect that relates to economic problems in the family, and hereinafter is referred as SSC students. In general, SSC students relate to failing classes and dropping out of school because of economic problems in the family or environment.

Some constraints relating to students that are encountered in implementing SSC program or RR, are: • student's attendance and interest which is not optimal; • Children who have work in the morning are not willing to be transferred to the morning class (regular); • SSC or RR students prefer to learn in a short time (2 hours); • Students always feel quickly bored and are sluggish in learning; • The student's concentration is still unstable and quickly disturbed oftentimes; • The desire to learn is low, the lack of confidence that is very disturbing in the absorption of the lesson • lesson materials which are unattractive and boring make students reluctant to go to school.

In general, the problem encountered by SSC or RR students is the psychological problem in learning. In overcoming the problem, SSC teachers in Elementary School are required to have an ability in developing learning techniques, patience, and an ability in teaching by using enjoy-learning method (fun learning) so that they will be able to overcome various kinds of problem in learning activities in class. In this regard, in order to make compulsory education for nine years successful, it is necessary to increase our attentions on SSC students. Psychological and sociological intervention integrated in every subject is essential to emphasize in the learning activity in the Special Service Class to prepare the students to follow the lesson in regular class, particularly in math subject.

B. The characteristics of contextual learning

Contextual approach is a learning concept which has an emphasis on the interrelation between subject materials and the students' real lives, so that the students will be able to connect and apply the competencies from the learning outcomes in daily life. Contextual learning is a learning approach that motivated the students to connect the knowledge that they gained from the process of learning with their daily lives, which is beneficial for them to solve the real-life problems so that the learning process experienced by the students will be more meaningful.

Masnur Muslich (2007:42) stated that contextual learning had characteristics as follows:

1. The learning is conducted in the authentic context, i.e. a learning that is directed to the achievement of skills in the context of real-life situation or a learning that is conducted in a natural environment (learning in real-life setting).
2. The learning gives a chance for students to do meaningful tasks (meaningful learning).
3. The learning is conducted by giving meaningful experiences to students (learning by doing).
4. The learning is conducted through group works, discussions, and mutual corrections between peers (learning in group).
5. The learning gives a chance to create a sense of togetherness and cooperation, as well as a deep mutual understanding between peers (learning to know each other deeply).
6. The learning is conducted actively, creatively, productively, and by giving priority first to cooperation (learning to ask, to inquiry, to work together).
7. The learning is conducted in a pleasing situation (learning as an enjoying activity).

C. Characteristics of Indonesian Realistic Mathematics Education

According to Zainurie, 2007 (in Evi Soviawati, 2011) realistic mathematics is a school of mathematics which is implemented by placing the reality and experience of students as a starting point of learning. Realistic problems are employed as a source of emergence of mathematical concepts or formal mathematical knowledge. Realistic mathematical learning in class focuses on the characteristics of Realistic Mathematics Education (RME), so that the students will have a chance to re-discover mathematical concepts or formal mathematical knowledge. Furthermore, the students will be given a chance to apply those mathematical concepts in solving the problems in their daily lives or in another fields.

Realistic Mathematics Education (RME) is a theory of teaching and learning in mathematics education. the theory of RME is first introduced and developed in Netherlands in 1970 by Freudenthal Institute. This theory refers to Freudenthal (in Zainurie, 2007 in Evi Sviati, 2011) which states that mathematics must have a relation to reality and mathematics is a human activity. It means that mathematics has to be close to children and relevant with the real life. Realistic mathematical learning is essentially an usage of reality and environment which are understood by students to facilitate the process of learning mathematics which will therefore reach the objective of mathematics education better than before. what is meant by reality is the real or concrete things that can be observed or understood by students by imagining them, while environment can be described as the neighborhood where the students live which can be school, family and society. Environment in this case can also be considered as the daily life.

Due to the fact that Indonesian Realistic Mathematics Education is an adaptation from RME, thus the principles of IRME are similar to the principles of RME. However in some ways they are different because of the difference in context, culture, social system, and the nature. Van Den Heuvel-Panhuizen (1996) formulates the principles of RME, which are:

a. Activity principle, i.e. mathematics is a human activity. The learner has to be active both mentally and physically in learning mathematics. The learner is not someone who passively receives what is said by the teacher, but is physically and mentally active

in processing and analyzing the information as well as constructing the mathematical knowledge.

b. Reality principle, i.e. learning should begin with realistic problems that are imaginable for students. Realistic problems will be more interesting for students compared to formal mathematical problems without meanings. If the learning activity begins with meaningful problems, the students will be interested in learning. Gradually, the student will be directed to formal mathematical problems.
c. Tier principle, i.e. students learn mathematics through various levels of understanding, from the ability of finding a solution of a contextual or realistic problem, which through schematization gained an insight about fundamental problems, to the ability of finding a solution of a formal mathematical problem. This is a model of acts as a bridge between the formal and informal. The model which is initially a model of situation shifted through the abstraction and generalization to be a model for any other equivalent problems.
d. Intertwining principle, i.e. various aspects or topics in mathematics should not be considered and learned as separate parts, yet intertwine to one another so that the students will understand the relation between the materials better. Mathematical concepts are relations. Psychologically, the things that relate to one another will be easier to understand and to call back in long-term memory than the things that are separated without any relation to one another.
e. Interaction principle, i.e. mathematics is considered as a social activity. Students need to and should be given a chance to express their strategies in solving a problem to others to respond. Through discussion, students' understandings about a problem or concept become more profound and later on the students will be motivated to do a self-reflection which makes them possible to find an insight to improve their strategies or solutions of a problem.
f. Guidance principle, the students are given a chance to re-invent guided mathematical knowledge. The teacher creates a learning condition that makes the students possible to construct their mathematical knowledge.

According to Treffers (in Zainurie, 2007) as cited in Evi Soviati, 2011 characteristics of RME are as follows:

a. Using real-life context, which connects mathematical concepts with students' everyday experiences.
b. Using models (mathematical), which mean that the students make their own models in solving the problem.
c. Using the production and construction, by the free making of production the students will be motivated to do a reflection on parts that they consider important in the process of learning. Informal strategies of students that are in the form of procedures in solving contextual problems are an inspirational source in constructing formal mathematical knowledge.
d. Using interaction, i.e. explicitly interactions in the form of negotiation, explanation, justification, agreement and disagreement, question or reflection are used to reach the formal form from the students' informal forms of interaction.
e. Using intertwinement, in applying mathematics, a more complex knowledge is typically required which is not only arithmetic, algebra, or geometry, but also other fields of study.

III. GAME-BASED LEARNING

Meaningful learning for students is a learning experienced directly by the students. The knowledge that is gained from this direct experience will settle long enough in the memory of the students and be remembered throughout time. Moreover, if the experience is close to their world which is the world of playing, the knowledge will be more fun and meaningful to them.

Game-based learning can be a contextual situation or problem because most games employed more actions than material explanation through words. This characteristic can stimulate students' motivations to learn. Therefore, games can support the learning activity in order for students to be more active in their process of learning.

Cooperation in the form of games can train students' senses of collaboration and interaction. Aryadi Wijaya (2008) states that games can be an effective tool to improve learning and understanding of a particular topic. One of the examples of the benefits is how Indonesian children's games (such as *patilan* and *kelereng*) can support the process of learning length measurement. Although games have many benefits for the process of learning, the utilization of games in the process of learning cannot be carried out independently. The utilization of games in learning should be followed by a discussion to talk about and develop the values from the game to be a mathematical concept. This is in accordance with the principles of experience-based learning that is developed by Kolb (Ariyadi Wijaya, 2008). Kolb formulates four stages in experience-based learning, which are: (1) real experience, (2) reflective observation, (3) abstract conceptualization, and (4) active experimentation.

In creating game-based learning environment, in which we will implement Indonesian Realistic Mathematics Education (IRME) in the learning process, thus the teachers should determine the strategy to obtain a fair game since the game will support the formation of natural situation for social interaction as students' deals in determining the strategy to obtain a fair game. Steps that must be done for game-based learning are as followed:

- The teacher divides the students into groups. The groups that are formed are a combination in terms of social background, sex, and their learning abilities.
- The teacher explains the instructions and procedures of the game.
- Give the students time to play the game in their groups while they learn independently to find mathematical concepts that are contained in the game that they play.
- The teacher has a role in leading students' social interactions to reach the objective of learning.
- The teacher leads the students to be able to express their ideas about the concepts that they have gained from the game.

- Each group can express their idea to other students and the others can give a response or protest towards their friend's opinion.
- Afterwards, the teacher give a conclusion and explain the concepts that have been gained from the game itself.

Examples of Games for Mathematical Learning.
These games are examples of games for children that can be used for game-based mathematical learning:

A. Patilan

Patilan is a game that can be played in groups. There are three session in this game. First, a short stick is thrown from the back line by the group who plays, next the distance to which the stick fell is measured. Second, two short sticks are thrown by the group who guards and by a long stick by the group who plays, then again the distance is measured. And third, the short stick is hit with the long stick by the group who plays by *patil*-ing the short stick, then the distance of the stick falling is measured by the short stick. The winner is the group who earns most points accumulated. The process of measuring the distance of stick contained a concept of measurement in not-standard unit. Naturally, the player will use his limb and any objects around him such as the span, step, or even the length of stick to measure the distance. The span difference that is used as a unit will give a different result of measurement. Here, the teacher can use the term "fair game" to lead the students to the standard unit of measurement. The teacher can use an appropriate measuring instrument so that the measurement will be fair. The result which does not always in the form of whole number can also be used to introduce the concept of fraction.

B. Ganepo

Ganepo is a children's game that can be played individually. The game is similar to the game hide-and-seek. However, to decide who the guard is, all the player threw balls together from the back line. The player who threw the ball closest to the line became the one who guarded while the others can hide. The mathematical concept that is contained in this game is comparing the distance directly when the difference between the distance of the balls is clear or by measuring when the distance of the balls is not too clear.

C. Marbles (*Kelereng)*

The mathematical concept of this game is when the players determine the order of play. The player who can throw the marble closest to the hole will play first. The player can use two kinds of strategy to decide the closest marble, which are by comparison (when the difference of distance between the marbles is clear) or by measurement (when the difference of distance is not too clear).

D. Dakon or *congklak*

Congklak is a game played by two people. The instrument is made of wood or plastic. At each end there is a hole called *Induk*. Among them there are holes with a diameter smaller than *Induk* which is about 5 cm. There are three versions of the *Dakon* instrument, i.e. *Dakon* with 10 holes, 12 holes and 16 holes.

- For *Dakon* with 10 holes then there will be used 32 small seeds that will be shared equally to all the small holes (4 small seeds each).
- For *Dakon* with 12 holes then there will be used 50 small seeds that will be shared equally to all the small holes (5 small seeds each).
- For *Dakon* with 16 holes then there will be used 98 small seeds that will be shared equally to all the small holes (7 small seeds each).

The game is played by taking the seeds in the hole of ours then filling those seeds one by one into the hole that is passed through including our hole of *Induk* (on the left side) except the hole of *Induk* of the other person's. If the last seed fell into the hole that has another seeds then the seeds are taken to fill another next holes, and so on until the last seed fell into an empty hole. If the last seed fell into the empty hole then it is the other person's turn to play. the game ends if the smaller holes had ran out of seeds. The winner is the one who collects most seeds in his/her hole of *Induk*. This game is a means to set a strategy and accuracy. The principle of "sharing the seed fairly for every small hole" can be used as a learning of the concept of division, which is by slightly changing the rule about how many seeds that are used. The concept of calculation and addition is also contained in the game, when deciding who wins the game.

E. Kubuk

Kubuk is a game played by a number of players by using seeds or pebbles. The player who got the turn will guess the amount of seeds that are shown by the player who guarded by estimating the amount of other seeds. For example, the game uses 20 seeds that are hidden in the right and left hands. The player who guards will show the seeds in the left hand for three seconds and the other player will guess the amount of seeds in the right hand of the guard. The mathematical concepts that are contained in this game are the concepts of estimation and reduction.

F. Snakes and ladders

In this game, the player must throw the dice and then run the pawn as many as the number shown on the dice. When the pawn fall on the stairs, then the player "jump up" to the end of stairs. However, when the pawn fall on the tail of a snake, then the player must "slid down" to the square that contained the head of the snake. The winner is the one who first reaches the victory square. For example, for the class 1 SD the victory square can be set at 20 or 50. The mathematical concepts that are contained in Snakes and Ladders are calculation, addition, and subtraction. The concept of calculation will appear when the player steps the pawn on a square after square. The concept of addition will appear when the player does not step the pawn to the next square, instead directly adds up the number of the dice with the number on the square in the previous position and when the player talks about how many squares she/he go through after getting a ladder. The concept of subtraction can be emphasized when the player is asked how many squares she/he lose when she/he meet the snake.

G. Jap-japan

This game can be played by a number of players by using a set of cards with numbers, for example 1-40. Each

player is given two cards and asked for his final digit after they sum the numbers. If the sum exceeds 9 unit of number, for example 10, then it will be counted as 0, 11 counted as 1 and so on so forth. The winner is the one who get the final number counted as 9. However the player can make a strategy by exchanging the card with the other person so that he/she will get the highest sum. The mathematical concepts that are contained in the game are a simple calculation and the concept of numeral places.

H. Gol-golan

This game can be used to introduce numbers and to teach the concept of jumping numbers to children. The game is played in groups, each group has a hurdle that must be guarded. Between the two hurdles there are squares consisting of numbers, for example 1-10 or a sequence of numbers multiplied. The game is played when every representative of the group jumps square by square while mentioning the number that he/she stands on in the opposite direction. One group will count forward and another group will count backwards. When two of the players meet in one same square, then they must do the rock, scissors, paper thing and the player who lose has to resign and be replaced by another player, while the player who wins can continue his pace. The group who can reach the hurdle of the other group first becomes the winner. The position of the hurdle can change so that everybody can feel counting forward and backwards. The mathematical concepts in this game are the concept of counting forward and backwards and also the concept of jumping numbers/multiples.

I. Monopoly

There are two types of monopoly which are Indonesian monopoly and world monopoly. The game of monopoly uses a square board on which there are squares with the names of cities in Indonesia or in the world. The player can build a house or hotel in a city. So, if there is a player who stops on the square that already has a house/hotel, he/she must pay the rent. Besides, there are also squares that read opportunity and funds in which the player will have a chance to receive gifts, pay a fine, or bank interest. The mathematical concepts in this game are the concept of money, addition, and subtraction.

IV. THE ROLE OF TEACHER IN GAME-BASED LEARNING

Games help to establish a natural situation for social interaction such as the students' deals in determining a strategy to obtain a fair game (Ariyadi Wijaya, 2008:10). The games need to be supported by class discussion to develop students' real experiences to be mathematical concepts. Therefore, the teacher plays a very important role in leading students' social interaction to reach the objective of learning. The role of teacher in leading the class discussion can be described as followed: (1) giving a chance for the student to express he/her idea; (2) stimulating the formation of social interaction; (3) making a link between activities; (4) establishing mathematical concepts contained in the game; (5) asking for students' clarification.

V. CONCLUSION AND RECOMMENDATION

The conclusion that we can draw from this paper is that learning does not only happen in classroom and in the learning situation between the teacher and the student, where the teacher gives the information and the students pays attention. Learning can be done outside or inside the playing ground. The curriculum and materials that are given in Special Service Class or RR, tricked with a fun learning method such as CGL, can help the SSC students to follow the lesson well and overcome various kinds of problem in learning activities in class. CGL activities that are given can also create a mental stability, so that the confidence in SSC students can grow well.

Children's games for realistic mathematics education include *pantilan, ganepo,* marbles (*kelereng)*, *kubuk,* snakes and ladders, *dakon, jap-japan, gol-golan,* and monopoly. Such game-based learning will draw students' interest to learn math and give a strong understanding in mathematical concepts at the early stage/beginners. After understanding one of the ways to implement Realistic Mathematics Education by using this game-based learning, first or second grade teachers can apply the method in instilling the mathematical concepts in children that the children will find their own concept to be applied in formal mathematics education.

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