



***PROBLEM BASED LEARNING APPROACH WITH SCIENCE KIT SEQIP TO
ENHANCING STUDENTS' SCIENTIFIC PROCESS SKILLS
AND COGNITIVE LEARNING OUTCOMES***

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(Naskah diterima: 1 Maret 2019, disetujui: 20 April 2019)

Abstract

This classroom action research was motivated by the students' low scientific process skills and cognitive learning outcomes in natural science. One of the reasons is the lack of teachers' ability in choosing appropriate learning model and using of Kit or learning science equipments in natural science learning. Thus, the implementation of Problem Based Learning approach with science Kit Seqip to students of class V SDN 20 Kurao Pagang Padang is one of the ways to solve this problem. The objective of this research is to describe the improvement of the students' scientific process skills and cognitive learning outcomes in natural science at class V at SDN 20 Kurao Pagang Padang by using Problem Based Learning approach with science Kit Seqip. The instruments of this research were the observation sheets of students' scientific process skills and teachers' activities and the test sheets of students' cognitive learning outcome. The results showed that there was a significant improvement of students' scientific process skills and cognitive learning outcomes in natural science class V by using Problem Based Learning approach with science Kit Seqip from the first cycle to the second cycle.

Keywords: *Problem Based Learning Approach, Science Kit Seqip, Scientific Process Skills, Cognitive Learning Outcomes.*

Abstrak

Penelitian tindakan kelas ini dimotivasi oleh keterampilan proses sains siswa yang rendah dan hasil belajar kognitif dalam sains alam. Salah satu alasannya adalah kurangnya kemampuan guru dalam memilih model pembelajaran yang tepat dan penggunaan Kit atau peralatan pembelajaran sains dalam pembelajaran sains alam. Dengan demikian, penerapan pendekatan Problem Based Learning dengan sains Kit Seqip kepada siswa kelas V SDN 20 Kurao Pagang Padang adalah salah satu cara untuk mengatasi masalah ini. Tujuan dari penelitian ini adalah untuk mendeskripsikan peningkatan keterampilan proses sains siswa dan hasil belajar kognitif dalam sains alam di kelas V di SDN 20 Kurao Pagang Padang dengan menggunakan pendekatan Problem Based Learning dengan Kit sains Seqip. Instrumen penelitian ini adalah lembar observasi keterampilan proses sains siswa dan kegiatan guru dan lembar tes hasil belajar kognitif siswa. Hasil penelitian menunjukkan bahwa ada peningkatan yang signifikan dari keterampilan proses sains siswa dan hasil belajar kognitif di kelas sains V dengan menggunakan pendekatan

Problem Based Learning dengan sains Kit Seqip dari siklus pertama ke siklus kedua.

Kata kunci: pendekatan pembelajaran berbasis masalah, kit ilmu seqip, keterampilan proses ilmiah, pembelajaran kognitif penghasilan.

I. INTRODUCTION

Education can be defined as a process of changing learners' behavior and attitude to become independent human beings and part of a community who can adapt with their environment (Hamalik, 2013). Qualified education will involve children to actively learn from any resources. Learning is also defined as the act of acquiring new, or modifying and reinforcing, existing knowledge, behaviors, skills, values, or preferences and may involve synthesizing different types of information (Karban, R., 2015). Teachers are functioned to facilitate learners in teaching process that they possess good learning outcomes and life skills needed by the students in their life settings. The children's potentials, skills and creativity can be well developed when teachers realize that using varied teaching approach may motivate learners to study. Learning outcomes will be obviously improved when contextual teaching and learning process is conducted and the availability of teaching media is guaranteed.

Natural science learning process is emphasized on giving direct experiences that

the expected competencies can be developed. Natural science is a collection of systematic theory, its application generally limited on natural phenomena, born and develop by scientific method like observation, and experiment, also involve scientific attitude as curiosity, open minded, honest, etc (Trianto, 2011). Natural science is human being effort in understanding universe through observation right on target, using procedure, and explain with logical thinking so derive a conclusion (Susanto, 2013).

There are some objectives of subject of natural science in elementary schools determined by National Education Assurance Board in KTSP (Depdiknas, 2006). It is to develop learners' knowledge and understanding of scientific concepts which are beneficial and applicable in daily life basis. Moreover, it is expected that learners' curiosity, positive attitude and awareness are elevated that they understand that science is mutually related to learners' environment, technology, and community. It is objected that learners' are able to expand their scientific skills to study their physical surroundings, to solve scientific pro-

blems and to find the solution of problems. This subject is targeted to improve students' awareness and roles in preserving their environment and overall nature and its regularity as one of God's creation. Last, but not the least, it is expected that learners will possess the knowledge, concepts and skills of Natural Science as one of the basis for their advanced level of education (SMP/ MTs).

The objective of the course of Natural Science in elementary school is not merely on obtaining and mastering the scientific knowledge, but also on developing students' valuable characters which are curious, honest, responsible, faithful and devoted to Allah S.W.T and possessing strong beliefs on the greatness of God the Almighty. Character resembles to human's nature based on their values, moral and norms which becomes the basis of one's perspectives, way of thinking, attitude, and action which differs one from another. Character refers to one or a group's particular characteristics consisting of values, capabilities, moral capacity, and rigidity in facing any life's obstacles and challenges. In another way character can be defined as way of thinking, feelings, and attitude that becomes habitual, characterizing an individual, particular community and nation that they

enable to live peacefully and cooperate together.

To achieve the objectives of the subject, it is highly recommended that teachers should pay a massive attention to appropriate approaches and learning strategies, learning environment, learning medium and infrastructure and to recognize learners' intellectual, psychological and biological development that must support teaching and learning processes. Moreover, it is expected that teachers are able to motivate students that they can be very active and enjoy their learning process that their potentials can be optimally developed.

When the real condition of teaching and learning process of the subject is observed, it can be admitted that the learning outcomes does not achieve the prior stated objectives. Teachers skills and knowledge still does not meet the expectation that students cannot complete the learning objectives stated in learning instruction. Pursuant to observation conducted in grade V of SD Negeri 20 Kurao Panggang Padang, the implemented approach is regarded conventional. Teaching learning process is centralized by the teachers. Students are passively listening to the teacher, taking their notes and waiting for teachers' further instruction. Teachers rarely provide an oppor-

tunity for the students to do learning activity independently that the process becomes monotonous. The lack of teachers' control makes students in chaos that some of them start playing or bothering their other classmates. Monotonous learning process is the result of teachers who keeps asking students to read the textbook without giving further explanation that students have lack of understanding of the concepts of what they are learning. Another issue is that the teachers mostly do not make use of teaching and learning kit or media. There are some reasons why this happens; teachers' lack of understanding and skills in using the kits and teachers' reluctance to train themselves in using the media. Another reason is that teachers feel complicated in using the kits in their teaching and learning process. Further, teachers' anxiety to benefit the kits becomes another reason. They are mostly afraid that the students will broke the kits while students are not able to replace them due to the kits' high costs. Teachers rarely provide the opportunity to the students to questions and to conduct a research or observation of scientific phenomena through experiments and report writing. As a matter of fact research activities conducted by the students are extremely vital in the subject to train

learners' scientific process skills. It can be concluded that the existed teaching and learning process has not yet made the learners active, challenged, enjoyable and meaningful for the students.

Pursuant to an initial observation, it is found that some of the students are reluctant to learn; they do not take into an account when they are assigned to do the tasks, they feel shy to answer the teacher questions when they are asked, learners' are afraid that their friends will laugh and bully them. Learners' capacity in conducting the observation, solving problems, writing the report of the findings of their research or observation, and conducting the experiment is regarded low. All of these obviously affect the learners' scientific process skills and learning outcomes. This can be observed from the result of their end semester I exams that of 22 students, only 12 (55,00%) whose grade above the standard while other 10 students are below the minimum standard score determined by SD Negeri 20 Kurao Pagang Padang. The minimum standard score in SD Negeri 20 Kurao Pagang Padang for the subject of natural science is 75.

Based on the observation it can be concluded that learners' low motivation and learning outcome in subject of natural science

might be caused by the lack of optimality of learners scientific process skills. The teachers should stimulate the students to actively use their scientific process skills in learning process through making use of the kits or media in their science class. One of the approaches that might improve learners' scientific process skills and elevate their understanding of scientific concepts and principles is Problem Based Learning approach through Science Kit Seqip. This approach is believed to be motivating and enjoyable that all concepts and materials will be saved in learners' long term memory or in other words, the learners will always remember the concept taught by the teachers through the use of science Kit Seqip.

Problem Based Learning approach (Savery, 2006) belongs to an approach that is an instructional (and curricular) learner-centered approach that empowers learners to conduct research, integrate theory and practice, and apply knowledge and skills to develop a viable solution to a defined problem. Problem based Learning (PBL) is based on the thinking that every individual form their understanding through their life experiences (Hosnan, 2014). This will be a factor that might influence learners' learning outcome which has been determined in the objectives of teaching. It is a

student focussed approach to learning based on solving open-ended problems, but tends to be more knowledge focused and to operate in loops of inquiry, analysis and articulation. In this approach students are presented with an unfamiliar problem, situation or task and are asked either individually or in groups to solve it. Teachers provide guidance through this process but determining how the problem will be solved is a student responsibility. Traditionally, problem-based learning has a series of steps that commence with the presentation of an issue, student research, presentation of understandings and gaps in knowledge, further research, and collaborative resolution of the challenge through discussion, usually culminating in a report and/or presentation (Ertmer, 2015).

Science Kit Seqip is making used that the teaching and learning process through Problem Based Learning approach enable to motivate learners that they actively use their scientific process skills in conducting an experiments and observation. Kit of Natural Science is a box contained some tools to help learners to learn science. A set of the kits will be used continuously. The kits is designed and similarly manufactured like experiment kits in scientific experiment in Natural Science subject.

Science Kit Seqip relates to scientific kits designed and produced as the result of bilateral cooperation between both governments Indonesia and Germany. The project is aimed at improving the outcome quality of natural science subject matter. Scientific process skills are some steps used by scientists in conducting their researches. A scientist should possess some skills that enable him/her to conduct a research namely: observation, measurement, questions, making a hypothesis, classification, interpreting, communicating, experiment, etc.

Related to effort of the development of learners' potentials, an action research is conducted to find out whether and how Problem Based Learning approach by using science Kit Seqip enable to improve learners' scientific process skills and cognitive learning outcome on grade V in SDN 20 Kurao Pagang Padang. The research is limited on learners' cognitive learning outcomes in knowledge and understanding levels and learners' scientific process skills obtained when they are conducting an observation, interpreting, experimenting, and presenting their findings (communicating) in the subject of natural science by using Problem Based Learning approach in grade V

II. REREARCH METHOD

The method of the study is classroom action research of two cycles in which each cycle consists of some steps, namely planning, action, observation and reflection. The location of the research is SDN 20 Kurao Pagang Padang West Sumatera. Subject of the research is 22 learners of grade V. Of 22 learners, twelve are girls and the rests are boys. The research was conducting within six meetings collaboratively. The resources of the data are teachers and students which directly involved in teaching and learning process. Data of the research was obtained through the observation of Natural Science teaching and learning process by using Problem Based Learning approach though the use of science Kit Seqip, data of observation result of learners' scientific process skills, and learners' cognitive learning outcomes. The data was collected through observation, and test. The data was analyzed through qualitative and quantitative models.

The data of learners' test result was analyzed qualitatively by counting the means of the class and the percentage of the students who already achieved the expected minimum score, namely 80% of the students obtained 75 or more out of 100. The data related to teachers observation, and learners' scientific pro-

cess skills were analyzed by counting the score, means and percentage of the indicators out of the overall indicators which were observed or the number of students with succeeding indicator was 70%.

III. RESEARCH RESULT

A. Cycle I

In cycle I, the learning materials were about Light. The materials delivered in the first and second meeting of cycle I were Properties of Light. They were taught to the students by using Problem Based Learning approach assisted with Science Kit Seqip. The time allocated for each meeting was 2 x 35 minutes. The results of the observation on the treatment given were as follows.

1. The Result of the Observation on the Students' Scientific Process Skills

The result of the observation in Cycle I toward the development of learners' scientific process skills during the teaching and learning process though Problem Based Learning Approach by using science Kit Seqip is described in Table 1.

Table 1. The Students' Scientific Process Skills in Cycle I

No	Indicators of Scientific Process Skills	Meeting		Average
		1	2	
1	Observing	41.00%	55.00%	48.00%
2	Interpreting	31.81%	41.00%	36.41%
3	Experimenting	55.00%	68.00%	61.50%
4	Communicating	36.36%	59.00%	47.68%

The Table 1 indicates that:

1. The students' scientific process skills in doing observation increased slightly from cycle I to cycle 2. The percentage of the students who were able to do this activity was 48.00% or 12 students in the second meeting. It's showing that almost half of the students were able to do observation in groups based on the tasks given. However, there were still many students who were not able to do observation (on guiding group investigation phase), they instead looked confusedly at the activities done by their friends. This was caused by the students who did not understand about what should be observed and they were not accustomed to Natural Science learning process of Problem Based Learning approach assisted with science Kit Seqip. In addition, the students had lack of understanding on the assignments contained in the Student Work-

sheet. The teacher also gave less guidance and motivation to the students to do observation on experimenting Light Properties (Light travels in the straight line and Light can pass through some materials) required in the Student Worksheet.

2. The development of the students' scientific process skills in interpreting in the two meetings was not yet satisfactory (this could be seen in core activity or on guiding group investigation phase and presenting group report phase). The percentage of the students' who were able to do this activity was 41.00% or 9 students in the second meeting. In the first cycle, the students had been willing to interpreting data during the experimenting process about Light Properties, and the application of Light properties in daily life. Some students, however, were still ashamed, unwilling and did not understand about the task and the materials given. In this cycle, the teacher seemed unable to stimulate the students to interpreting data about the materials taught and the activities in the Student Worksheet about Light and its properties. The teacher gave less motivation to the students to interpreting about the activities they have done.
3. The improvement of the students' scientific process skills in the indicators of practicing or doing experiment in the second meeting was also still low. The number of the students who were able to do this activity was 68.00% or 15 students in the second meeting. The students' lack of understanding on the instructions given in the Student Worksheet was assumed as the cause of the problem. Many of the students also felt afraid of doing experiment of Light properties using hot candle light (experiment of Light travels in the straight line). Furthermore, some of them used the learning props as toys. Meanwhile, the teacher also given less guidance and motivation to the students doing the experiment for the learning process.
4. The students' scientific process skills in communicating the learning activities in cycle I was also still low. This result showed that many students did not understand about the learning materials and the activities being done. The number of the students who were able to do this activity was 59.00% or 13 students in the second meeting. This number suggests that there were only a half of the students who were able to deliver or write the result of their

observation on the Student Worksheet, and there was also similar number of students who were able to draw conclusion about properties of light. A large number of students were also unable to see the application of Light properties in their daily life.

In cycle I, it seemed that many students were not able to perform scientific process skills as the learning approach applied by the teacher was different from the previous ones. They were not accustomed to such approach and did not understand what they should solved in the learning posted by the teacher. The students were also not accustomed to their new teacher.

2. The Students' Cognitive Learning Outcome

The result of the test in cycle I at third meeting revealed about the students' learning outcome about light materials, the number of the students who were able to achieve the Minimum Standard Score, the number of the students who were not able to achieve the Minimum Standard Score, the students' average score and the percentage students' learning mastery classically. The results were presented in Table 2.

Table 2. The Students' Cognitive Learning Outcome in Cycle I

No	Description	Total
1	The number of students who were able to achieve the score above the Minimum Standard Score	9
2	The number of students who were not able to achieve the score above the Minimum Standard Score	13
3	The students' average score	70
4	The percentage of the students who were able to achieve the score above the Minimum Standard Score	40.90%
5	Target	70%

From Table 2, it was revealed that the students' cognitive learning outcome in cycle I was still low, and there were many students who were not able to achieve the score above the Minimum Standard Score. The number of the students who got score above the Minimum Standard Score was 13 indicating that the target of 70% students achieving the standard score was not yet achieved. This problem was triggered by the students who were not familiar to the learning process of Problem Based Learning approach with Science Kit Sequip. The teacher was less skillful in explaining and giving reinforcement of the learning materials on the end activity so that the students could not memorize the materials longer. In the initial activity, the teacher rarely correlated the learning materials to the students' real experience which was concrete and easy to be

understood. In the end activity, the teacher did not yet verify thoroughly whether the students had understood the materials or not. The students' scientific process skills which were low in experimenting, interpreting, doing observation and communicating the learning materials had made the students got low mastery / understanding on the materials being learned. Many of them were not able to answer questions in the test of the cycle I. The students' low learning outcome was also caused by the teacher who was not good at managing the time and class, stimulating the students to actively use their scientific process skills in the learning process. In addition, the teacher was not fully proficient in applying the steps suggested in Problem Based Learning approach with Science Kit Seqip.

After the action stage and observation were done, reflection activity with the teacher and observers was carried out to discuss the results of the observation. The results of the observation revealed that the teacher was still awkward / less proficient in conducting the steps suggested in Problem Based Learning approach with Science Kit Seqip. The teacher's performance should be more fun so that the students felt eager to learn. The teacher was not yet able to raise the students' learning

motivation to make them more active in using their scientific process skill in the learning process. The teacher needed to improve her ways of teaching in initial activity, in core activity, in end activity. In order to increase the students' understanding, the teacher should guiding the students doing problem solving or experimenting and giving concrete examples to the students. The teacher was also required to stimulate the students to work actively by making use of Natural Science props provided for groups, and challenge them to interpreting. The teacher could give some helps especially to those who were shy and quiet. The teacher was also expected to guide the students in doing observation through the Student Worksheet which had been revised (accompanied by better pictures and instructions). In the next cycle, the teacher was expected to be more skillful/effective in making use of the time provided and to be able to explain the lesson more clearly by using pictures. She was also demanded to give reinforcement in reflection stage. By doing such improvement, it was expected that there would be many students who were able to answer the questions in the test. The teacher was demanded to guide her students to think about the application of the learning materials in their daily life. To the

two observers, it was expected to do observation well and carefully during the learning process.

B. Cycle II

Based on the reflection result in cycle I, a better planning was remade regarding the way the teacher taught by using the Problem Based Learning approach with the Natural Science props. The teacher was asked to do better classroom management and instructional time. She was also asked giving more motivation to students at the beginning of learning. The improvement was also made by making concept pictures with colors, and attractive words in order to create meanings for the students and help the teacher in explaining the concept to enable students to understand more easily and remember the material that they studied longer. A better planning on how the teacher explained the material was also done in the initial and end activity by connecting the material to be taught with real-life experiences. It was helpful because the brain learned best from concrete experiences. The teacher guided and motivated the students better in order to improve their will to observe, experiment, interpret during the core activity as well as when they performed inquiry activities. The teacher also intensively guided and facilitated

the students who wanted to try and to be able to communicate what they had learned. After discussing with the teacher, it was found that other aspect that needed to be improved in cycle II was the worksheets. It was hoped that the worksheets would help the students to understand easily and be active in doing the observation and experiment. The way the teacher provided reinforcement to the students towards learning in the end activity was also improved. She checked whether the students were already familiar with the material they had learned or not, so that it was expected that a lot of them obtained satisfactory learning achievement in the final test.

In the implementation of the natural science learning activities in cycle II, the material being taught was Light may be reflected in the first meeting and Light may be refracted or bent in the second meeting by using the Problem Based Learning approach with Science Kit Seqip. The observation was carried out by two observers using observation sheets. The result of the observation showed that the teacher was successful in motivating and building a positive relationship with the students, in implementing the Problem Based Learning approach, in presenting the subject matter by using pictures and giving concrete examples.

She was also successful in motivating and guiding the students to observe and solve the activities and things learned by using available worksheets and Natural Science props as well as guiding them to interpret in a group and communicate about their activities in the worksheets. She also succeeded in motivating and guiding groups of students in making observations and asking them to consider the applications of refracted and reflected light in daily life by giving few clues. In addition, she checked her students' understanding about the material that had been taught and reminded them to read more material about Reflected and Refracted Light at home at the end of the second meeting. Thus, the students would be able to pass the cycle II's final test. The full descriptions of students' increased activities in cycle II were as follows:

1. The Result of the Observation on the Students' Scientific Process Skills

Based on the data obtained, it could be observed that the development of students' scientific process skills in cycle II was as follows:

Table 3. The Students' Scientific Process Skills in Cycle II

No	Indicators of Scientific Process Skills	Meeting		Average
		1	2	
1	Observing	77.27%	86,36%	81.82%
2	Interpreting	77.27%	81,81%	79.54%
3	Experimenting	77.00%	82.00%	79.50%
4	Communicating	73.00%	77.27%	75.14%

The data in Table 3 could be interpreted as follows:

1. There were 86.36% or 19 students who had been actively involved in doing observation at the end of the second meeting of Cycle II. They were able to describe the properties of light reflected and refracted. The students got much guidance from the teacher to actively observe experiment and investigation activities by using mirror, flasflight, water, pencil, glass, coins, black papers, spoons, lens and as it was required in the Student Worksheet. The students were motivated, pleased and highly interested to do observation during the learning process in the class.
2. There were 18 students or 81.81% of them who were able to perform scientific process skills of interpreting data in which they could interpret data either about reflected and refracted light in core and end activities. The teacher also had been

proficient in motivating and stimulating the students to interpreting data from other groups report.

3. The students' scientific process skills in doing experiment also increased at the end of the second meeting of cycle II in which 18 students were motivating and willing to do experiment by using mirror, flasflight, water, pencil, glass, coins, black papers, spoons, lens and doing experiment about reflected and refracted light in the daily life. The students were guided by the teachers and they were able to apply reflected and refracted light during the learning process so that they could answers very well the questions contained in the Student Worksheet.
4. The scientific process skills of communicating was done by 17 students at the end of the cycle II. It could be done actively by the students because they were guided by their teacher so that they were able to communicate the results of their investigations on the applications of the reflected and refracted light on the Student Worksheet and presented the result of their observations in front of the class. This skill needed to be taught to the students so that they could think the exam-

ples of the reflected and refracted light applications in everyday life. The teacher also helped the students to draw conclusion appropriately. In the future, students will need to be left alone to think about solving the problem or answering the question asked in the learning activities.

From these results, it can be concluded that all of the scientific process skills of students studied in this research had corresponded to the indicators set out. It could be concluded that the use of the Problem Based Learning approach assisted with Science Kit Seqip could increase the fifth grade students' scientific process skills.

2. The Students' Cognitive Learning

Outcome

Cycle II test was conducted after second meeting. The students' learning outcome was shown in Table 4. From the table, it could be seen that the students who passed were 81.81%, or 18 people. The percentage exceeded the specified passed score indicators. Learning science by using the Problem Based Learning approach and the Science Kit Seqip successfully improved the students' natural science learning outcome. This could not be separated from the teacher's corrective action efforts taken on the cycle II so that the stu-

dents became more motivated and active in using their scientific process skills and understood about the lessons more easily. The improvement of the students' scientific process skills in the cycle II helped them to get better learning outcome. It could also not be separated from the number of students who motivated solve the problems and got involved in the spirit of trying to use the Science Kit Seqip in the learning activities of cycle II, who were good at observing the activities performed, and who were active in interpreting data. They could easily answer the cycle II's final test because they had observed well, had understood the material being taught, and they were motivated and pleased with the way activity and their teacher taught so that they became eager to follow the lessons. The test's questions were related to what they did in the activities of the first and second meeting in cycle II.

Table 4. The Students' Cognitive Learning Outcome in Cycle II

No	Description	Total
1	The number of students who were able to achieve the score above the Minimum Standard Score	18
2	The number of students who were not able to achieve the score above the Minimum Standard Score	4
3	The students' average score	80
4	The percentage of the students who were able to achieve the	81.81%

	score above the Minimum Standard Score	
5	Target	70%

V. CONCLUSIONS

Based on the findings and the discussions of the research, it was revealed that the Problem Based Learning approach with the Science Kit Seqip was successfully implemented in the fifth grade of SDN 20 Kurao Pagang Padang through which it could improve the students' scientific process skills and their cognitive learning outcome in Natural Science. Based on the results of the research, it was concluded that: (1) the fifth grade students' scientific process skills in doing observation increased from 48.00% in cycle I to 81.82% in cycle II, (2) the fifth grade students' scientific process skills in interpreting increased from 36.41% in cycle I to 79.54% in cycle II, (3) the fifth grade students' scientific process skills in doing experiment increased from 61.50% in cycle I to 79.50% in cycle II, (4) the fifth grade students' scientific process skills in communicating increased from 47.68% in cycle I to 75.14% in cycle II, (5) the fifth grade students' cognitive learning outcome increased from 40.90% in cycle I to 81.81% in cycle II.

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