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THE ABILITY OF CREATIVE THINGKING IN MATHEMATICS

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ABSTACT

In this artcle, i discuss about the ability of creative thinking in mathematics, including (1) what is meant by the ablity of creative thinking in mathematics, (2) why the ability to think creatively in mathematics is important and what is the reason, (3) how the ability of creative thinking in mathematics applied in the process of learning mathematics so that the ability of creative thinking in mathematics can be owned by students, (4) what mathematical material is suitable for generating students' ability of creative thinking in mathematics. The method used in this article is discourse analysis, from some articles in various national and international journals. The discussion is presented in the form of description based on the data that is written in the articles. Based on the data presented in these articles, that to create and develop the ability of creative thinking in mathematics, teachers should be able to choose and apply appropriate models and media in the process of learning mathematics, learning process with discussion based model and problem solving.

Keyword **:** *Creative Thinking*

ABSTRAK

Dalam artikel ini, saya membahas tentang kemampuan berpikir kreatif dalam matematika, termasuk (1) apa yang dimaksud dengan kemampuan berpikir kreatif dalam matematika, (2) mengapa kemampuan berpikir kreatif dalam matematika itu penting dan apa alasannya, (3) bagaimana kemampuan berpikir kreatif dalam matematika diterapkan dalam proses pembelajaran matematika sehingga kemampuan berpikir kreatif dalam matematika dapat dimiliki oleh siswa, (4) materi matematika apa yang cocok untuk menghasilkan kemampuan kreatif siswa dalam berkreasi berpikir dalam matematika. Metode yang digunakan dalam artikel ini adalah analisis wacana, dari beberapa artikel di berbagai jurnal nasional dan internasional. Diskusi disajikan dalam bentuk deskripsi berdasarkan data yang ditulis dalam artikel. Berdasarkan data yang disajikan dalam artikel ini, bahwa untuk menciptakan dan mengembangkan kemampuan berpikir kreatif dalam matematika, guru harus dapat memilih dan menerapkan model dan media yang sesuai dalam proses pembelajaran matematika, proses pembelajaran dengan model berbasis diskusi dan penyelesaian masalah.

Kata Kunci : Berpikir Kreatif

1. Introduction

According to Pehkonen & Helsinki (1997) creativity does not only happen in fields such as art, literature or science but also found in various fields of life including mathematics. Mathematics is one of the most important science to teach in schools. In the regulation of the Minister of National Education No. 22 of 2006 on Content Standards it is mentioned that mathematics subjects should be given to all learners, ranging from elementary school to equip them with the ability to think logically,

analytically, sytematically, critically, creatively, and cooperatively. This indicates that the future challanges will be tighter so that it takes graduates of education who are not only skilled in one field but also creative in developing the field being occupied. This needs to be manifested in every subject at school including mathematics. It is clear that creative thingking becomes one of the abilities that must be developed in the learning of mathematics.

The ability to think creatively that is considered important in the learning of mathematics is the ability of creative thinking in mathematics. Mathematical creative thinking is the ability to discover new, varied solutions to easily open and flexible open-ended mathematical problems, yet acceptable to the truth.

Based on the Reasearch and Development Agency (2011), Trends in International Mathematics and Science Study (TIMSS) in 2011, attended by 600.00 students from 63 countries, the mathematical achievement level of Indonesian students is ranked 38th out of 42 countries with score 386. This proves that students' math skills are still far from the target.

Reality found in schools is, that mathematics learning in schools still has not emphasized the students's creativity. In learning mathematics, creativity is rarely improved. Teachers more often use teacher center learning. They only give examples then exercises and do not allow students to show their own ideas or representations. Even though mathematics is a creative work (Matsuko and Thomas, 2015). If mathematics learning usually use teacher center continuously will cause a sense of saturation that result students lazy to receive a learning because they are not given the freedom to be creative, independent learning and put forward their ideas and opinions.

2. *The* Ability *of Creative Thinking in Mathematics*

Analysis of the literature affirms the fact that creativity is multifaceted in the field of mathematics education (Mann, 2006, 2009; Sriraman 2006). Nevertheless, four components that recur in nearly all creativity literature are fluency, flexibility, originality, and elaboration. Here, these four components are discussed.

Fluency, or the number of relevants responses that can be created by any one individual, is an indicator. Often compared to brainstorming, fluent thinkers are able to generate many ideas, possibilities, and potential approaches to finding solutions to a problem. Generation of ideas is the focus here, though once completed, creativity assessment evaluations do consider the relevancy of the responses.

Flexibility in thinking (Krutetsky 1976; Torrance 1966) is considered one's ability to think about a problem solving task from more than one perspective and/or to reverse mental processes. It is not uncommon for problem solvers working on task to be constrained by a preconceived solution path. According Ervynck (1991) the development of mathematical creativity as a series of stages with algorithmic activity as precursors to creative activities. When producing creative solution, it is necessary to be able to draw on the foundational knowledge of the technical and computational aspects of mathematics. However, when the emphasis does not transition to the next stage of development, the student is stuck in the view of mathematics as a world of right and wrong answers (Ginsburg, 1996). When this happens, flexibility is generally precluded and individuals are locked into searching for the right solution path rather than looking for multiple paths to a solution. With sufficient mathematical knowledge and experience, flexible thinkers can evaluate the result for appropriateness and elegance. As an axample, if a mathematical problem was provided in which most

problem solvers used number sense to solve the problem, a flexible thinker may revise an initial solution to find a more efficient approach or look for connections to other mathematical domains such as statistics and probability or algebra. Flexible thinkers lend themselves to highly creative solutions due to their ability to think in addition to the manner in which others might typically think. Often the concept of fexibility and fluency are confused. While fluency is considered the number of responses generated, flexibility is focused on the variety of approaches that an individual is able to use in solving problem.

Originality, the ability to create novel products (e.g., physical models, mathematical models, or on paper prototypes) serves as one piece of evidence that creative potenctial exists. Along with the aforementioned manfestations of originality, it is important to note the mathematical proceses, procedures, and algorithms also can be highly original.

For several years, creativity in mathematics was comprised of only fluency, flexibility and originality (Haylock, 1997; Kim et al. 2003; Tuli, 1980). More recently, the notion of elaboration (Imai, 2000) was connected to creativity in mathematics. Elaboration pertains to the ability of an individual to provide in an explanation. Individuals with a high degree of elaborative skill may identify and be capable of expounding on intricacies of a solution that many peers may not recognize.

Especially in mathematics, Balka (Mann, 2005) states that the ability of mathematical creative thinking includes the ability to think convergent and divergent thinking, (a) the ability to formulate a mathematical hypothesis focused on the causes and effects of a situation of mathematical problems, (b) the ability to find patterns in situation of mathematical problems, (c) the ability to break the impasse of the mind by proposing new solution of mathematical problems, (d) the ability to express unsual mathematical ideas and to evaluate the consequences, (e) the ability to identify missing mathematical information from the given problem, (f) the ability to elaborate common mathematical problems into more specific sub-issues.

3. Method

The method used in this article is discourse analysis, from articles in various national and international journals. The discussion is presented in the form of description based on the data that is written in the articles. To enrich the content and discussion about the ability of creative thinking in mathematics, the author also adds references from several books.

4. Discussion

Many discussion-based and problem-solving learning models can be used to multiply and develop students' mathematical creative thinking skills. One of which is the learning model of "Search Solve Create and Share (SSCS). This SSCS learning model gives students the opportunity to think, express ideas, analyze, and construct their knowledge to solve problems and communicate orally so as to improve student learning outcomes (Zulkarnain, 2015).

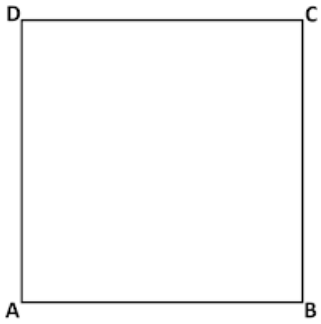
Based on the above axplanation, found that one of the mathematical material that allows to see the ability of students' mathematical creative tinking is the material of geometry. In the learning of geometry materials, student should not just memorize what has been taught but the student must be able to solve the problem with skill, so that student can find many possible answers from a given problem.

Materi Geometri

A. Bangun Datar

Setiap bangun datar mempunyai sifat-sifat yang berbeda. Apa saja sifat bangun datar? Perhatikan uraian berikut:

1. Sifat-Sifat dan Rumus Persegi



Pada bangun datar persegi, mempunyai sifat-sifat diantaranya :

a. Memiliki 4 sisi dan 4 titik sudut
b. Memiliki 2 pasang sisi yang sejajar dan sama panjang
c. Keempat sisinya sama panjang
d. Keempat Sudutnya sama besar yaitu 90 derajat (siku-siku)
e. Memiliki 4 simetri lipat
f. Memiliki simetri putar tingkat 4
g. Rumus:

Luas = s x s
Keliling = 4 x s

2. Sifat Sifat dan Rumus Persegi Panjang

Pada bangun datar persegi panjang, mempunyai sifat-sifat diantaranya :

a. Memiliki 4 sisi dan 4 titik sudut
b. Memiliki 2 pasang sisi sejajar, berhadapan dan sama panjang
c. Memiliki 4 sudut yang besarnya 90 derajat
d. Keempat sudutnya siku-siku
e. Memiliki 2 diagonal yang sama panjang
f. Memiliki 2 simetri lipat
g. Memiliki Simetri putar tingkat 2
h. Rumus

Luas = p x l
Keliling = 2(p+l)

3. Sifat Sifat dan Rumus Segitiga

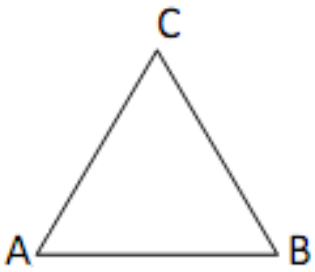
Pada bangun datar Segitiga, mempunyai sifat-sifat diantaranya :

a. Mempunyai 3 sisi dan 3 titik sudut
b. Jumlah ketiga sudutnya 180 derajat
c. Rumus:

Luas = ½ x a x t

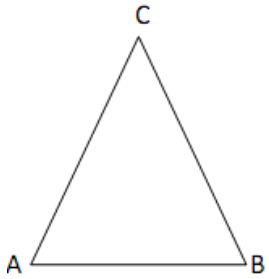
Keliling = AB + BC + AC

Bangun segitiga terdiri dari 4 macam, jika dibedakan menurut panjang susu segitiga tersebut yaitu : segitiga sama sisi, segitiga sama kaki, segitiga siku-siku dan segitiga sembarang.



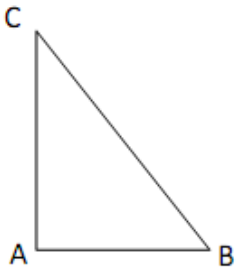
Pada bangun datar Segitiga sama sisi, mempunyai sifat-sifat diantaranya

a. Mempunyai 3 buah sisi sama panjang, yaitu AB=BC=CA
b. Mempunyai 3 buah sudut yang besar , yaitu <ABC , <BCA, <CAB
c. Mempunyai 3 sumbu simetri.
d. Mempunyai 3 simetri putar dan 3 simetri lipat



Pada bangun datar Segitiga sama kaki, mempunyai sifat-sifat diantaranya :Mempunyai 2 buah sisi yang sama panjang, yaitu BC=AC

a. Mempunyai 2 buah sudut sama besar, yaitu < BAC = <ABC
b. Mempunyai 1 sumbu simetri.
c. Dapat menempati bingkainya dalam dua cara.

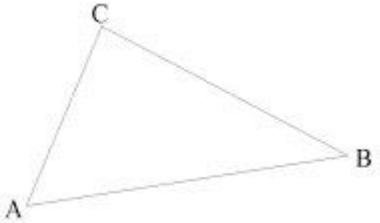


Pada bangun datar Segitiga siku-siku, mempunyai sifat-sifat diantaranya :

a. Mempunyai 1 buah sudut siku-siku,yaitu <BAC
b. Mempunyai 2 buah sisi yang saling tegak lurus, yaitu BA dan AC
c. Mempunyai 1 buah sisi miring yaitu BC
d. Sisi miring selalu terdapat di depan sudut siku-siku.
e. Segitiga siku-siku samakaki memiliki 1 sumbu simetri.

Pada bangun datar Segitiga sembarang, mempunyai sifat-sifat diantaranya :

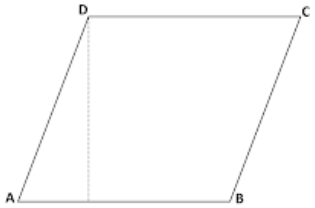
a. Mempunyai 3 buah sisi yang



tidak sama panjang.

b. Mempunyai 3 buah sudut yang tidak sama besar.

4. Sifat Sifat dan Rumus Jajaran Genjang



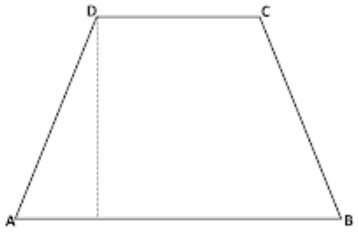
Pada bangun datar Jajaran Genjang, mempunyai sifat-sifat diantaranya:

a. Memiliki 4 sisi dan 4 titik sudut
b. Memiliki 2 pasang sisi yang sejajar dan sama panjang
c. Memiliki 2 sudut tumpul dan 2 sudut lancip
d. Sudut yang berhadapan sama besar
e. Diagonalnya tidak sama panjang
f. Tidak memiliki simetri lipat
g. Memiliki simetri putar tingkat 2
h. Rumus:

Luas = a x t

Keliling = AB + BC + CD + AD

5. **Sifat Sifat Dan Rumus Trapesium**



Pada bangun datar Trapesium, mempunyai sifat-sifat diantaranya :

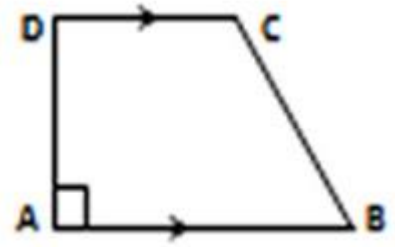
a. Memiliki 4 sisi dan 4 titik sudut
b. Memiliki sepasang sisi yang sejajar tetapi tidak sama panjang
c. Sudut - sudut diantara sisi sejajar besarnya 180 derajat
d. Rumus:

Luas = (Jumlah sisi Sejajar) x t /2

Keliling = AB + BC + CD + AD

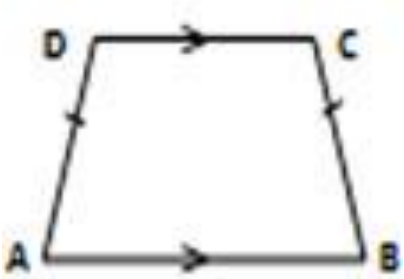
Trapesium mempunyai 3 bentuk, diantarnya :

1) Trapesium siku-siku
   a) Mempunyai 2 sudut siku-siku
   b) Diagonal tidak sama panjang
   c) Tidak mempunyai simetri lipat

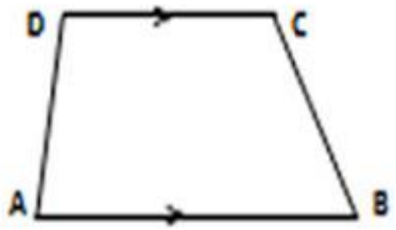


2) Trapesium sama kaki
   a) Sisi diantara sisi sejajar sama panjang.
   b) Memiliki 2 pasang sudut yang sama besar

c) Diagonal sama panjang.
d) Memiliki 1 simetri lipat.

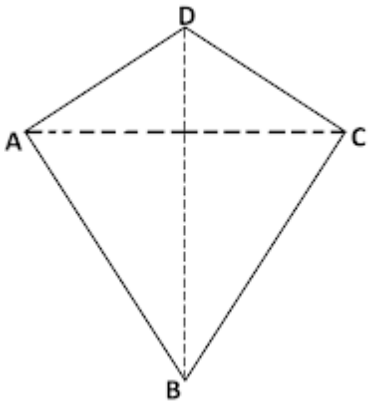


3) Trapesium sembarang
a) Keempat sisinya tidak sama panjang.
b) Keempat sudutnya tidak sama besar.
c) Diagonalnya tidak sama panjang.
d) Tidak memiliki simetri lipat.



6. Sifat Sifat dan Rumus Layang – Layang

Pada bangun datar Layang - Layang, mempunyai sifat-sifat diantaranya :

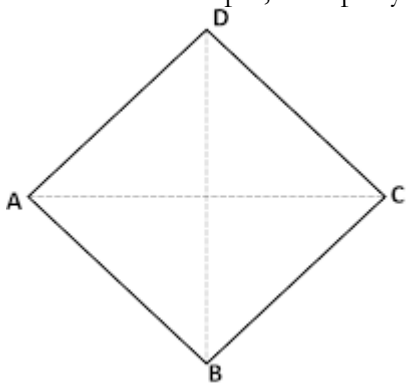


a) Memiliki 4 sisi dan 4 titik sudut
b) Memiliki 2 pasang sisi yang sama panjang
c) Memiliki 2 sudut yang sama besar
d) Diagonalnya berpotongan tegak lurus
e) Salah satu diagonalnya membagi diagonal yang lain sama panjang
f) Memiliki 1 simetri lipat.
g) Rumus:
Luas = ½ x AC x BD

Keliling = AB + BC + CD + AD

7. Sifat Sifat dan Rumus Belah Ketupat

Pada bangun datar Belah Ketupat, mempunyai sifat-sifat diantaranya :



a) Memiliki 4 sisi dan 4 titik sudut
b) Keempat sisinya sama panjang
c) Memiliki 2 pasang sudut yang berhadapan sama besar
d) Diagonalnya berpotongan tegak lurus
e) Memiliki 2 simetri lipat
f) Memiliki simetri putar tingkat 2
g) Rumus:

Luas = ½ AC x BD

Keliling = AB + BC + CD + AD

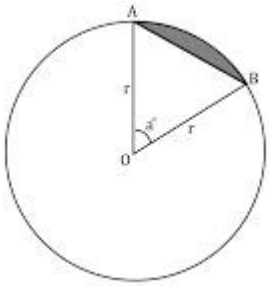
8. Sifat Sifat dan Rumus Lingkaran

Pada bangun datar Lingkaran, mempunyai sifat-sifat diantaranya :

a) Mempunyai 1 sisi
b) Memiliki simetri putar dan simetri lipat tak terhingga
c) Rumus:

Luas = $\pi r2$

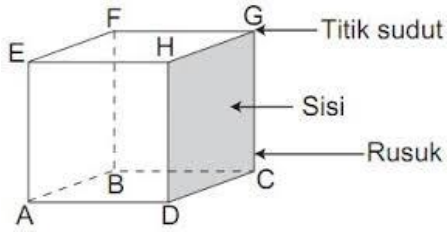
Keliling = $2\pi r$



B. Bangun Ruang

Setiap bangun ruang mempunyai sifat-sifat yang berbeda. Apa saja sifat bangun ruang? Perhatikan uraian berikut:

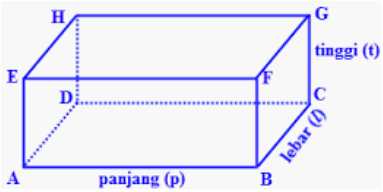
1. Kubus



Sifat-sifat yang menjadi ciri khas dari kubus adalah:

a) mempunyai enam buah sisi dengan ukuran dan bentuk yang sama persis.
b) jumlah rusuk yang membentuknya ada 12 buah denga ukuran yang sama persis.
c) rusuk tersebut saling bertemu dan membentuk delapan buah sudut yang besarnya sama (90^0)
d) Rumus
   Luas salah satu sisi = rusuk x rusuk
   Luas Permukaan Kubus = 6 x rusuk x rusuk
   Keliling Kubus = 12 x rusuk
   Volume Kubus = rusuk x rusuk x rusuk (rusuk 3)

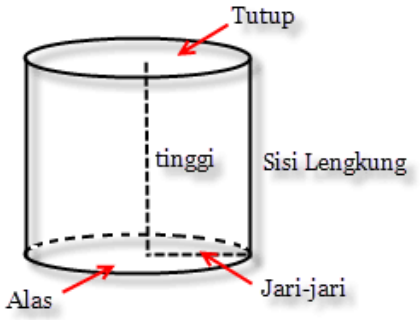
2. Balok



Sifat-sifat yang menjadi cirikhas dari balok adalah:

a) mempunyai empat buah sisi dengan bentuk persegi panjang
b) ada dua buah sisi yang memiliki bentuk sama.
c) terdapat empat buah rusuk yang memiliki ukuran sama persis.
d) Rumus:
   Luas Permukaan Balok = 2 x {(pxl) + (pxt) + (lxt)}
   Diagonal Ruang = Akar dari (p kuadrat + l kuadrat + t kuadrat)
   Keliling Balok = 4 x (p + l + t)
   Volume Balok = p x l x t (sama dengan kubus, tapi semua rusuk kubus sama panjang).

3. Tabung



Sifat Bangun Ruang Tabung

Sifat-sifat yang menjadi ciri khas tabung adalah:

a) memiliki sisi alas

dan atas yang bentuknya sama berupa lingkaran.

b) mempunyai sisi lengkung atau selimut yang menghubungkan sisi alas dan atas.

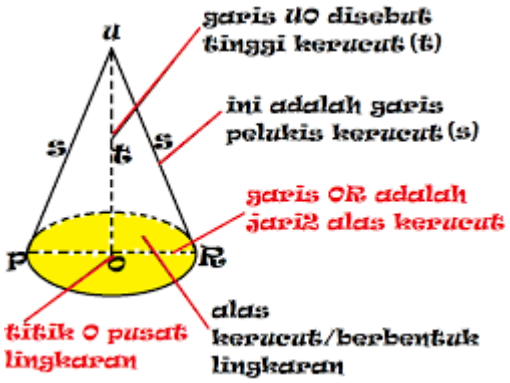
c) Rumus

Volume = luas alas x tinggi, atau luas lingkaran x t

Luas = luas alas + luas tutup + luas selimut, atau

(2 x π x r x r) + π x d x t)

4. Kerucut



Sifat-sifat yang menjadi cirikhas kerucut adalah:

a) mempunyai sebuah alas yang bentuknya lingkaran

b) mempunyai titik puncak atas

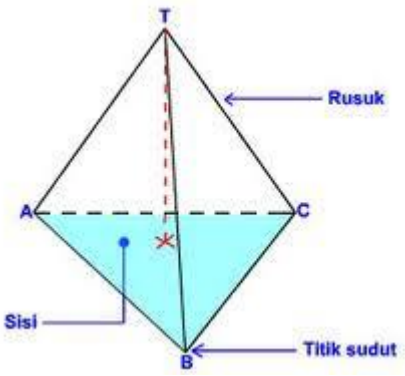
c) memiliki selimut (sisi) yang berbentuk lengkungan.

d) rumus:

Volume = 1/3 x π x r x r x t

Luas = luas alas + luas selimut

5. Limas Segitiga



Sifat-sifat yang menjadi cirikhas dari limas segitiga adalah:

a) memiliki alas yang berbentuk segitiga

b) terdapat tiga buah sisi yang bentuknya segitiga

c) terbentuk dari enam buah rusuk

d) mempunyai tiga rusuk yang sama persis ukurannya.

e) mempunyai titik puncak atas.

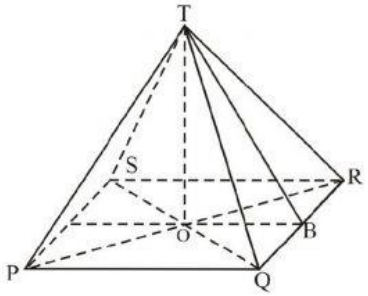
f) Rumus

Rumus Luas Limas Segitiga = jumlah luas keempat sisinya

Rumus Volume limas segitiga yaitu

V = 1/3 x {1/2 x Panjang x Lebar } x Tinggi

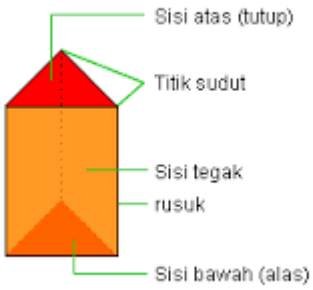
6. Limas Segiempat



Sifat-sifat yang menjadi cirikhas dari limas segiempat adalah:

a) bentuk alasnya berupa segiempat
b) mempunyai empat buah sisi yang bentuknya segitiga
c) ada empat buah rusuk yang ukurannya sama persis.
d) mampunyai titik puncak atas
e) Rumus
   Volume = 1/3 luas alas tinggi sisi
   Luas = luas alas + jumlah luas sisi tegak

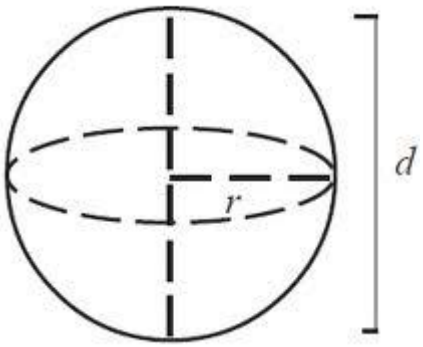
7. Prisma



Sifat-sifat yang menjadi ciri khas dari prisma adalah:

a) mempunyai tiga buah sisi, dua buah sisi berbentuk segitiga dan tiga buah sisi berbentuk persegi panjang.
b) mempunyai 6 buah titik sudut
c) jumlah rusuknya ada sembilan
d) Rumus
   Luas Prisma = (2.luas alas)+ luas selubung
   Volume Prisma =luas alas ×tinggi

8. Bola



Sifat-sifat yang menjadi cirikhas dari bola adalah:

a) hanya memiliki satu buah sisi
b) tidak mempunyai titik sudut
c) hanya mempunyai sebuah sisi lengkung yang tertutup
d) Rumus:
   Luas Bola = 4 x π x jari-jari x jari-jari, atau 4 x π x r2
   Volume Bola = 4/3 x π x jari-jari x jari-jari x jari-jari
   π = 3,14 atau 22/7

Contoh Soal:

1. Sebutkan benda-benda yang berbentuk bangun datar yang kamu ketahui! (Kelancaran).
2. Ayah ingin membuat sebuah kolam ikan berbentuk lingkaran berdiameter 14 m. Berapa luas kolam yang dibuat ayah? (Keluwesan).
3. Buatlah jarring-jaring tabung sebanyak-banyaknya! (Kelancaran).
4. Gambarlah 2 bangun datar berserta sifat-sifatnya! (Elaborasi).
5. Pak Win membeli sekardus sabun untuk persediaan tokonya. Setiap sabun dikemas dalam bungkus berbentuk balok kecil. Di dalam kardus, sabun-sabun itu disusun dengan panjang 7 bungkus, lebar 7 bungkus dan tinggi 7 bungkus. Berapa jumlah seluruh sabun dalam kardus? (Keluwesan).
6. Gambarlah subuah bangun ruang berserta sifat-sifatnya! (banuak rusuk, banyak titik sudut, sisi alas, dan atas, sisi tegak) (Elaborasi).
7. Pak Soleh baru saja selesai mengecat tembok samping rumah yang berbentuk segitiga. Tinggi tembok tersebut 2,5 m, panjang sisi alas tembok 4 m. berapa luas tembok yang telah dicat oleh Pak Soleh? (Original).
8. Sebuah drum minyak diameter alasnya 70 cm dan tinggi 120 cm. jika diisi penuh dengan minyak, berapa liter minyak dalam drum? (1 Liter = $1dm^3$ = 1000 cm^3) (Original).

5. Conclusion

The ability of creative thinking in mathematic can be owned by students if the teachers can choose the model and the appropriate learning media in accordance with the material presented. In other words, teachers need not only to talk the talk, but also to walk the walk. Consider some examples of

instructional or assessment activities that encourage students to think creatively. These kinds of problems can be studied as a basis for understanding creativity in mathematics.

REFERENCES

A.K. Warda, Mashuri, Amidi. (2017). *The Effectiveness of SSCS Learning Models with KNWS Strategy towrds Mathematical Creative Thinking Ability and Self Confidence of Students*. UJME 6 (3) (2017)

Depdiknas. (KTSP, 2006). Permendiknas No.22 tahun 2006. Jakarta: Depdiknas.

Erick L. Mann, Scott A. Chamberlin, and Amy K. Graefe. (2016). *The Prominence of Effect in Creativity : Expanding the Conception of Creativity in Mathematical Problem Solving*. Hope College. Digital Commons@Hope College.

Heris Hendriana, Utari Sumarmo, Euis Eti Rohaeti. (2017). *Hard Skills and Soft Skills*. Bandung. Refika Aditama

Mar'atun Hasanah, Edy Surya. (2017). *Differences in the Abilities of Creative Thinking and Problem Solving of Student in Mathematics by Using Cooperative Learning and Learning of Problem Solving*. International Journal of Science: Basic and Appled Research (IJSBAR) Vol. 34 No.1 pp. 286-299.

Robert J. Sternberg. (2017). *School Mathematics as a Creative Enterprise*. Oroginal Article. ZDM Mathematics Education (2017) 49:977-986. DOI 10.1007/s11858-017-0884-2.

Tressyana D, tatag Yuli Eko S. (2017). *Improving Students' Creative Thinking Ability Throuhg Problem Posing-Geogebra Learning Method*. MATHEdunesa. Jurnal Ilmiah Pendidikan Matematika Vo. 2 No. 2 (2017).