Wanda Nugroho Yanuarto, 2015

Volume 1 Issue 1, pp.57-71

Year of Publication: 2015

DOI- https://dx.doi.org/10.20319/pijss.2015.s11.5771

This paper can be cited as: Yanuarto, W. N. (2015). The Benefits of Images: Guess and Check Game in Math Classroom. PEOPLE: International Journal of Social Sciences, 1(1), 57-71.

THE BENEFITS OF IMAGES: GUESS AND CHECK GAME IN MATH CLASSROOM

Wanda Nugroho Yanuarto
Faculty of Teacher Training and Education, University of Muhammadiyah Purwokerto, Purwokerto, Indonesia
wandanugroho86@gmail.com

Abstract

Geometry is a learning that requires some abilities to cover it. One of it is the spatial ability. The purpose of this study are how learning geometry in mathematics education, Teacher Training and Education Faculty at the University of Muhammadiyah Purwokerto, Indonesia can be easily understood by students. So, the researchers made a model of learning that is associated with the game, guess and check game is one of a game which is support for the student to understand the geometry with easily. Guess and check game consists of several steps or rules of the game. Guess and Check game also closely associated with the image. To improve a spatial ability and motivation to learn geometry for students, images are needed in the game especially in guess and check game. How guess and check the game as the application of the use of the image can improve spatial ability and motivation to learn in geometry?

Keywords

Images, Geometry Course, Guess and Check Game

1. Introduction

The use of images in teaching and learning has benefits to support student comprehension, retention, and application. For example related the use of images to spatial intelligence, and student motivation to learn, which are established models and theories in education.

The theory of multiple intelligences suggests that there are a number of distinct forms of intelligence that each individual possesses in varying degrees. Gardner (1991) proposes eight primary forms: naturalistic, linguistic, musical, logical-mathematical, spatial, body-kinesthetic, intrapersonal and interpersonal (Gardner, 1991). A number of others also suggest an additional one: technological. Students who are spatial intelligence ("picture smart" or visual smart) have the ability, or preference, to think in pictures. Spatial intelligence people create and use mental images; enjoy art, such as drawings, and sculpture); use maps, charts, and diagrams; and often remember with pictures. One implication of Gardner's theory is that learning/teaching should incorporate the intelligences of each person. For example, if an individual has strong spatial intelligence, then spatial activities and learning opportunities should be used.

In humans the sense of sight is by far the most dominant of the five senses. Scientists who study the brain have determined that about one-quarter of the human cerebral cortex is involved in the sense of sight. The studies that are done reveal that today's media environment reflects our strong reliance on sight as a way of taking in information. It is an environment filled with a vast array of visual images, some moving, some still. Although video and film occupy most of our attention when it comes to the visual media, the photograph or still image provides valuable lessons in understanding the techniques used to convey information visually (Thurstone, 1950; Embretson, 1987).

The benefits of images has been recognized in educational psychology for a long time. For example, back in 1996, Richard Mayer and several of his colleagues from the University of California, Santa Barbara studied the effects of a media summary (a sequence of annotated illustrations depicting the steps in a process) on learning how lightning is formed (Karen, 2000). Through a series of experiments, the researchers that are performed found that the students who read a multimedia summary on its own recalled the key explanative information and solved transfer problems as well as or better than the students who read the multimedia summary accompanied by a 600-word passage. Both groups of students performed as well as or better than

the students who read the text passage on its own. The researchers consider these results important because, not only do they support the idea of pictures enhancing learning, but they also suggest that an graphic can achieve similar learning outcomes whether or not it is accompanied by a relatively large amount of text. The researchers interpreted their results in terms of their "cognitive theory of multimedia learning", which draws heavily from cognitive load theory. They proposed that lengthy verbal explanations may in fact distract the learner with unnecessary information, which adversely affects their cognitive processing and thus their learning. In contrast, a concise graphic provides only the important information. This reduces the cognitive load, making it easier to process and to "learn" (Tall, 1977; McFarlane et al., 2002).

"Guess and Check" is a problem-solving strategy that students can use to solve mathematical problems by guessing the answer and then checking that the guess fits the conditions of the problem. For example, the following problem would be best solved using guess and check: Of 25 rounds at the regional spelling contest, the Mighty Brains tied 3 rounds and won 2 more than they lost. How many rounds did the Mighty Brains win? (Groff et al., 2010; Hays, 2005).

What are the benefits of guess and check game? Spatial intelligence, and student motivation to learn are the benefits of images in this research. Authors think that those are important because in geometry class students must have spatial intelligence, student motivation to learn is one other of benefits of images. Learning in general will not be able to run optimally if the student does not have a strong motivation to learn, to guess and check the game is expected student motivation to learn geometry (Spires et al., 2011; DeLong Matt, 2002).

In many curricula, especially in geometry class specific training of spatial ability is of little importance. The main emphasis is put on 2D geometry. Spatial intelligence are frequently and extensively avoided, the way that geometrical polyhedral are already projected in oblique parallel perspective. Thus, the student has only to copy the formula, fill in the measurements and, if necessary, rearrange the formula for calculation (Webb, 1997). This is a very unsatisfying characteristic of today's geometrical teaching. So the major critics leads to the following initial thesis: Spatial geometry is still not more than learning mathematical vocabulary, arithmetic and algebra (Wise & DeMars, 2003). Therefore, space geometry education has to be fundamentally reformed.

Motivation, both intrinsic and extrinsic, is a key factor in the success of students at all

stages of their education, and teachers can play a pivotal role in providing and encouraging that motivation in their students. Of course that's much easier said than done, as all students are motivated differently and it takes time and a lot of effort to learn to get a classroom full of kids enthusiastic about learning, working hard, and pushing themselves to excel (Malone, 1981). Even the most well-intentioned and educated teachers sometimes lack the skills to keep kids on track, so whether you're a new teacher or an experienced one, try using these methods to motivate your students and to encourage them to live up to their true potential. This approach enables the student to devote their cognitive efforts to processing the initial conceptual framework, prior to following it up with more substance once a broad understanding of the main concepts is achieved (Forsyth & McMillan, 1991).

2. Research Design

In this special issue on Benefits of images in guess and check game in math class, it presents a selection of mathematical projects that are in some way relevant, directly or indirectly, to guess and check game. It is take place in Geometry class in Teacher Training and Education Faculty at The University of Muhammadiyah Purwokerto, Indonesia. Authors start with projects that have applications of math and continue with the closely related topic of concept math. Then go on to the timely topic of concepts of math in guess and check game. The class is star with making group which consisted of 5 students. Each group will be taught how they look for the most appropriate alternative answers of some of the issues presented in the paper. But before they look for alternative answers, first they must find the concept of the material being studied today by discussed with a group of their friends. The basic concept of math used as material to make a guess and check the game, Reviews those games is composed of two parts, the problem and alternative answers. The problem Consists of the existing problems in the field of analytic geometry, and alternative consists of four alternative answers, students are asked to look for an alternative that is most correct problems. After alternative answers obtained each group present it in front. The process consists of the presentation will be a question and answer process from another group. So that the process of this game are not only concern to spatial intelligence, but also student motivation to learn.

3. Result and Findings

3.1 Guess andCheck Game's Process

3.1.1 Determine What Students areTrying toFind

The learning begins with the division of the group. Each group consisted of 5 students. Each group will be taught how they look for the most appropriate alternative answers of some of the issues presented in the paper. But before they look for alternative answers, first they must find the concept of the material being studied today by discussed with a group of their friends. This process is very intensive because the thinking of students with their friends in group will improve their ability to think critically. The results is getting their search results with friends. Therefore lecture needs to be intensively give a help for students because the students have been looking for a concept that they should do and her friends. After they did the research for the concept they get the goal, the goal is the same perception of the concept that what has been produced has a shared the knowledge.

Figure 1: *Students determined what they try to find*

3.1.2 Determine What Students Comparing To

The results of what they get together group of their friends then compared with the results conducted by other groups, whether of the discussion draft is done and the results of the search of alternative answer to the problem is provided. This process needs to be done so that what they do does have a truth value or not.

Figure 2: *Students determined what they are comparing to*

3.1.3 Try out a Number

The searching of alternative answer to the problem presented lecturers need to be analyzed by using the method and specific answer. This search process requires trial and error.

The results obtained have the right to perform a lengthy process, which is then corrected by the first trial group of their friends and then analyzed again to the results obtained have the truth.

Figure 3: *Students try out a number*

3.1.4 If Students are Close toTheir Number but Not Quite There Yet, Determine What Should Be Done

The process of finding alternative answers needed timeless, if it given time has run out while the student has not completed the given problem lecturer, then students need to correct myself whether management has owned the right time or not. So not only have good cognitive abilities but time management and division of tasks between the groups also need to be considered by each group of student learning.

Figure 4: *Students determined what should be done if it is not quite finish yet*

3.1.5 Once Students are done, check to Make Sure the Numbers Really Work by Plugging Them Back into the Original Conditions

The alternative answers that have been obtained by each group has a different way of reference and different for each group. So when it has a difference by each group of lecturers

need to consider whether the means used was appropriate or not. Restore step by step do need to figure out which one has the most appropriate alternative answers.

Figure 5: *Students check their final answer*

3.2 Students' Spatial Intelligence

Spatial intelligence skills are essential for mastering a game such as guess and check. When student play guess and check game they have to use strategy and skill in not only planning their moves but anticipating what moves their opponent will make. This is where spatial intelligence comes in because this type of brain exercise lets they visualize the board several moves in advance even though the pieces haven't been moved. Student's spatial intelligence in guess and check game is ask to student looking for an alternative answer to the problems. To find out the problem solving students need to find the most appropriate alternative answers, the process of finding a solution to the student needs to calculate, drawing, and analyzing mathematical concepts. Student's spatial intelligence of this is how students can draw a shape with a diagram. To create a diagram, students need to use the ability to draw and analyze the images properly.

3.3. Students' Motivation to Learn

3.3.1 Give Students a Sense of Control

While guidance from a lecture is important to keeping student on task and motivated, allowing students to have some choice and control over what happens in the classroom is actually one of the best ways to keep them engaged. For example, allowing students to choose the type of assignment they do or which problems to work on in guess and check game can give them a sense of control that may just motivate them to do more.

3.3.2 Use Positive Competition

Competition in the classroom isn't always a bad thing, and in some cases can motivate students to try harder and work to excel. Work to foster a friendly spirit of competition in their

classroom, perhaps through group games related to the material or other opportunities for students to show off their knowledge. Before students use guess and check game, the students were divided into several groups, the grouping process is performed to find the concept in groups, after which the concept can be realized obtained followed by guess and check game. The game is also timeless, so that each group should use the time well, in order to compete with other groups.

3.3.3 Give Students Responsibility

Assigning students classroom jobs is a great way to build a community and to give students a sense of motivation. Most students will see classroom jobs as a privilege rather than a burden and will work hard to ensure that they, and other students, are meeting expectations. It can also be useful to allow students to take turns leading activities or helping out so that each feels important and valued. Allow students to work together. While not all students will jump at the chance to work in groups, many will find it fun to try to solve problems, do experiments, and work on projects with other students. The social interaction can get them excited about things in the classroom and students can motivate one another to reach a goal. Lecture need to ensure that groups are balanced and fair, however, so that some students aren't doing more work than others. Make things fun. Not all class work needs to be a game or a good time, but students who see college as a place where they can have fun will be more motivated to pay attention and do the work that's required of them than those who regard it as a chore. Adding fun activities into their class day can help students who struggle to stay engaged and make the classroom a much friendly place for all students.

4. Discussion

All research mathematicians use guess and check, and it is one of the most powerful methods of solving differential equations, which are equations involving an unknown function and its derivatives. A mathematician's guess is called a "*conjecture*" and looking back to check the answer and prove that it is valid, is called a "*proof*." The main difference between problem solving in the classroom and mathematical research is that in school, there is usually a known solution to the problem. In research the solution is often unknown, so checking solutions is a critical part of the process (Kiili, 2005).

Introduce a problem to students that will require them to make and then check their guess

to solve the problem. For example, the problem: Ben knows 100 baseball players by name. Ten are Red Sox. The rest are Blue Jays and Diamondbacks. He knows the names of twice as many Diamondbacks as Blue Jays. How many Blue Jays does he know by name? (Spires, 2008). When students use the strategy of guess and check, they should keep a record of what they have done. It might be helpful to have them use a chart or table. Understand the problem, demonstrate that the first step is understanding the problem. This involves finding the key pieces of information needed to find the answer. This may require reading the problem several times, and/or students putting the problem into their own words. For example, "I know there are twice as many Diamondbacks as Blue Jays. There are 10 Red Sox. The number of Blue Jays and Diamondbacks should equal 90." Choose a strategy, use the "Guess and Check" strategy. Guess and check is often one of the first strategies that students learn when solving problems. This is a flexible strategy that is often used as a starting point when solving a problem, and can be used as a safety net, when no other strategy is immediately obvious (Bain, 2004).

In mathematics, "Guess and Check" can be a way of determining two or more numbers based on their relations with other numbers. These are best done using a table and if needed, equations/rules. They are: determine what students are trying to find, for example, a problem may say, "The product of a certain number and another number two more than the first number is twenty-four, so find the numbers." Assign variables, like, for example, x = the first number, y = the second number, etc. Determine what number students are comparing *to*, normally, the result of the equation equals a certain number. In the example taken, the product is twenty-four. *Make a* table, assign one column per number/variable (Nilson, 2003).

Make several slots, so each guess can be tested out. Try out a number, in this case, try out for example, two. The second number has a relation with the first number. In this case, it is two more, so it would be four. Carry out with the numbers' relation. For the problem described above, students would multiply the numbers. Since the product is only eight, they are obviously off-track. Try different numbers. If students are close to their number but not quite there yet, determine what should be done, if the result is too high, then try reducing the number they start with, if the result is too low, increase the starting number. Once students are done, check to make sure the numbers really work by plugging them back into the original conditions, does everything work out? If not, go back and see what have done wrong (Dolan, et al., 2012; Egenfeldt, 2007).

The human brain is not a purely logical entity. The complex manner in which it function

is often at variance with the logic of mathematics. It is not always pure logic which gives us insight, nor is it chance that causes us to make mistakes. To understand how these processes occur, both successfully and erroneously, we must formulate a distinction between the mathematical concepts as formally defined and the cognitive processes by which they are conceived. We shall use the term concept image to describe the total cognitive structure that is associated with the concept, which includes all the mental pictures and associated properties and processes. It is built up over the years through experiences of all kinds, changing as the individual meets new stimuli and matures.

Spatial intelligence might be one of less familiar kind of intelligence, however it has wide implications in many academic and professional disciplines. It is extremely important in disciplines such as mathematics and computer science. Spatial Intelligence also accounts for the thinking process of engineers, architects, designers, sculptors and inventors. This paper is an overall comprehension of spatial reasoning and why it is important in learning and problem solving, it is an investigation into what spatial reasoning is and its role in learning and cognition. This paper will also address the neurobiology of spatial reasoning and discuss the specific areas and organization of the brain that accounts for spatial intelligence.

The research's source of data came from learning geometry which is modified by guess and check game, so it can call by Project guess and check game in geometry class. While several studies have investigated the role of spatial abilities in tasks involving visual searching or path finding, authors and colleagues focused on the relationship between spatial abilities and student motivation in learning. Finding that adolescents with strong spatial abilities also show greater interest than most in working with their hands, manipulating and tinkering with tangible things. While building, repairing, and working with inanimate objects might bore some, spatially gifted adolescents reported a preference for such activities.

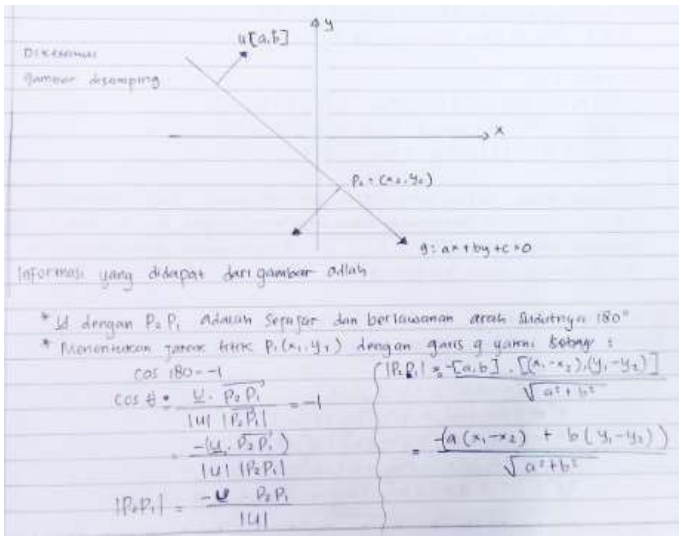

Figure 5: *Students' task who impress a spatial ability*

To find thespatialabilityin the taskabove, the authorscanseethat thestudentis able tointerpretthe problem to relateto the distancebetweenpoints oftheline. Todetermine the distancebetweenpoints ofthelineinto thestudent mustinterpret thediagram, the diagramobtainedfroma distancein realand visually. After thattofind the distancebetweenpoints and lines studentscancalculatetheformulathat has beenstudiedpreviously.

The spatial intelligencethatcan besearchedby theguessandcheckgame, it is also canmotivate students to learn geometry. Paulsen (1999) stated that motivation is decided by two things, they are intrinsic motivation and extrinsic motivation. *Intrinsic Motivation* include fascination with the subject, a sense of its relevance to life and the world, a sense of accomplishment in mastering it, and a sense of calling to it. Students who are intrinsically motivated might say things like the following:

- "Literature interests me."
- "Learning math enables me to think clearly."
- "I feel good when I succeed in class."

Extrinsic motivatorsinclude parental expectations, expectations of other trusted role models, learning potential of a course of study, and grades, Students who are extrinsically motivated might say things like the following:

- "I need a B- in statistics to get into business school."

- "If I flunk chemistry, I will lose my scholarship."
- "Our instructor will bring us donuts if we do well on today's quiz." (Paulsen & Feldman, 1999)

So that way, guess and check game is one way to encourage student motivation. Here are some ways in guess and check game to student motivation to learn in geometry class: a) Become a role model for student interest, deliver your presentations with energy and enthusiasm. As a display of lecture's motivation, they passion motivates their students. Make the course personal, showing why student are interested in the material; b) Get to know the student,Lecture will be able to better tailor their instruction to the students' concerns and backgrounds, and their personal interest in them will inspire their personal loyalty to them. Display a strong interest in students' learning and a faith in their abilities; c) Use a variety of student-active teaching activities. These activities directly engage students in the material and give them opportunities to achieve a level of mastery, such as teach by discovery, student find as satisfying as reasoning through a problem and discovering the underlying principle on their own. Cooperative learning activities, they are particularly effective as they also provide positive social pressure.

In many cases, there are many ways in geometry class to help motivate students: Structure the geometry class to help students know what to expect.

- Use the syllabus to clarify what the student will learn, lecture's expectations, and how the course will be conducted
- At the beginning of class, explain the focus of the class and what they should be able to know and do by the end
- Align what happens with this initial framing of the class
- Close the class with a summary; provide opportunities for students to summarize by asking them to:
  - Respond to clicker questions that gauge what they learned in class.
  - Draw a concept map of what they learned.
  - Write a one minute paper about what they have learned.
- Prepare students for future classes and other learning opportunities.

5. Conclusion

The conclusion of this issue are the answers to math problems that all use in the course of improvement of spatial intelligence and student's motivation to learn in geometry. The benefits of images in guess and check game in this course are pictures can be used for: 1) engaging the students, 2) motivating the students to learn, 3) provoking students spatial intelligence in this case spatial intelligence and 4) a picture paints a thousand words, use one to replacing wads of text. As a researcher, some of the benefits of the images would not only as a spatial ability and improve student motivation to learn, but many others as well. The only one that concern here is closely related to learn geometry in spatial ability, so to improve their ability to study the geometry should be a major to concern. More primary math education students at The University of Muhammadiyah Purwokerto must have good spatial capabilities to support learning geometry. Learning is expected to the guess and check game spatial ability and motivation in learning can be improved as well be an interesting experience for them to learn geometry.

References

Dolan, R.P., Goodman, J., & Strain-Seymour, E. (2012). Evaluation of a game-based performance task for measuring collaborative problem solving skills. Paper presented at the annual meeting of the American Educational Research Association, Vancouver, BC, Canada

Egenfeldt-Nielsen, S. (2007). Third generation educational use of computer games, Journal of Educational Multimedia and Hypermedia, 16(3), 263-281

Embretson, S.E. (1987). Improving the measurement of spatial aptitude by dynamic testing. Intelligence 11(4), 333-358

Forsyth, D.R. & McMillan, J.H. (1991). What teories of motivation say about why learners learn. New directions for teaching and learning. 45: 39-51

Gardner, H. (1991). Abschiedvom IQ-Die Rahmentheorie der vielfacheIntelligenzen. Stuttgart, (Orig.: Frames of mind)

Groff, J., Howells, C., & Cranmer, S. (2010). The impact of console games in the classroom: Evidence from schools in Scotland. UK: Futurelab

Hays, R.T. (2005). The effectiveness of instructional games: A literature review and discussion.

Orlando, FL: naval Air Warfare Center Training Division. Retrieved from http://www.dtic.mil/cgi-bin/GetRDoc?AD=ADA441935

Karen, Zill. (2000). Educational materials, develops outreach campaigns, and conducts media literacy classes and workshops. Routledge: California

Ken Bain, What the Best College Teachers Do, Harvard University Press, 2004, pages 32-42.

Kiili, K. (2005). Educational game design: Experiental gaming model revisited. Research Report 4. Tampere University of Technology. Retrieved from http://amc.pori.tut.fi/publications/EducationalGameDesign.pdf

Linda Nilson, Teaching At Its Best: A Research-Based Resource for College Instructors, 2nd edition, Anker Publishing, 2003, pages 41-44.

Malone, T.W. (1981). Toward a theory of instrinsically motivating instruction. Cognitive Science, 5(4), 333-369

Matt DeLong and Dale Winter, Learning to Teaching and Teaching to Learn Mathematics: Resources for Professional Development, Mathematical Association of America, 2002, pages 159-168.

McFarlane, A., Sparrowhawk, A., &Heald, Y. (2002). Report on the educational use of games: An exploration by TEEM of the contribution which games can make to the education process. Cambridgeshire, UK

Paulsen, M.B., & Feldman, K.A. (1999).Student motivation and epistemological beliefs.New directions for teaching and learning. 78: 17-25

Spires, H.A., et al. (2011). Problem solving and game based learning: Effect of middle grade students' hypothesis testing strategies on learning outcomes. Journal of Educational Computing Research, 44(4), 452-472

Spires, H. A. (2008). 21st century skills and serious games: Preparing the N generation. In L.A. Annetta (Ed), Serious educational games (pp. 13-23). Rotterdam, The Netherlands: Sense Publishing

Tall, D.O. (1977). Conflicts and catastrophes in the learning of mathematics, Mathematical Education for teaching, 24, 2 – 18

Thurstone, L.L. (1950). Some primary abilities in visual thinking. Psychometric laboratory research report no. 59, Chicago: University of Chicago Press

Webb, N.L (1997). Criteria for Alignment of Expectations and Assessments in Mathematics and

Science Education. Washington, DC: Council of Chief State School Officers

Wise, S. L., &DeMars, C. E. (2003). Examinee motivation in low-stakes assessment: Problems and potential solutions. Paper presented at the annual meeting of the American Association of Higher Education Assessment Conference. Retrieved from http://www.jmu.edu/assessment/wm_library/Examinee_Motivation.pdf