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Designing Number-Based Word Synonyms (NBWS) Game as a Learning Technique

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Abstract

Mathematics and Indonesian Language are subjects that are considered difficult by students in Indonesia. In addition, students are also considered less creative. One way to solve this problem is to apply the game in learning. For this reason, a game that can solve the problem needs to be designed. The game that is hypothesized to improve math, language, and creativity is Number-Based Word Synonyms (NBWS). The purpose of this paper is to present the design NBWS game, which consists of ten levels.

Keywords: Games, Synonyms, Words, Numbers, Learning Techniques

In this article three things are examined: 1) Why NBWS game needs to be designed? 2) Games as learning techniques and their effectiveness, and 3) The results of NBWS game designs. The three studies are presented in sequence, as follows.

Why do NBWS games need to be designed?

The game of replacing letters in vocabulary with numbers and summing them up is an easy game. Henceforth the game is called the Letter-Number Change (LNC) game. How to play the LNC as follows: if A = 1, B = 2, and so on until Z = 26, then the word of money = 72%, hard work = 98%, knowledge = 96%, and attitude = 100%. In the LNC game, stated that because attitude has a value of 100%, then the word attitude has strong power, some even say attitude is what determines one's success. In 2005, when I first saw the LNC game in training, I was amazed. The LNC game was delivered several times to us during the training. The question arised, what if the vocabulary is in Indonesian? Is the attitude vocabulary in Indonesian which is *sikap* also worth 100%? Apparently, the *sikap* vocabulary is not worth 100%.

In 2010, a review of the LNC game was conducted, and it was produced that there was a mistake in the game. The error lies in: 1) the use of the concept of percent, and 2) the number of vocabulary words is not regulated, so they include both words and phrases. In the LNC game, letters of a word were only substituted by numbers and then summing it up using percentage unit. Supposedly, if a percentage unit is used accordingly, then the total number of each vocabulary is divided by the total number of all letters from A through Z multiplied by 100%. If A = 1, B = 2, and so forth until Z = 26, then the number of A to Z = 351. In this way, the results are as follows:

money = 72/351 x 100% = 20.51%, hard work = 98/351 x 100% = 27.92%, knowledge = 96/351 x 100% = 27.35%, and attitude = 100/351 x 100% = 28.49%. Thus, attitude is no longer 100%, but 28.49%. The second mistake is that there are no rules on the number of vocabulary words, so there will be many phrases that are 100% in number. Correcting the first and second error of the LNC game can result in obtaining the vocabulary that has a number greater than 100, such as corruption = 149 > attitude = 100. This causes the attitude vocabulary to have strong power no longer. Although mathematically wrong. the game of LNC can still be used as a distraction in adult learning, both as a warm-up and a refresher that can break the situation of freezing the mind and physical learners. However, this LNC game cannot be played when learning mathematics or integrated learning at school. If this LNC game is played in those learnings, it is feared that the children will experience a misconception.

Based on this error, Riyanto (2010) has designed the game, which is looking for the same meaningful vocabulary from Indonesian and English language which has the same amount of numbers. In the game, vocabulary is limited to only one. The results of the design show that of the several vocabulary counts, only the emas (Indonesian) and gold words (English) have the same number. This game is suitable for use as ice breaking in training or learning especially in the fields of mathematics and language. However, the game has a weakness, which is difficult to play because there are not many vocabularies in Indonesian and English that have the same meaning and the same amount of numbers. Because of that, other games that are easy to play and can facilitate children's learning need to be designed.

This LNC game is a blend of two elements, namely number, and vocabulary. The number is in a field of mathematics, while vocabulary is in a field of Indonesian. These two fields are the basic knowledge taught since elementary school. Mathematics is a subject feared by most students, whereas Indonesian is a subject that students are less interested in. Some students underestimate Indonesian because as a mother tongue language. As a result, most students have difficulty speaking Indonesian well and correctly. Based on the results of a survey conducted by Trends in the International Mathematics and Science Study (TIMMS) in 1999, 2003, 2007, 2011, and 2015 the mathematical abilities of Indonesian elementary and junior high school students were always at the bottom (NCED, 2004: Mullis, Martin, Foy, & Arora, 2012; Mullis, Martin, Foy, & Hooper, 2016). While the results of the 2012 and 2015 Program for International Student Assessment (PISA) survey, the reading and math skills of elementary and junior high school students were also at the bottom (Ranking Indonesia dalam PISA, 2013; Indonesia-PISA, 2015). According to Rosengard, around 58% of Indonesian children have reading skills below level 1, and almost none exceed level 4, even university graduates in Indonesia have the same reading ability as out of school children in developed countries which are members of the OECD (Kompas, 2017). According to Nizam, quality improvement has actually been massive but was going nowhere (Kompas, 2017). The results of the national examination are also still low. Since the national examination conducted to date, a passing grade is set at 5.50, whereas for the world level graduation limit is 6.0. In the Education Ministry report disclosed that the 1999/2000 national NEM at the high school level was 3.73 for physics, 4.61 for biology, and 4.63 for chemistry; at the junior secondary level the average was 4.85; and at the elementary level for 1998/1999 the average was 6.17, with the lowest value of 5.13 and the highest score of 7.19 (Info Ebtanas, 2000). According to Jalal, many regions have not reached national standards, for example, NTB, the Indonesian language scores 425, mathematics 444, IPA 429, while national average scores are 500 (Kompas, 2017). In fact, according to the OECD criteria, a different score of 25 alone shows a problem. In 2017, senior high school students, in Bengkulu Province, there were 54% of students who scored below 5.5 (Rakyat Bengkulu, 2017; Suara Pembaharuan, 2017). According to Tabri (2017), the 2017 National Examination score in Jambi Province dropped by 10-12 percent.

To reduce the fear of mathematics and increase student interest in the Indonesian language can be overcome through games. The application of games in learning is very suitable, among others, to support the achievement of cognitive goals in language learning activities, arithmetic, and science and to increase student interest (Heinich, Molenda, and Russell, 1993) and learning outcomes (Sapari, 2000): and Rieber (1996). The results of the study show a positive relationship between the game and student learning (Lieberman, 1977). According to Heinich, Molenda, and Russell (1993), the conditions of games are relaxed and pleasant, especially good for students who are low achievers who have difficulties from the types of structured learning activities. The use of

games can arouse learning interest (Randel, Morris, Wetzel, & Whitehill, 1992; Rieber, 1996) and play a role in shaping the emotional and social intelligence of students (Elias, Zins, & Weissberg, 1997). Games can increase attention, planning skills, and student attitudes (McCune & Zanes, 2001); memory (Jensen, 1999, 2000); language development (Clawson, 2002); as well as creativity and divergent thinking (Holmes & Geiger, 2002). Creativity can be seen as an aspect of problem-solving that has meaning in playing games. When children use imagination in playing games, either by using tools or without tools, they are more creative. A game that combines mathematics with language is Number-Based Word Synonyms (NBWS). Therefore, an NBWS game needs to be designed.

Games as Learning Techniques and Their Effectiveness

Games are activities in which players play according to predetermined rules that are different from reality to achieve the game's goals (Heinich, Molenda, and Russell, 1993). Games are usually carried out in an atmosphere of competition between individuals or groups that are guided by rules to determine winners and losers (Riyanto, 2010). So the games are activities that are arranged differently from reality, are competitive, and have winners. The difference between these games and everyday reality is what makes the games fun.

The technique as one of the components of learning resources is a routine procedure in managing materials, equipment, people and the environment to deliver the message. Techniques include programmed learning, independent learning, mastery learning, discovery learning, simulations, demonstrations, lectures, instructions, questions, and answers, etc. (AECT Task Force, 1994). Gerlach and Elly (1980) interpret techniques as paths, tools, or media used by teachers to direct the activities of students towards the goals to be achieved. Anthony (1963) defines techniques as a method of strategy or tactics used by teachers to achieve maximum results at the time of teaching in certain parts of the lesson. Based on these three experts, the technique is interpreted as a procedure or method. This interpretation differs in the level of breadth, AECT Task Force (1994) and Gerlach and Elly (1980) define techniques as procedures with very broad coverage, while Anthony (1963) means techniques as procedures with a narrow scope. In this paper, learning techniques define as concrete and specific ways used during the learning process to achieve learning goals.

Barth (1990) classified the game into learning techniques because it can provide value-deeper learning effectiveness. With games, classes will become more lively, cheerful study atmosphere, and full of spirit. In addition, students will be confident and pro-active to follow the lessons. According to Ginnis (2008), games can effectively change class dynamics and usually create a greater willingness to learn and behave. Therefore, the games should be used as part of the learning process, not just to fill in the blank or just playing. Games should be designed to be an event that is experienced by students.

Application of games in learning is very suitable among others, to support the achievement of cognitive learning in language, arithmetic, science, and increase student interest (Heinich, Molenda, and Russel, 1993); learning outcomes (Sapari, 2000) and Rieber (1996). The results showed a positive relationship between the game and the students' learning (Lieberman, 1977). According to Heinich, Molenda, and Russell (1993), the conditions of games are relaxed and pleasant, especially good for students who are low achievers who have difficulties from the types of structured learning activities. The use of the game can arouse interest in learning (Randel, Morris, Wetzel, & Whitehill, 1992; Rieber et al., 1996) and be instrumental in shaping social and emotional intelligence (Elias, Zins, Weissberg, 1997). Games can increase attention, planning skills, and attitudes (McCune & Zanes, 2001); memory (Jensen, 1999, 2000); language development (Clawson, 2002); as well as creativity and divergent thinking (Holmes & Geiger, 2002). Creativity can be seen as an aspect of problem-solving that has meaning in playing. When children use imagination in playing games, either by using tools or without tools, they are more creative. Thus, it can be concluded that games can improve learning outcomes and interests, foster creativity, explore desires and ideals, transform knowledge, and generate enthusiasm and motivation.

Through this playing activity, students will be activated in cognitive, affective, and psychomotor. Through the game, the learning process will be better. The game provides opportunities for students to understand their classmates, understand various abstract concepts, and see the real world around them. Through the game,

learning becomes fun. Fun learning makes students feel at home in school. Those who experience pleasant learning tend to repeat it and grow into lifelong learners. So, learning behavior is influenced by previous learning experiences. Therefore, learning needs to be conditioned so that learners can learn with high concentration.

NBWS Game Design Results

The result of the NBWS game design consists of ten levels game, ranging from very easy to very difficult. Ten levels of the game are: 1) replacing letters with numbers, 2) replacing letters in a word and summing them up, 3) replacing letters in several words and summing, subtracting, multiplying, or dividing them, 4) filling one or more letters in the equation, 5) finding two words that have the same number, 6) finding two words that have the opposite number, 7) finding a person's name that has equivalent number to words of characters, metals, plants, or others, 8) finding years of Indonesia important events that have equivalent number with Indonesian vocabulary, and 9) finding arithmetic results of science or non-science concept in English and Indonesian vocabulary, and 10) finding two words in Indonesian and English that have the same number. The ten-level game is presented as follows.

1. Level 1 (L1) Game: Replacing letters with numbers
This game is simply replacing letters with numbers. There are 26 letters of the Latin alphabet, so it is only necessary to memorize the numbers 1 to 26. This game can be used to remember letters and numbers at once. The game can be played for grade 1 elementary school children because it only remembers numbers and sequence letters. The game links the two elements, and both used to train memory.
The game is played by asking the children to replace letters with numbers
Example: If A = 1, B = 2, and Z = 26, what number are the letters P, R, and W?
Answer: P = 16, R = 18, W = 23

2. L2 Game: Replacing letters in a word with numbers and summing them up
This L2 game is more complex than the L1 game. In L2 game, players are required to be able, to sum up, numbers of letters in a word. So players are required to remember numbers of letters and then add them together. This game can stimulate memory and practice summation. This game can be played for elementary school students in grades 1 and 2. For grade 1 students, simple vocabulary is chosen, while for grade 2 students, more difficult vocabulary is chosen.
The game is played by asking the children the total numbers of certain vocabulary
Example: What are the numbers of each vocabulary below?

a) *Jujur*, b) *Semangat*, c) *Zamzam*, d) *Adab*, e) *Abad*

Answer: *Jujur = Semangat = Zamzam* = 80, *Adab = Abad* = 8

3. L3 Game: Replacing letters in some words and adding, subtracting, multiplying, or dividing them
L3 game can be played by adding, subtracting, multiplying, or dividing numbers of several words. This game can be applied to elementary school students in grade 3 or above. It can also be played competitively, for example, fast racing. This game can train memory and speed counting. Both of these abilities are basic capabilities for arithmetic operations and can increase vocabulary.
Example:
1) What is the sum numbers of *jujur* and *semangat*?
    Answer: *Jujur + Semangat* = 80 + 80 = 160
2) What is the result of subtracting numbers of *jujur* and *semangat*?
    Answer: *Jujur - Semangat* = 80 - 80 = 0
3) What is the result of multiplying numbers of *jujur* and *semangat*?
    Answer: *Jujur* x *Semangat* = 80 x 80 = 6400
4) What is the result of dividing numbers of *jujur* with *semangat*?
    Answer: *Jujur* : *Semangat* = 80: 80 = 1

4. L4 Game: Filling one or more letters in the equation

This game is conducted by filling one or more letters in the equation. It can be played
for elementary school students grade 4 and above. The game can improve children's abilities in solving equation
problems.

Example:

Fill in the blanks in the equation below with one letter, so it completes the equation.

a) L - ... = 10   b) C + ... = 15   c) ... + ... = 25   d) Y x ... = 175   e) H : ... = 4

Answer:

a)   L - B = 10   b) C + L = 15   c) O + J = 25   d) Y x G = 175   e) H: B = 4

5. L5 Game: Finding two words which have the same number

This L5 game can be played by anyone from children to adults. It requires mastering a lot of vocabulary. For
players who have a lot of vocabulary, it is easier to solve it. This game can be used to develop persistence in
finding two vocabularies that have the same number. In this game, a dictionary can also be used.

Example:

1) Find 2 words which have the same number.

Answer:
Semangat and *Jujur* = 80
Emas and *Damai* = 38
Malas and *Maling* = 46
Pancasila and *Pemilu* = 76
Abad and *Adab* = 8

2) Find 3 words which have the same number
Answer: *Zamzam = Semangat = Jujur* = 80

6. L6 Game: Finding 2 words which have an opposite number

L6 game is almost the same as L5 game. This game can be used to develop persistence in finding two words
that have the opposite number.

For example: Find two words which have an opposite number.

Answer:
Besi >< Kuat (*Besi* = 35, *Kuat* = 53)
Adil >< Serakah (*Adil* = 26, *Serakah* = 62)

7. L7 Game: Finding a person's name that has an equivalent number with words of characters, metals, plants, or others

This game is almost the same as L5 and L6 game, but with a higher level of difficulty because there are
limitations. This game can be played by children and adults.

a. Finding your name or friend name that has an equivalent number to a certain Indonesian word
b. Finding your name or friend name that has an equivalent number to a word depicting the character
c. Finding your name or friend name that has an equivalent number to a word of metal concept
d. Finding your name or friend name that has an equivalent number to a word of plant concept

Example: Find equivalent names Riyanto with certain Indonesian vocabulary
Answer: Riyanto = 102, *Pengetahuan* = 102

8. L8 Game: Finding important events that have an equivalent number with Indonesian vocabulary

This game is almost the same as the L7 game. This game can be played by children to adults.
Example: Find an Indonesian word that has an equivalent number with the year (2 digit ends) of
Indonesian independence
Answer: Year of Indonesian independence = *Kerja* = 45

9. L9 Game: Finding arithmetic results of numbers of science or non-science concept in English and Indonesian vocabulary

This game is almost the same as L5, L6, L7 and L8 game with a higher level of difficulty because it involves many fields of science. Players are required to have a lot of Indonesian and English vocabulary in various fields of science and must be diligent in reading dictionaries. This game can train accuracy, perseverance, hard work, and diligence. The game can be played by children to adults.

Example:

1) What is the summation number of Gold (English vocabulary) and *Emas* (Indonesian vocabulary?

   Answer: Gold + *Emas* = 76

2) What is the substraction number result between English and Indonesian vocabulary of metal?
   Answer: Gold – *Emas* = 0

3) What are the results of times (you) of the English and Indonesian vocabulary of metal?
   Answer: Silver x *Perak* = 85 x 51 = 4335

4) Find English and Indonesian vocabulary that has the same meaning and one difference!
   Answer: *Kerja keras* = 99 and hard work = 98

5) Find English and Indonesian vocabulary that has the same meaning and difference of six!
   Answer: Knowledge = 96 and *Pengetahuan* = 102

6) What is the sum of 2 Indonesian vocabularies of *Besi* and *Emas*?
   Answer: *Besi* + *Emas* = 35 + 38 = 73

7) What is the difference of 2 Indonesian vocabulary of *Besi* and *Emas*?
   Answer: *Besi* – *Emas* = 35 - 38 = -3

   Note: Metal elements can be replaced with elements or concepts in other fields

10. L10 Game: Finding 2 vocabulary in Indonesian and English have the same amount

This game can be played by anyone from children to adults. This level game has a higher level of difficulty because besides there are limitations, and players are also required to find 2 vocabulary words from Indonesian and English with the same number of numbers. This game requires mastery of a lot of vocabulary both Indonesian and English vocabulary. For players who have a lot of vocabulary, it's easier to find 2 vocabulary words that have the same number of numbers in Indonesian and English, for example Gold = Gold = 38. Players are required to have a vocabulary of two languages or have to read the dictionary diligently. This game can train accuracy, tenacity, hard work, and crafts.

Example: Find 2 Indonesian and English vocabularies that have the same meaning and number!
Answer : Gold = *Emas* = 38

Based on the design results there are 10 levels of NBWS games. Each level of the game has different levels of difficulty. The design of this game is based on the theory that children, even adults love to play. The subjects presented through the game will make students happy. The game is designed in integrated learning. Integration can consist of two or more subjects, can also be combined with all the concepts of the subject. In addition, this NBWS game can be played both inside and outside of school learning, either alone or in groups.

Conclusion

In this paper, the developed NBWS game is described. The NBWS game can be applied as a learning technique. It could theoretically facilitate children in learning mathematics (arithmetic) and Indonesian language (develop vocabulary), also increase the creativity of learners.

Recommendation

Based on the results of the NBWS game design, it is recommended that: 1) the NBWS game design is validated and evaluated both in class and outside the classroom and 2) the results of the L3 game design can be further developed into more complex games, such as: changing letters in several words and adding up, subtracting, multiplying, or dividing the results in word form.

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