

Development of Mathematics Chess Instructional Media  
to Improve Mathematics Learning Outcomes  
of Primary School Students

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## Development of Mathematics Chess Instructional Media

### Abstract

Multiplication is important concept in Mathematics learning. Because it is related to other concepts in Mathematics. In fact, The process of teaching it, many teachers deal with some problems of method as well as provision of instructional media. This research which applied developmental research and experiment research is expected to produce mathematics chess instructional media on multiplication topic so that the purpose to improve mathematics learning outcomes of primary school students can be achieved. The population in this research are third grade students of SD HARAPAN I MEDAN, SD HARAPAN II MEDAN, SD NEGERI 060943 MEDAN, and SD NEGERI 060944 MEDAN in the academic year of 2014/2015, randomly selected for an experimental class and a control class. The instruments used in this research are test and questionnaire. The instrument is valid with reliability value is 0,70.. The research of this study shows that the students who are taught by using mathematics chess instructional media have higher scores compared to those who are taught by conventional method on 5 % significant rate. Meanwhile, The responses of students indicate that hundred percent of the students stated that multiplication topic by using this mathematics chess instructional media is interesting and eighty percent of them stated that multiplication topic is easier to understand. All of the teachers agree that teaching multiplication by mathematics chess instructional media is interesting and can be applied in their class.

*Key words:* Mathematics Chess, Multiplication, Instructional Media

# Development of Mathematics Chess Instructional Media

## Introduction

In daily life, the role of mathematics is very great. The most role of mathematics prosecute the students must be able to learn about mathematics. Soviawati (2012) stated the subject of mathematics need to be given all the students from Primary School to provise the students by logic thinking ability, analitical, sistematical, critize, and creative, and also ability to work together. Setiawan (2012) stated that the science to review the object of abstract and mainly use deductive thinking, the nature of mathematics so that it will appear the difficulty for students to learn mathematics.

In mathematics, every concept having the relation. Like in primary school, the aljabar concept is one of the important concept for understanding the structure of mathematics, and one of the most important part that must be understood by the student is a multiplication concept as the basic aljabar.

At this time, there are many students in junior or senior high school who don't understand about the aljabar concept. And because of the phenomena the researcher try to solve the problem by creating instructional media. And the media is mathematic chess. Mathematic chess is media that used to help students for understanding multiplication operation.

The purpose of this research is to know the effectivity of instructional media mathematics chess in improving the result of study the students. The benefits of the study are: (1) to create an instructional media

## Development of Mathematics Chess Instructional Media

in aljabar operation especially multiplication operation, (2) to give a motivation for the teacher, to be more creative in making a learning media.

### **Literature Review**

According to Sudjana and Rivai (1990), so that interrelated to communicate and interaction are so well between teacher and students, a teacher must pay attention to be ready the students intellectual either choose the method or use appropriate instructional media in teaching learning process. To use instructional media in teaching mathematics, it is hoped can be easy for students to accept and to understand mathematics. The criteria that must be considered by the teacher or educator for selecting the instructional media, they are: (1) the appropriate media with learning objective, (2) the support of learning material, (3) an easy media, (4) the teacher's skill, (5) the available time, (6) the student's skill for understanding it. By doing that, Supriatna (2009) stated that there are some factors need to be considered for teacher/ educator participant in choosing instructional media, they are: (1) the objective of instructional, (2) the effectiveness, (3) students, (4) available, (5) cost, (6) technical quality. According to Wibawa & Mukti (1993, 67-68) the criteria need to be considered in choosing instructional media, they are: (1) goal, (2) the characteristics of student, (3) time allocation, (4) the available, (5) the effectiveness, (6) compatibility, (7) cost. Including with the choosing media, Arsyad (2011) stated that choose of media, they are: (1) the appropriate with the objective that it want to be achieved, (2) suitable to

## Development of Mathematics Chess Instructional Media

support the learning content, (3) practice, flexible, and endure, (4) the skill of teacher when using it, (5) the grouping of objective, (6) technical quality. Brown, Lewis & Harcleroad (1983, 76-77) stated that in choosing instructional media need to be considered some criterias, they are: (1) *content*; (2) *purposes*; (3) *appropriatness*; (4) *cost*; (5) *technical quality*; (6) *circumstances of uses*; (7) *learner verification*, dan (8) *validation*.

From the opinions of the experts above, we can conclude that the success of using the instructional media is depend on the way of giving learning material, the learning method that used by the teacher. As described in figure below :

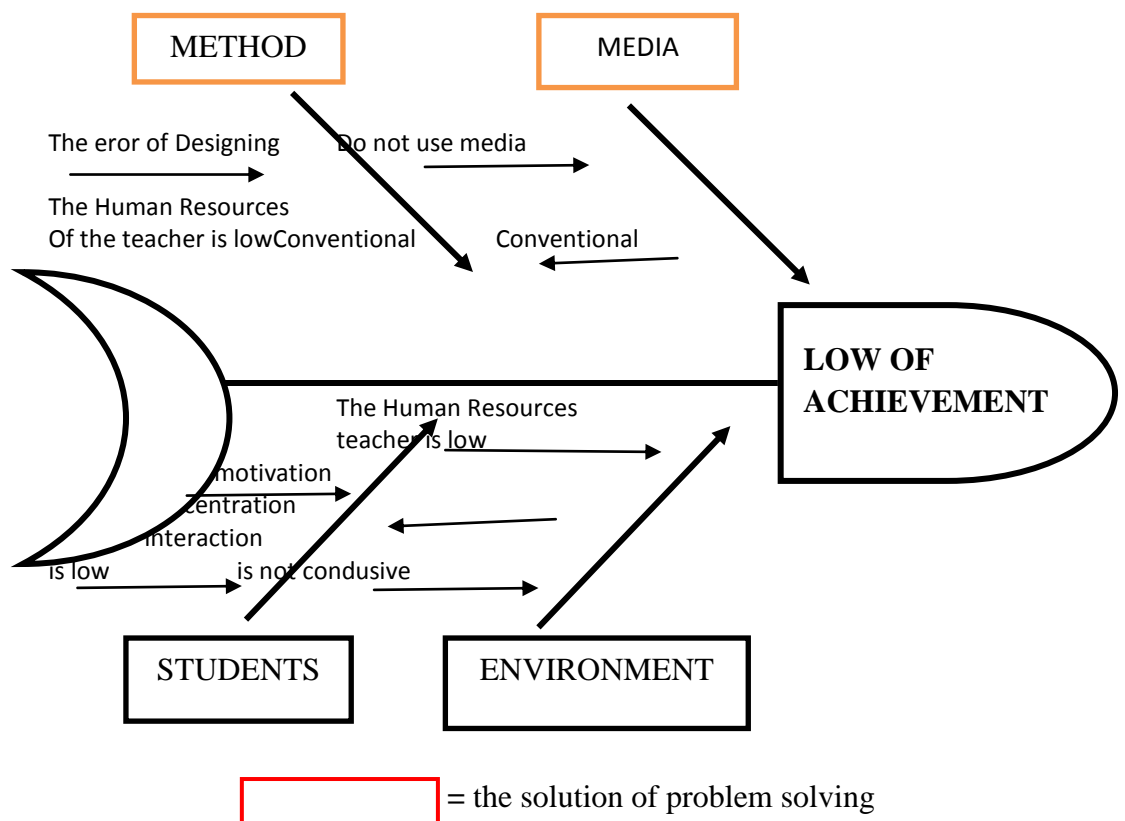


Figure 1. Diagram of Fish Bone

Many kinds of instructional media that used in presenting learning material. The instructional media is expected to improve the achievement

## Development of Mathematics Chess Instructional Media

to use instructional media, mathematics chess. Mathematics chess that used in this research is an instructional media that contain unit multiplication and all results. Mathematics chess can be played by minimum two people. The rule of playing in mathematic chess, every player think to determine the result of unit multiplication and logical thinking in winning the game. This instructional media can be played not only in teaching learning process, but also when students in relax. This is why this media is more interesting. This instructional media designed for more tend to the game for encourage the student's interesting.

15	3	8	25	32	20
48	21	36	40	2	45
4	27	81	63	28	16
30	49	1	18	35	6
9	56	24	10	54	42
14	5	72	64	7	12

1	2	3
4	5	6
7	8	9

Figure 2. Mathematics Chess

### Methodology

The research in this study is *Research and Development* that developed by Borg and Gall (1983) continued experiment research with design *Randomized Post Test Control Group Design*.

## Development of Mathematics Chess Instructional Media

Development research to produce instructional media on material multiplication operation. Next experiment research to see effectiveness instructional media and prove reserach hypothesis. The research done by two sampling, experiment and control group.

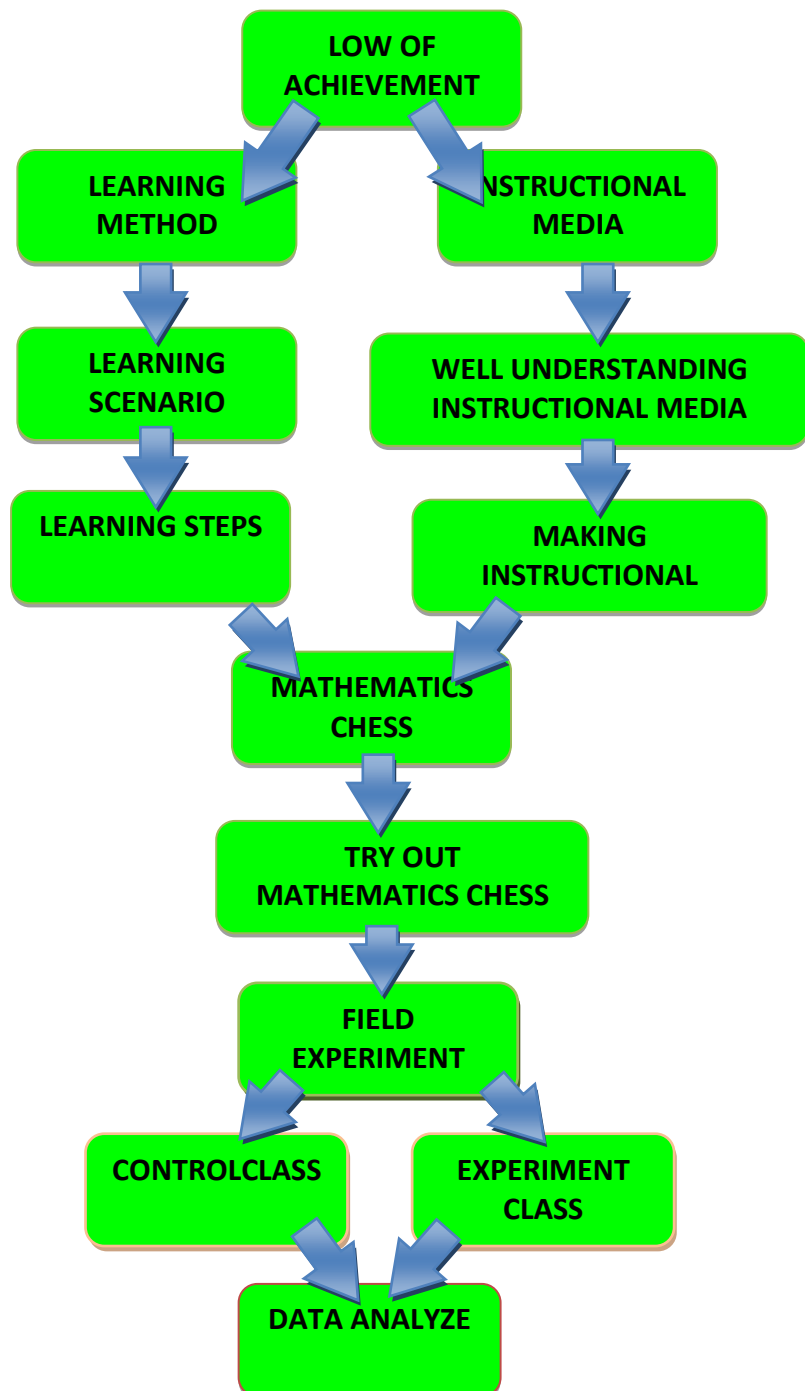


Figure 3. Research Methodology Design

### **Development Research Method**

Development research done by using some steps, they are:

- a. Step arranging learning equipment, that involve instructional media that is mathematics chess. Lesson plan and test of achievement. The result of this step called draft 1.
- b. Step develop learning equipment, they are:

**Expert validation.** After draft 1 finish, next done evaluation by some expert that competent to evaluate and to give suggestion and idea to use the perfect of draft 1. They are selected are the lecturer of mathematic education and mathematic teacher. This validation generally involve the correctness substantiation, the appropriatness with the grade of students' thinking, and the appropriate with the concept and learning steps by using instructional media mathematics chess, that contain in validation sheets. Based on the evaluation, correction, input and suggestion from this validator next to be done a revise on draft 1 so that result draft 2.

**Simulation Instructional Media.** Simulation instructional media (mathematics chess) carried out with the purpose to give describing to the teacher's friend about carrying out learning that will be done also to get input about the appropriatness time allocation and is instructional media can be clearly understood by students in using so that can be applied in



## Development of Mathematics Chess Instructional Media

the classroom to be subject of research. The result of this simulation used to revise draft 2 and result draft 3.

**Try out of the field.** After draft 3 finish, next it done try out of the field. Try out done in class III A Kemala Bhayangkari Primary School Medan. Select this school because it considered can represent ability of all students Primary School in Medan. Select the class III A done based on the class that have ability in average in multiplication material. In this also done based on the discussed between researcher and head master and mathematic teacher in the Primary School. The design of try out from learning equipment is *one-group pretest-posttest design*. The instrument that data collection used (1) the questionnaire of students respond to get the data about students respond, (2) test of study result to get data about the achievement about students. The data about students repond analyzed by using percentage though the data that got from test of the achievement next produced to determine validity and reability. This study result used to revise draft 3.

### **Method of Experiment Research**

The population in this research is students grade class III Primary School Harapan 1 Medan, Primary School Harapan 2 Medan, Primary School State 060943 Medan, Primary School State 060944 Medan that list in the year 2014/2015. The research done on two representative class that

## Development of Mathematics Chess Instructional Media

selected randomly from population. One for each experiment and control class.

Table 1. Research Sampling

School	Experiment Class	Control Class
Primary School Harapan 1 Medan	III C	III B
Primary School Harapan 2 Medan	III B	III A
Primary School State 060943 Medan	III A	III B
Primary School State 060944 Medan	III A	III B

Design of experiment research that used is *Randomized Post Test Control Group Design* as the figure below:

Class	Treatment	Postest
Experiment	$X$	$T$
Control	$Y$	$T$

Description:

$T$  : Pos test

$X$  : Treatment, that is learning with instructional media mathematics chess.

$Y$  : treatment, that is learning with conventional approach.

Independent variable / treatment in this research is learning use instructional media with mathematics chess and as dependent variable is the achievement of student after given treatment ( postest score). As control variable, they are: (1) material that taught, experiment group and control group to get the same material that is multiplication operation, (2) the teacher is teaching. Experiment and control group taught by the same teacher, (3) time. The total of time of enter the classroom in learning in

## Development of Mathematics Chess Instructional Media

the experiment class and the same control class. The variable is not control in this research is the economic background and health condition from the students, students parents' education, and distance the students' address with the school.

Knowing the effectiveness of instructional media with mathematics chess in improving of students' achievement, so that collected the data of achievement and students' repond and teacher on instructional media's using mathematics chess. The data of students' achievementcollected through test, that is post test that given after learning process in the experiment class and control class. The test of instrument of study result form essay test as 20 questions. The test instrument of study result be appropriated with curriculum 2004 about material multiplication operation. To get well test, the achievement test the firstly it is tried out to the students' respond is not only to be research sampling. This students' respond taken from the students class IV Primary SchoolKemalaBhayangkari Medan that have studied material multiplication operation. The score oftry out test done to know about validity test with using coeficient Biserial Point Correlation. From the result validity of test stated that all of the questions tested validity. To know about reability test used split technique then next to be continued with formula*Spearman-Brown*.The reability test result got  $r_{\text{count}} = 0,70$  and  $r_{\text{table}} = 0,361$ . It can be concluded that instrument test is reliable. The test of achievement also analyzed the difficult grade for question item, and analysis of the trick different question. The students' respond data

## Development of Mathematics Chess Instructional Media

collected by using questionnaire that given to the student experiment class after learning finish with the purpose to know students' respond on mathematics learning by using instructional media with mathematics chess. Students' respond data and teacher that collected next to be analyzed use descriptive statistic with percentage.

To know about what do the achievement between students in the experiment class that use instructional media with mathematics chess is better than from the study of result to the control class that use conventional method and so that the achievement of the students analyzed with descriptive statistic and inferential statistic. The data of achievement **analyzed descriptively** with distribution table and inferentially with t-test (Sudjana, 1992).

### Results and Discussions

From the research results got 254 data, as the result of **student's study** in the mathematics learning multiplication material. The data got from sampling research that spread in the eight class with details 128 data got from experiment class that given mathematics chess learning dan 126 data got from control class with using **conventional learning method**.

The achievement got in the table 2.

Table 2. The students' Achievement

	N	$(\bar{X})$	SD	Me	Mo	High Score	Low Score
Totally	254	27.19	3.03	25	22	30	18
Experiment Class	128	28.14	2.55	25	25	30	21
Control Class	126	26.27	3.19	25	23	30	18

## Development of Mathematics Chess Instructional Media

From table 2 seen that the achievement average of students on mathematics learning multiplication material that use mathematics chess higher than **using** conventional learning media.

Table 3. The distribution of frequency of the score achievement Experiment Class and Control Class

No	Interval	Experiment Class		Control Class	
		Freq.	Freq. Relative (%)	Freq.	Freq. Relative (%)
1	17 – 18	0	0	1	0.79
2	19 – 20	0	0	12	9.52
3	21 – 22	10	7.82	28	22.22
4	23 – 24	23	17.97	29	23.02
5	25 – 26	36	28.11	21	16.67
6	27 – 28	32	25.00	20	15.87
7	29 – 30	27	21.10	15	11.91
	Total	128	100	126	100

Form the frequency of distribution known that average score  $(\bar{X})$  experiment class is in the grade 6 with frequency relative as 25 %. The data frequency relative of data in the below score class average  $(\bar{X})$  as 53.9 %, and as big as relative frequency in the above score class average  $(\bar{X})$  is 21.1 %. Though at the control class, average score  $(\bar{X})$  is there in the grade 5 in the frequency relative as 16.67%. The frequency relative of data in the below score class average  $(\bar{X})$  as 55.55%, and as many as frequency relative of data in the above in the score class average  $(\bar{X})$  as 27.78%. The data of achievement can be also presented in the histogram form as the below.

## Development of Mathematics Chess Instructional Media

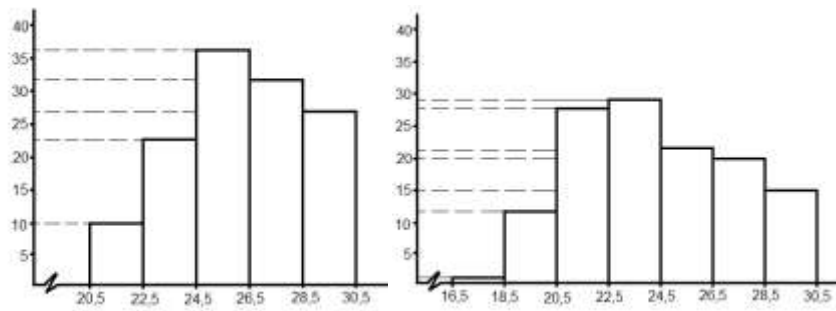


Figure 4. Histogram of score the result study Figure 5. Histogram of score Mathematics Experiment Class Mathematics Control Class

Descriptively seen that the distribution of data achievement mathematics experiment class with using mathematics chess is better than from the control class do not use mathematics chess media (conventional). Inferentially, this result must be still proved through analysis t-test though previously it first done the test requirements use analyze that is normality test and homogeneity test. The technique that used for normality test with using Liliefors test though for homogeneity test used Fisher test. The result of data analyze show the result study of students on experiment class and control class, every class has normal distribution with  $L_{count} = 0.06 < L_{table} = 0.08$ . The varians of data achievement of students homogen with  $F_{count} = 1.18 < F_{table} = 1.35$  at the degree of significant 5 %. In this moment, the hypothesis test have been done. From the result of counting with t- test, got for  $t_{count} = 4.86$  dan  $t_{table} = 1.65$  at the degree of significant 0.05. It means that  $t_{count} > t_{table}$ , thus hypothesis null ( $H_0$ ) rejected and hypothesis alternative ( $H_a$ ) accepted. It can be concluded that the result study of students with mathematics chess in material learning multiplication is better than from conventional learning. This result shown that select the use of mathemtaics chess media in learning material multiplication has

## Development of Mathematics Chess Instructional Media

been appropriate and has been suitable with the criteria that must be paid attention in selecting media that is the objective of learning, the effectiveness, students, the appropriateness, technical quality, cost, flexibility, and ability of the people that use also available time allocation (Arsyad (2011), Supriatna (2009), Wibawa & Mukti (1993), Brown, Lewis & Harclerod (1983)). The use of mathematics chess media has fulfilled the criteria they are: (1) the suitable with the objective that want to be achieved that is help the student to be able to multiplication operation, (2) the appropriateness to support the content of multiplication learning, (3) the pleasure condition that appeared by learning with using mathematics chess media directly can improve the effectiveness of learning, (4) the suitable with degree of students' thinking, (5) it is easy to make, cheap, and easy to use by students or teacher **because** learning with mathematics chess, the students do not feel bad, or forced and created more relax situation and made the student enjoy mathematics like play a game (6) flexible and smooth because the use of mathematics chess also can be used in the outside of learning time that means can be done formally or non formal. Eventhough the mathematics chess also can be done without the teacher. This is suitable with the learning concept that stated by Gagne, Briggs and Wager (1992) that expressed by Paulina Panen (1999) that the learning is a set of activities that designed to be possible happened the learning process to the students. Based on this learning concept, so the learning activity is not only doing in face to face context between teacher and student in the classroom, students'

## Development of Mathematics Chess Instructional Media

interaction is not limited by presenting of teacher's physically. Students can study through print material learning, module, book, students' worksheet and another sources, like mathematics chess instructional media.

This result supported by students and teacher respond data in using instructional media mathematics chess that collected through questionnaire. A hundred percent of students stated that multiplication material through the use of instructional media mathematics chess is interesting and 80% that is stated multiplication operation to be easier to understand. A hundred percent of teacher's opinion presenting multiplication material through instructional media mathematics chess interested and can be applied in the their teaching classroom. This is show that mathematics chess have been function well as an instructional media. Levie and Lentzin Arsyad (2011) stated that 4 function in instructional media, they are: attentive function, affective function, cognitive function, and compensatoris function. Attentive function is a function that mainly media that is interesting and carry out attention, students to concentrate to the learning material. Affective function included with pleasure feeling that has the students when follow the activity of learning. Cognitive function contain the meaning that instructional media can launch to achieve the objective of learning to understand and to remember the information or the message that contained in the instructional media. Though convensatoris function contain the meaning that media has been function to accomodate or to help the weak student and slow to accept or to understand the learning



## Development of Mathematics Chess Instructional Media

material that presented with text ( verbal). This result also suitable with Marisa's opinion stated that the use of instructional media to be learning more interesting and more interactive, more concrete and real, and also to support the students to study more autonomy. Some of the research result also found were there any affect and significance instructional media in the students' achievement Primary School. Neswari (2012) found that was there any affect significant CD instructional media on students' achievement of science in Primary School. Na'im (2014) found that use and beneficial about audio media, visual, and audio – visual can improve the study result of students Primary School on religion's subject. On the mathematics' learning, to use media manipulative of dragnet can improve the achievement of students Primary School (Riana, Margiati, and Nursyamsiar, 2013 ). Haryanto (2010) and Tri Parmana (2012) found that the use of concrete media can improve the achievement of mathematics' students in Primary School. This finding of the research to support the result of research on this article.

**Limitations of This Study.** Though, there are some limited of this research, they are *first*, in doing the research, the treatment in experiment and control class carried out by the same teacher so the teacher performance doesn't optimal. *Second*, mathematics chess that can be occurred as a game make the frequency of exercise in experiment class is higher than control class. *Third*, the students to be the subject of the research are not controlled tightly in the outside of the school, so that it

## Development of Mathematics Chess Instructional Media

possible there are different students' learning experiences to affect the students' ability.

### **Conclusions**

Based on the result of research and discussion that have explained, so that it has been taken the conclusion of using instructional media with mathematics chess can improve the students' achievement on multiplication. For mathematics' teacher suggested so that do not use conventional method in learning. And it can use the mathematics chess in learning multiplication because the use of this media makes students easy to understand the multiplication. Next, the school is hoped can provide the mathematics chess instructional media to be used some teachers in learning multiplication. The mathematics chess is not only one of the instructional media significantly have proved can improve the students' achievement on multiplication. Next it needs to be creativity from a mathematics' teacher to develop other media that can make something that abstract to be concrete, it is something that potential to be actual.

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