

# Mathematical Operations from Teacher to Student: A Case Study of Applied Division Wheel in Primary School

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**Abstract:** *Mathematics is calculation subject expanding towards advanced fields, namely engineering, computer sciences, sciences, and others. Addition, subtraction, multiplication, and division are basic operations in mathematics, but the majority of students are still unable to master the topic. Therefore, this research study has been carried out to determine the implication of 'division wheel' in mathematics operation from teacher to students. Mix methods were applied, in which the quantitative sample size is 400 students and 10 teachers. A pre-post test will be conducted before and after the intervention of division wheel as concrete material is organized. The result from pre-post test indicates an improvement within students, which was influenced by several factors such as students, parents, teachers, and the school environment. Experience teachers in mathematics agree that parents play an important role in shaping their children towards the pros and cons, and the students' attitude and interest will affect their achievement in the subject of mathematics. At the same time, teachers are responsible to acts as educators to educate the students, and the school should prepare a conducive learning environment and good facilities for students to learn. If these factors are successfully reduced, this will improve the students' achievement in the mathematics subject.*

**Keywords:** Division wheel, parents, students, teachers, school environment.

## 1. Introduction

Mathematics is an important subject in school curriculum due to being the natural universal language of human culture [18]. In daily activities, people apply mathematics all the time, for example in constructing buildings for stability, making calculations to design a car m, developing medicines and painkillers, or even making machines like watches to determine time. Indeed, mathematics is developed into various fields like engineering, sciences, computer system, biology and so on [17]. Due to this, students compulsorily study mathematics, especially from the basic operation in primary school level until advanced mathematics at the university level. The government is working hard to develop and increase the quality of education through various education policies and long-term plan like Teaching and Learning of Science and Mathematics in English (PPSMI) [8], Standard Curriculum for Primary Schools (KSSR), Education Development Plan (MECC) and others planning. However, a majority of students in Malaysia are still unable to master mathematics [11]. This can be proven through the ranking in Trends in International Mathematics and Science Study (TIMSS) and Programme for International Student Assessment (PISA) showed the result of mathematics achievement are getting worse year by year [3]. The curriculum of mathematics is always changing due to modernization, and this causes the government to undergo some changes especially the teaching methods from chalk and talk method to student centered approach, which allows the students understand the concepts in a distinctive way [16]. In general views, the chalk and talk method is an effective approach for strengthening the ability of students in making the algorithm calculation. However, this method is unable to train students to think critically and make used the relationship between mathematics in everyday life problems with mathematics problems in the form of words [24].

Teachers are encouraged to ask questions with high order thinking according to the hierarchy of Bloom's Taxonomy [2] so that the students can explore and understand in a distinctive way. A student centered method will provide an opportunity for students to explore and create a relationship by themselves between the actual situations with the situation given by the teacher. Indirectly, this will fulfil the aspiration of government which wants to create an intellectual young generation.

Through the syllabus provided by government, students should be able to master basic operations before learning others advance topic in mathematics subject. This is because basic operation in mathematics subject will be involve with additional, subtraction, multiplication and division before continue others advance topic. However, based on research done by Ping and Hua [20], a majority of primary students are unable to master the basic operations very well due to not understanding the concept meaningfully. This problem causes the students to experiencedifficulties in calculation due to failure to memorize the multiplication tables [4]. Thompson [23] research studies clarify the students that are unable to empower the topic of division operation (which also known as 'long division') due to calculation problem and students will require to use other method to solve mathematics problems by memorizing multiplication tables. Memorizing solutions will make the students feel bored in studying mathematics, and assume the subject is difficult and boring [10]. According to the National Numeracy Strategy, teachers should encourage students to explain how they solved the mathematical questions so that the teacher will know the students' weaknesses in understanding the concepts that are being taught [21] [12]. Therefore, it is important to investigate the students' difficulties issues in mastering the concept of division and find solution to improve their proficiency in the division operation.

The main focus of this case study is the problem in mastering the basic concepts of operation especially in division calculation. This research study was conducted to determine the impact of division wheel toward teachers and students in master the concepts of division operation. It is happen when teachers are too concentrate on memorizing the multiplication tables method in solving mathematical problems especially in division operations. The students found it difficult to solve math questions as they are unable to memorize the multiplication tables. Average students are only able to understand the division calculation by applying the repeated subtraction process, while at the same time they are not exposed to the previous method by using concrete material. This definitely will cause the students to unable to link between both of this operation [19]. This situation will become worse if it is not treated immediately at early stage, because the syllabus of the Primary School Curriculum Standard (KSSR) mathematics emphasizes the skills of students in master basic operation such as addition, subtraction, multiplication and division. So, the weak students in mathematics subject will struggle in mastering multiplication table to solve the problems involving the division operation and assume that mathematics is a difficult and dull subject [15]. Moreover, the multiplication table is very dull, as it is not colorful and unattractive to students. Hasnah Awang and Habibah Mohd Samin[7] stated that the color can leave a deep impact in memory compared to using only black and white. The statement is supported by research study by Hidayat[9], in which the color plays a friendly role in teaching and learning to attract students in continuing the study. According to an experienced teacher, Khatimin et al. [13], students need a lot of drill and practice. The uses of teaching aids can be manipulated so that the students can better understand what they have learned with their own ways which will have a positive impact. Indirectly, the students became more interested in learning mathematics and increase their confidence in solving the basic mathematics operation. Therefore, this will affect the level of student achievement in mathematics, which is considered an important subject in educational systems worldwide.

**2. Methodology**

Methods of collecting data in this research study involved a mix of methods, as a quantitative approach was applied to students as respondents in providing information for pre-post test, while a qualitative approach is applied to teachers through interview after undergoes the intervention process. 400 respondents from standard five were selected randomly from three different classes (excellent class, middle class and poor class) as the sample in this research study. Besides that, 10 mathematics teachers have been selected based on the classes that involved in the collecting data for qualitative through interview. In other words, 400 respondents are eligible for quantitative [14] [3] and a maximum of 10 respondents are suitable for qualitative research [1] [6]. The pre-test and post-test have been carried out to evaluate the respondents through mathematics examination, which involve the interventions of division wheel as the concrete material after conducting the pre-test examination. The purpose to carry out both tests is to determine the impact of division wheel towards the students and the teachers. Each test contains 10 questions for pre-

posttest which involve mathematics division question with remainder and without remainder. Meanwhile, the interview is conducted towards 10 teachers who had experience in teaching mathematics for several years. The interviews were conducted to understand individual attitudes, backgrounds, and experience in answering for the pre-post test. According to Seidman[22], knowledge from an interview will help the researcher to gain better understanding of the context for an individual’s behavior and decision-making rationale. The questions in the interview consist of three parts, namely demography, teaching experience and the factor effect students’ ability in mastery the basic mathematics operation (addition, subtraction, multiplication, and division). Interview data will be analyzed to evaluate whether other factor will also affect the respondents in mastery of division operations.

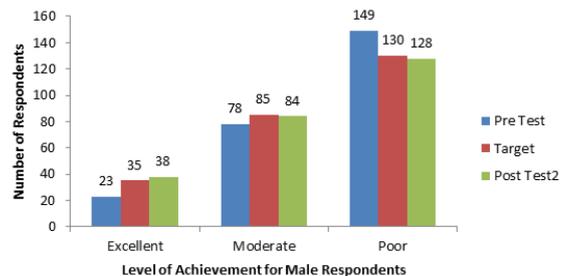
**Table 1:** The standardized grade of achievement using in the country

Mark	Grade	Achievement
80-100	A	Excellent
60-79	B	Modest
40-59	C	Pass
20-39	D	Failed
0-19	E	Failed

Source: Ministry of Education Malaysia

**3. Result and Discussion**

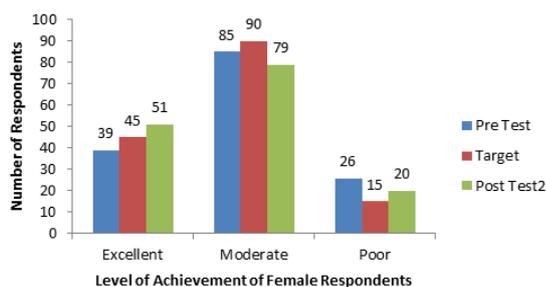
Once the results of examination for pre-post test are collected and gathered, the analysis process will take place, which involves descriptive analysis in Statistical Package for Social Science (SPSS) version 19. This information is shown in graph 1 and graph 2.



**Graph 1:** Pre-post Test Result for Male Respondents

Graph 1 shows the comparison of pre-test and post-test of the male respondents. The result had been category to excellent, moderate and poor according to graph 1. Meanwhile, the researcher set a target result to achieve in examination after the post-test to evaluate the effectiveness for the intervention that had been performed. Graph 1 shows a significant increase in post-test result, as the number of respondents who achieved excellent levels increased from 23 to 38 persons with the result is beyond the target. The moderate level also shows a slight increase, although it cannot achieve the target. However, the number of respondents in poor level achievement shows decreases accordingly when other parts achievement is improvement in the post test result. Comparisons between the target and post results indicate that the most targeted result is achieved, except for the moderate level. The resulting analysis proved that male respondents who applied

the division wheel in solving the divide operation gained a favorable impact.



**Graph 2:** Pre-post Test Result for Female Respondents

Graph 2 shows the pre-post test results and targets for the female respondents. Similarly to graph 1, graph 2 also shows impressive improvement. According to graph 2, 130 respondents had pass in the post test compared to the pretest which increased 5 respondents. One third of the respondents have achieved an excellent result in the post test, meanwhile 79 of respondents are category in moderate achievement. As accomplishment, the numbers of respondents in poor level achievement also declined after others level of achievement are increasing. Although the post results showed improvement, the target for moderate and poor level achievement is still unable to achieve. This might be due to the different learning style and interest in the subject between male and female respondents. However, it may be concluded that the female respondents were also able to master the divide operation after the intervention using the division wheel. It had an impressive impact.

Analysis of graph 1 and graph 2 shows an obvious improvement of the respondents in mastery of basic divide operations, especially in terms of female achievement. This show that the female can mastery the basic divide operation very well after following the intervention compare to male although the number of respondents for gender are different. This statement is supported by a case study done by Ping and Hua [20], which found that a majority of students suffering poor achievement is male and that females mostly reach excellent or moderate achievement. In their research it was also stated that concrete materials (division wheel) can help both genders in mastery of basic division operations and solving all types of division operation questions. The division wheel can be applied by the students in mastery divide operation as it has a positive impact to the students especially in solving the questions which involving divide [20]. Furthermore, researchers feel that this division wheel can be used for all level of students in their learning mathematics for primary one until primary six students, especially students from a weak class, and it can be modified according to the need of the topics involved. However, there are other factors that may become obstacles to the learning progress due to the role of family (in terms of financial, divorce, parents' professional, etc.), the role of school (in term of learning environment, and facilities), the role of teacher (in terms of teaching method and attention towards the poor students) and the role of student themselves (in term of behavior, interest, and so on), which is explained below.

'The role of students in attitude and interest will also affect their achievement.'

The statement is agreed with by a majority of mathematics subject teachers that had been interview. Experience teacher in teaching the subject for several years clearly noticed that the students' attitude and interest will affect in their achievement. In overall, the weak students in mathematics subject will possess lazy attitude especially in doing revision and they were have more interest in playing around. This situation becomes worse when their parents do not pay attention to their children. Moreover, the student's interests towards the subject are is important because if not, the students will feel that mathematics is a very dull and boring subject. When teachers are teaching in the class, the students will not pay attention to the study and this will create difficulty during the exercise given. Therefore, the attitude and interest of a student towards mathematics will require parents and teachers to influence them to change it. For example, in changing attitudes, parents should spend some time with their children to do revision, guiding and awaken the children about the important of gaining knowledge, especially in mathematics as a basic core subject to other fields. For changing interests, teachers should find solution in teaching methods to let the students study and having learning in enjoyment so that they feel interest in every topic in mathematics by using concrete material (like "division wheel", clock, money toy, etc.), simulation (like real life problem), quizzes, and other activities. Thus, students' attitude and interests also play an important role in ensuring the success of the students.

According to the teachers who have experience more than 10 years in teaching mathematics stated that:

'Parents play an important role in shaping their children towards the pros and cons.'

Referring to the statement above, family background is a main factor influencing the success of a student in the role of parents. Nowadays, there are many issues and problems involve with family such as abuse problem, divorce problem, financial problems and etc. There are two categories involved with family, which are complete and incomplete. A complete category in the family will provide their children a perfect growth environment. Love and motivation from parents in the process of growth and learning is important to determine the success of students in the future because parents will give fully attention on their children especially in study. Parents should spend some time to accompany their children both day and night. They care about their children, especially for "do's and don'ts" at school. Besides that, parents should take every opportunity to teach and guide their children when they face problem in doing the exercises in study. The support from family will be able to motivate the children and built up their confidence to do better in their study and aware about the important of gaining knowledge. On the other hand, it is totally different when involved with an incomplete category of family due to unavoidable problems that happen in the family affecting the students. These unavoidable problems may be divorce or widower issues leading to abuse problems, financial problems, and so on. The children will live neither with one of their parents nor grandparents, and

this problem will have a deep negative impact to the children's growth and learning. When a student is isolated from one of their parents, they will feel lacking of love in family especially support and motivation due to the parent busy working to earn money. These actions will influence the student to have low self-confidence and feeling that study is wasting time. Therefore, both parents need to find a solution to this problem rather than ignore the children, as parents' love in the process of divorce problems may suffer. So, parents play an important role in order to build up children's' attitude and behaviors not only at school but also with the children at home.

'The school also should prepare a conducive learning environment and good facilities in order enable the students to learn in the meaningful ways.'

The learning environment can play a minor role, but still can be considered as a factor to affect the students. A majority of teachers agree that the environment of a school is a place for the students to gain new knowledge and that it is also known as "second home" for the students. The students may spend about 20 years of their life at school to gain knowledge from kindergarten until college or university level. Thus, the school needs to prepare a good learning environment and facilities so that the students can learn well and achieve excellent results in their future. Lacking facilities like computer or teaching aids will restrict and disrupt the learning process between teacher and students. Nowadays, the education system focuses more on how the students understand the knowledge in distinctive way. These become reasons for teaching method changes from teacher centered to student centered, in which the teacher acts as a facilitator to guide the students. Therefore, the school should prepare enough facilities for the students learning process so that they can gain all knowledge that sharing in class. In addition, learning spaces also play an important role for the students. The learning process will be 'disturbed' when the learning space (which refers to the capability to move in the classroom) is narrow due to many students within a class. This causes the teachers to become unable to pay attention to every student, especially in weak classes for teaching mathematics, because of the student numbers being too many in a small class. Indirectly, this lead to the crowd learning environment and the students will be unable to learn in conducive ways. When the classroom is too crowded, teachers will become unable to have other activities for fun for the students, and this will affect the learning process of the students. So, the school must pay more attention to preparing a conducive environment and good facilities.

'The teachers play an important in carrying out their responsibilities as educator to educate children to be successful.'

Teachers should teach students with faith and dedication without bias about their religion, social status, or other factors. When students are unable to master a topic, a teacher should teach using appropriate methods that can be easily understood. For an example, students cannot memorize multiplication tables because memorizing creates no meaning. Teachers can find other methods to teach students to understand topics, like using "division wheel" in

solving "long division", adopting friendly methods (like a mother and child), creating an interesting environment (examples and real life problems), and using concrete material (straw, marble ball, Lego, etc.). The first lesson is introduced with division wheel in order for students to experience in finding the answers by themselves. These activities will be more significant for students and they will be able to understand the topic in their own ways. When teacher successfully teaches the students, then they have no need to repeat teaching for the same topic and will be able to do administration work, such as documentation, attending meetings, and so on. However, due to a lot of administration work that teachers need to do, some teachers will take advantage by speeding up teaching to finish the syllabus. These actions will become a disadvantage to the students, especially for weak classes. So, the teachers may neglect students' abilities and lack special concentration in the learning process, especially weak students that are unable to master the topic. Therefore, teacher has to understand their students' conditions very well, especially in learning style and achievements, so that they can manages to find solutions for helping students in the learning process.

#### 4. Conclusion

The research objective is to determine the implication of teachers' view of students after using the 'division wheel'. The analysis for pre-post test has become evidence of the improvement of student's achievement in mathematics, indicating a positive impact on the respondents after intervention was implemented. Teachers have found restraining factors that interrupt the achievement of students in the mathematics course. Therefore, teachers will need to reduce these factors and strengthen the method of using "division wheel" that will surely help the students to master their basic operation concept. At the same time, parents and school perspective should also plays their role to make sure the students will 'gain enough' knowledge. Indirectly this will surely increase the achievement of mathematics subject in the schools. Finally, the "division wheel" is a new concrete material that can help to reduce difficulties and problems that students face in mastering the concept of division and help improve the students' proficiency in division operations.

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