Shadow Supervisor Strategy on Student with ADHD in Mathematics Learning Activity for Inclusive Secondary Class of Elementary School

R Marlina, Budiyono, B Usodo
Magister Mathematics Education, FKIP UNS, Sutami Street, Surakarta, Indonesia

rosymarlina@gmail.com

Abstract. The purpose of this study is to describe and analyze the strategy of Shadow Supervisor in mathematics learning for student with Attention Deficit/Hyperactivity Disorder (ADHD) in inclusive secondary class of elementary school. Learning strategies include models, approaches, methods and learning techniques. This is a qualitative research (field research) with purposive sampling. The samples are special supervisor (shadow) and student with ADHD. The instruments used are observation and documentation. The results showed that for basic competence to sequence of numbers and stepping number (number pattern), a place value number system, addition and subtraction, time measurement (clock reading), and two-dimensional figure grouping, the learning model used was behavioristic. The approach is synthetic, spiral and intuitive in accordance with the basic competencies being taught. The learning method used were question and answer, drilling and exercises, games and stories, and assignment. Learning techniques used was vary according to the basic competence of learning materials.

1. Introduction
Children with special needs are children who have special characteristics in their growing that are different from normal growing. One of them is a child with Attention Deficit/Hyperactivity Disorder (ADHD) or a hyperactive child, they have neurological disorder like difficult concentration and tend to hyperkinetic (too many actions) [1]. From the research, it was reported that 50-80% student with ADHD must repeat the class once, 30% student with ADHD must repeat the class twice to three times, and 10% student with ADHD must follow the special class [2].

Math lesson, for some normal students is still felt as a difficult subject, even less for student with ADHD. Teachers should bring math lessons to students with ADHD under conditions of concentration disruption, hyperkinetic and impulsive disorders within a limited time span. Teachers should have strategies to teach math for student with ADHD that are different from strategies for other students. The learning strategies discussed are models, approaches, methods and learning techniques. The curriculum of inclusive of elementary school states that the curriculum used is the same as the curriculum that applies in public schools, but for children with special needs it must to be adjusted to the needs of students because of the variety of obstacles and abilities [3]. The curriculum adjustments are realized
in the form of Individualization Learning Program (ILP) and implemented by special supervisor teachers known as a shadow.

The focus of this taken research is the process of learning mathematics for student with ADHD in the second inclusive class of elementary school. The purpose of this research is to describe the shadow supervisor strategy in mathematics learning process for student with ADHD in Individualization Learning Program (ILP).

2. Research Methods
This research is qualitative research with field research type. The research subjects are two, a shadow supervisor and a student with ADHD. They are chosen with purposive sampling. The instruments used are observation and documentation. The researcher chose passive participation observation method using the aid that is a video camera recorder. In this study, researchers have observed mathematics learning activities in seven observations in second inclusion class of elementary school. Data validation was done with diligent observation and discussion with peers. Data analysis techniques used are data display and conclusion drawing.

3. Results and Discussion
As recommendation given by the therapist, student with ADHD is placed in regular classes with full guidance. Is provides a great opportunity for him to develop with the help of shadow supervisor as a special tutor. This is appropriate with Platt [4] that says that hyperactive students are unable to process instructional language in classroom learning and that is why he is left behind in mathematics. One of the strategies needed in student with ADHD learning is a technical support strategy in terms of student mediation. The appropriate approach to learning needs for student in special needs is known as Individual Learning Program (ILP). One of the best ways to give instruction to student with ADHD who has learning disabilities is teaching that focuses on cognitive strategies rather than on facts. Teaching mathematical strategies with behavioral modification proved successful in helping hyperactive students who have difficulty learning math. Shadow supervisor identifies the strengths and the weaknesses of student with ADHD and hypothesizes the causes. This is the basis for shadow supervisor in creating an Individual Educational Program (IEP). This IEP is a reference for shadow supervisor in implementing and creating ILP. This is appropriate with Spangenberg [5] has suggested that some of the mathematics teacher's interventions may be (1) to identify how, when and why hyperactive students are less attentive, impulsive and inaccessible, by conducting diagnostic assessment and informal classroom observation for determining student strength, and (2) learning mathematics planned according to student with ADHD ability.

The strength of student with ADHD in learning is very enthusiastic about something or new material. The weaknesses of student with ADHD in mathematics are the difficulty of reading and writing two-digit numbers between 10-20, often forgetting in sorting numbers, still reminded of how to add and subtract, and still have difficulty solving simple story problems. This is appropriate with [6] that the weaknesses of the student with ADHD above includes problems; (1) Spatial arrangement (unable to align numbers in columns, upside down, or exchanged writing and reducing numbers), (2) Failure to move mindset from one type of problem to another (working on different types of questions in the same way), (3) Writing numbers (writing numbers that are too large and unclear so that the solution becomes unclear), (4) Problems with memory (unable to remember the facts of basic calculations when solving problems with one step), and (5) Problems with the language of mathematics (don’t understand the meaning of a number of key terms in mathematics).

One of the implementation of ILP in mathematics can be seen from the strategy of shadow supervisor in delivering mathematics subject matter to student with ADHD. The delivery strategy of mathematics learning is a variable component of the method to carry out
mathematics learning by providing information and materials needed [7]. This strategy includes four things that are learning model, learning approach, learning method and learning technique.

The learning model is a comprehensive pattern that is exemplary regarding the complete form of learning including planning, implementing and evaluating. Learning approach is a concept or procedure used in discussing a lesson material to achieve learning objectives whose implementation requires one or more learning methods. Learning method is a way of presenting subject matter to students which includes; outlining, giving examples and practice, to achieve certain competencies [12]. Learning techniques are roads, tools, or media used by teachers to direct the activities of students towards the goals to be achieved in [8].

The observation results of delivery strategies of shadow supervisor in mathematics learning on student with ADHD are as follows:

| Basic Competency (BC)                                      | Learning Strategies                      |
|------------------------------------------------------------|-----------------------------------------|
| 1. Sequence of numbers and stepping number (number pattern) | Behaviorism, Synthetic Drill and practice, Question and Answer, game and stories, Counting with units |
| 2. A place value number system                              | Behaviorism, Synthetic Drill and practice, Question and Answer, The numbers position determines the number value |
| 3. Addition and subtraction up to 500                       | Behaviorism, Spiral Drill and practice, Question and Answer, Addition with saving techniques and reduction with separating techniques, using simple media |
| 4. Time measurement (clock reading)                         | Behaviorism, Intuitive Drill and practice, Question and Answer, Using concrete experiences |
| 5. Two-dimensional figure grouping                          | Behaviorism, Intuitive Assignment, Question and Answer, Using concrete objects |

Based on the observation data above (Table 1), the delivery strategies of math subject matter by shadow supervisor to student with ADHD are; (1) The learning model used for all Basic Competencies (BC) is behaviorism, (2) the learning approaches used are synthetic (first and second BC), spiral (third BC) and intuitive (fourth and fifth BC), (3) the learning methods that are used are question and answer (all BC), drill and practice (first, second, third and fourth BC), games and stories (first and third BC), and assignments (fifth BC), (4) The learning techniques used are counting with units (first BC), the number position determines the number value (second BC), addition with saving techniques and reduction with separating techniques, using simple media (third BC), using concrete experience (fourth BC) and using concrete objects (fifth BC).
The learning model used for all basic competencies is behaviorism, the main principles of which are stimulus, response and reinforcement. This is appropriate with [9] said that students with ADHD benefit from an inclusive education model. School-based interventions, in which teachers modify their instructional practices and behavioral management techniques used, successfully improving behavior and literacy students with ADHD. Characteristic of this model is a person who is considered to have learned something if he is able to show changes in behavior. The most important thing is the stimulus response, about what happened between them is considered unimportant because it cannot be observed [10] says that on one level students are by nature accustomed to behaviorist learning, a concept of an older teaching style. The behaviorist view asserts that learners learn through positive or negative behaviors as well as supporting these behaviors with extrinsic motivators.

Shadow supervisor provides various direct and personal stimuli to student with ADHD so that they can be responded as desired in learning. The stimulus can be questions, touches, gazes, movements, pictures, stories, etc that lead to a response given by student with ADHD, suppose like answers, curiosity, enthusiasm, attention or anything else. Stimulus are given continuously in learning alternately after student with ADHD’s response. He responds based on the stimulus that is given by shadow supervisor, not because of his motivation. This is appropriate with [11] that behavioristic learning theory with a stimulus response relationship model emphasizes students who learn as passive individuals. Behavioristic learning theory view is a process of formation, bringing students to achieve certain targets, making students not free to create and imagine. So in this case, shadow supervisor should also apply other learning models that can make student with ADHD active and stimulate his motivation and creativity. The main objective of the study of mathematics is to develop reasoning skills that are necessary for solving problems. The teacher must create and maintain an open and informal classroom atmosphere to insure the students' freedom to ask questions and explore their ideas in [12].

The learning approach used for first BC (sequence of numbers and stepping number) and second BC (a place value number system) is synthetic, starting from things that are known to the things that are desired. Shadow supervisor tried to dig back what student with ADHD already knew to be directed to the desired things, which is an answers to the questions given. Synthetic approach is easier to understand, more practical, used by teacher, habit, having less formulas and used in textbook [13]. Even though it’s easy, but because one of the weaknesses of student with ADHD is often forgetting about what he learned beforehand if his diet is not maintained, shadow supervisor needs to use another approach that can strengthen student with ADHD in terms of understanding learning material.

The learning approach used for third BC (addition and subtraction) is spiral, using concrete objects intuitively then proceed to an abstract level. Shadow supervisor uses concrete objects around student with ADHD directly and intuitively to help solve addition and subtraction problems. This is appropriate with [14] about the spiral approach at the first time interval, that the concept is taught simply, suppose through concrete objects or images intuitively in accordance with the student ability. The spiral approach has also weaknesses, the spiral design hinders student learning by (a) treating topics superficially, (b) introducing concepts at an inappropriate rate, (c) minimizing academic learning time, and (d) providing insufficient cumulative review [15].

The learning approach used for fourth BC (time measurement) and fifth BC (two-dimensional figure grouping) is intuitive, using intuitive understanding such as math games, special circumstances or daily problems. Shadow supervisor links lessons about time to daily activities and student with ADHD habits, and asks him to guess the shape of the objects around them while telling stories. Jung stated that intuition is one of the three cognitive functions; they are: thinking, feeling, and sensation [16]. When the teacher teaches the students about the deductive reasoning, he has to make an emphasis on students’ intuitive
understanding through the image the students have in their mind. In psychology. Regarding the involvement of intuition in mathematics learning, there is an increase in students' mathematical problem-solving abilities who obtain exploration approach based on intuition [17].

The most commonly used learning methods are question and answer, and drill and training. In addition to some BC using game and story, and assignment. Drill and practice methods emphasize frequency of exercises to work on problems or solve mathematical problems. The question and answer method gives students the opportunity to reflect their curiosity and needs for complete information. The game and story method helps increase student motivation until they can concentrate again (Figure 1). The assignment method improves the quality of student learning through integrated and broader tasks of homework [18].

![Figure 1: Student's work sheet with game and story method.](image)

The assignment method can also stimulate students to be more active in learning. The learning by shadow supervisor in ILP is presented in the form of giving practice exercises. Student with ADHD is guided to work on these exercises from the beginning to the end with question and answer, interspersed with simple games and stories related to the lessons learned, and also giving simple tasks that can be done in accordance with his ability. Variation of methods in learning activities can increase students' attention, motivate students, maintain teacher authority, encourage the completeness of teaching facilities and encourage students to learn [19]. This is appropriate with [20] that the application of various teacher learning methods can improve student learning achievement. [21] said that variation as a powerful agent to generate mathematical knowledge and stimulates further research and practices using variation as a pedagogical tool in the mathematics classroom.

The learning technique used for first BC (sequence of numbers and stepping number) is counting with units, using imaginary objects or symbols (e.g. fingers) to become objects to be counted. But in this way the child has not yet counted out a hidden object, so it is better to proceed to the cardinal counting, stage as the basis for developing addition skills. Cardinal counting is to count all concrete objects both physically and mentally. The weaknesses of student with ADHD in this BC are difficult to read and write two-digit numbers between 10-20, and often forgetting in sorting numbers. Children find it difficult to differentiate pronunciation and number writing.

In this case, learning should use more concrete props that can be manipulated, moved, grouped or separated, such as dienes, grains, sticks or straws. This is appropriate with [30] that concrete material structures are very useful in the development of mathematics topics at all levels of class.
For stepping numbers, if seen from test work document (Figure 2 and 3), shadow supervisor guides student with ADHD to sort all numbers from the smallest to the largest then count the sequence of numbers according to the step.

![Figure 2. Student’s test work and work sheet in stepping number.](image)

Figure 2. Student’s test work and work sheet in stepping number.

![Figure 3. Student’s test work and work sheet in stepping number (another question).](image)

Figure 3. Student’s test work and work sheet in stepping number (another question).

The learning technique used for second BC (a place value number system) is using the number position determines the number value. From the following test work document (Figure 4), student with ADHD is still an error with determining the place value, ie the place value of tens is considered as a unit.

![Figure 4. Student’s test work in a place value number system.](image)

Figure 4. Student’s test work in a place value number system.

Similarly, from the following test work there is still an error with naming a three-digit number. The value of the place hundreds are considered as tens. But it is correct in multiple choice [22] said that there may be basic differences in children's cognitive representation of number that are influenced by the characteristics of the numerical languages they speak. In this case, learning should also use props such as beam model, money or abacus to hone this skill. Because place value skills are closely related to the re-grouping of objects to be calculated so that children can manipulate, read and understand number symbols [23].
The learning technique used for third BC (addition and subtraction) is addition with saving techniques and subtraction with separating techniques, and using simple media, such as turus, fingers or objects in the class. The weaknesses of student with ADHD in this BC are that he still has to be reminded of how to add and subtract, and still have difficulty solving simple story problems. [24] said that the less able children are often placed in difficulties as they grow older because they feel a pressure to conform and not use “baby methods” of counting.

It might be due to the guidance from shadow supervisor in answering questions. Step by step student with ADHD should start to be released to count independently so that he can be seen in his ability significantly. The teacher should encourage students to guess and conjecture and should allow them to reason things on their own rather than show them how to reach a solution or an answer.

The learning technique used for fourth BC (clock reading) is using concrete experience. Student with ADHD still has an error in drawing the clock. He was unable to imagine when the two clock wises are stacked or located in the same number. As previous studies showed clock reading to have quite some similarities with number knowledge, mathematical facts and mathematical procedures, it can be assumed that children with mathematics difficulties will experience difficulties in the acquisition of clock reading skills [25].

In this case, learning should use a clock prop which have long and short clockwise that can be moved compatible to the learning objectives.

The learning technique used for fifth BC (two-dimentional figure grouping) is using concrete objects in the classroom and its surroundings.

In this case, learning should also use a flat-shaped props so that student with ADHD can distinguish a square shape from a rectangle. In addition, the use of picture books as children’s literature is important too. Although much learning of shape ideas should be hands-on, two-dimensional figures are essential to develop children’s understanding of plane geometry. Books may effectively engage pre-literate children with plane shapes and shapes as gestalt wholes or prototypes. We review several guidelines and evaluative criteria for book selection, including in [25].

In general, the learning techniques used by shadow supervisor have been right but need to be equipped with a variety of props in accordance with each basic competencies in learning. Classroom use of such materials to construct addition and subtraction algorithms may provide perceptual support for both the place-value concept and problem solving [26]. Step by step, student with ADHD is accustomed to doing exercises independently so that his ability will increase, beside to dietary foods that must also to be maintained.

4. Conclusions and Suggestions

Identification of the strengths and weaknesses of student with ADHD and the hypothesis of the cause is the basis for Shadow supervisor in creating an Individual Educational Program (IEP) with class teachers and therapist. IEP is a reference for Shadow supervisor in implementing and creating Individual Learning Programme (ILP). The strength of student with ADHD in learning is very enthusiastic about something or new material. The weakness of student with ADHD in mathematics are they are difficult in reading and writing two-digit numbers between 10-20, often forgetting in sorting numbers, still reminded of how to add and subtract, and still have difficulty solving simple story problems.

The learning model used for all basic competencies is behaviorism, the main principles of which are stimuli, response and reinforcement. Behavioristic is very suitable to be used to train children who still need the dominance of the role of adults, like to repeat and must be accustomed to, like to imitate and enjoy the form of direct appreciation.

The learning approach used for first BC (sequence of numbers and stepping number) and second BC (a place value number system) is synthetic, starting from things that are known
to the things that are desired. The learning approach used for third BC (addition and subtraction) is spiral, using concrete objects intuitively then proceed to an abstract level. The learning approach used for fourth BC (time measurement) and fifth BC (two-dimensional figure grouping) is intuitive, using intuitive understanding such as math games, special circumstances or everyday problems.

The most commonly used learning method are question and answer, and drill and training. In addition to some BC using the game and story, and assignment. Drill and training methods emphasize frequency of exercises to work on problems or solve mathematical problems. The question and answer method gives students the opportunity to reflect their curiosity and needs for complete information. The game and story method helps increase student motivation until they can concentrate again. The assignment method improves the quality of student learning through integrated and broader tasks of homework. The application of various teacher learning methods can improve student learning achievement.

The learning technique used for first BC (sequence of numbers and stepping number) is counting with units. The learning technique used for second BC (a place value number system) is the number position determines the number value. The learning technique used for third BC (addition and subtraction) is addition with saving techniques and subtraction with separating techniques, and using simple media. The learning technique used for fourth BC (time measurement) is using concrete experience. The learning technique used for fifth BC (two-dimensional figure grouping) is using concrete objects in the classroom and its surroundings. The learning techniques used by Shadow supervisor need to be equipped with a variety of props in accordance with each basic competencies in learning. Step by step, Student with ADHD is accustomed to doing exercises independently so that his ability will increase, beside to dietary foods that must also be maintained.

Subsequent researchers should conduct more in-depth research about learning strategies on certain basic competencies in mathematics that are more specific by paying attention to the strengths and weaknesses of student with ADHD.

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