

Implementation of Curriculum-Based Measurement (CBM) on Reading, Writing and Numeracy Skills for Autistic Children

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Abstract— Autistic children have complex developmental obstacles that require measurable assessment techniques. However, teachers often find it challenging to conduct quantifiable assessments, primarily to monitor academic abilities because of the incompatibility of cognitive development of autistic children. This purpose of the study to describe the application of CBM to monitor the academic skills of reading, writing and arithmetic of autistic children and to describe and analyze the supporting factors and inhibiting factors of CBM implementation. This study uses a mixed method with the research subjects being autistic grade VIII junior high school girls. The findings indicate that CBM can be applied to children with autism. The CBM can be done on autistic children. The CBM for the development of learning plans has been carried out into four stages, namely screening, goal setting, diagnostic assessment, making hypotheses about interventions, and developing learning plans. The supporting factors for CBM implementation are the ease of using CBM, the assessment results make it easy to determine the next learning program, and use measurable measurement criteria, while the inhibiting factors are children's mood changes that are influenced by internal factors and external factors of autistic children.

Keywords— autism, CBM, reading, writing, counting

I. INTRODUCTION

Academic skills in reading, writing, and arithmetic are the primary skills that must be mastered by children because all learning processes are based on these skills [1]. The basics for broader learning and working on school practice questions are reading, writing and numeracy skills. As an example in learning natural science, children must do practice questions about the types of meat-eating animals. If the child does not have good reading and writing skills, it will be difficult to understand the practice questions and write the answers. If the skills in reading, writing, and arithmetic are essential in the child's learning process, then the development of these skills must be adequately monitored. Assessment is the process of gathering information to make learning decisions [2]. Assessment can be used to evaluate and adjust instructions based on children's performance and needs to produce good achievement. One assessment technique is measurement. Measurement has many types, one of which is measuring learning outcomes. Analysis of learning outcomes is done by giving numbers that reflect learning outcomes, processes,

and results [2]. Figures that show children's learning outcomes can be used to determine children's learning abilities at this time.

Generally, the teacher measures the learning outcomes of reading, writing and numeracy skills using questions in a general textbook or Student Worksheet (LKS). The teacher uses questions in books or worksheets that are still general to determine the current level of development of reading, writing and numeracy skills. Work on questions in textbooks or worksheets takes a long time, so the teacher has difficulty determining the level of reading, writing and counting skills of children in detail and efficiency. The teacher needs a measurement device that has sufficient normative reliability, validity, and data to be used in making learning decisions [3].

One type of measurement developed to find out the level of reading, writing and counting skills in detail is Curriculum-Based Measurement (CBM). The CBM is a system that is adequate (validity and reliability) and can perform assessments quickly and efficiently [4]. If the educator finds a child's weaknesses or needs in a particular skill, the curriculum or learning adapted to those needs. The problem-solving process uses all of these components that can help teachers to make better decisions. Also, the use of CBM can increase children's motivation because it can encourage children to try to improve their skills from time to time based on the learning progress [5]. Appropriate measurement of reading, writing and numeracy skills will produce decisions about the right learning design and by children's needs. The CBM criteria for measuring reading, writing and arithmetic skills have proven valid for children with developmental disorders such as autism [3].

Autistic children are children with pervasive developmental conditions ranging from severe disorders to mild disorders [6]. Characteristics of language development of children with autism who experience disruption cause a discrepancy in the cognitive development of autistic children with children of their age [7]. This incompatibility of cognitive development has implications for the development of academic skills in reading, writing, and arithmetic. Measurement of the development of learning outcomes of reading, writing and numeracy skills must be structured and meticulous based on the results of appropriate measurements.

Therefore, it is essential that this research is carried out as a concrete step to implement a measurement tool that can

describe the level of development of reading, writing and counting skills in detail. The hope is that this measurement tool can be applied by the teacher in conducting an assessment of learning outcomes by considering the supporting factors and inhibitors of their application. Also, children with autism are expected to get an improved reading, writing and numeracy skills based on their current development characteristics and needs.

The researchers aim to (1) describe and analyze the application of CBM to monitor the development of reading, writing and numeracy skills in autistic children and (2) define and explain the supporting factors and inhibiting factors for the application of CBM to monitor the development of reading, writing and numeracy skills in children with autism.

The rest of this paper is organized as follow: Section II describes the literature review. Section III describes the proposed research method. Section IV describes the result and following by discussion in Section V. Finally, Section VI concludes this work.

II. LITERATURE REVIEW

This section presents the literature review.

A. Autism

Autism spectrum disorders are increasingly detected and continue to increase [6]. The average annual increase in autism prevalence was 9.3% per year from 1996-2010 [8]. Autism occurs more in men than in women [9] and the number of autisms with comorbidity is increasing [10]. This increase in prevalence makes service needs that are appropriate to the characteristics of the development of autistic children are very necessary. Autistic children are known as children who experience complex developmental disorders which are determined by behaviors that arise not in biological diagnoses such as diseases in general [11]. Based on the Diagnostic and Statistical Manual of Mental Disorders V (DSM V) identification of Autism Spectrum Disorder (ASD) can be seen from two domains, namely communication and social interaction disorders as well as limited and repeated interest behavioral disorders [12], [13]. DSM V contains criteria for diagnosing autistic children that are useful for identification, service determination, and for research purposes [14]. Autistic children are referred to as children who experience spectrum disorders because each child has different levels of Autism. Levels of spectrum disorders Severe autism is related to as autistic disorder and a milder degree of dysfunction is called Asperger's Syndrome [6]. Autistic children experience complex disorders, namely the difficulty of processing senses that are sensed by Thye, *et al.* in [15], sharing experiences with others, placing words according to the context of word usage and displaying unusual behavior [16], including doing repetitive movements and various other movements that invite the attention of others [17]. Autistic children are included in the umbrella of Pervasive Developmental Disorder (PDD) disorders that experience pervasive disorders in cognitive aspects, language, behavior, communication, and social interaction [18].

Children who were diagnosed as autistic showed lower cognitive abilities than children of their age who were not diagnosed as autistic by Long, *et al.* in [7]. The cognitive characteristics of autistic children are in three areas, namely (1) executive function, (2) Theory of Mind (ToM), and (3) Central Coherence [9], [19], [20], [21]. Autistic children need more intensive guidance in planning, managing, and maintaining behavior to achieve a goal, understanding the feelings and thoughts, and focusing all information into meaningful things. Cognitive characteristics contribute to the difficulties of autistic children towards reading comprehension [22]. Autistic children are found more easily read, but not with understanding. A reader must think to make conclusions during reading by combining relevant backgrounds with the text being read [22]. Autistic children have difficulty doing this because of the cognitive characteristics of the autistic child mentioned above.

The following is the reason for autistic children having difficulty writing skills. First, the characteristics of the cognitive aspects of autistic children that require an author to master the principles of writing (discovery, composition, and style) and thinking so that it can help him achieve the purpose and purpose of literature by Carnahan in [23]. Autistic children have difficulty managing these cognitive processes in producing text writing because they experience deficiencies in the three main cognitive processes. Gaps in the three main cognitive processes namely weak central coherence, mind theory, and executive functions may contribute to writing difficulties in autistic children [24]. Second, autistic children often experience problems with motor skills. Autistic children often show difficulty in adjusting the size of the letters and the consistency of the notes during writing using handwriting. Usually, the script of autistic children is often of low quality when compared to children in general [25]. The low quality of the writing of an autistic child may be due to two problems; the first autistic child tends to write more concisely so that his physical does not try to keep writing [26]; second, neat writing products tend to be the teacher's assessment, so that unkempt writing will get a low score. Third, writing skills require that one can coordinate several processes simultaneously. Researchers have found that autistic children often experience deficiencies in many of the cognitive, linguistic and motoric processes [27], [28], [29], [30]. These three processes contribute to the difficulties of autistic children in producing functional writing. Fourth, the process of writing as a way of communicating or the relationship between the writer and the reader by Carnahan in [23]. According to this opinion, it can be interpreted that a writer has an idea that he wants to convey to others. The author translates the design into writing symbols. If the writing reaches the reader, the author's views are explained by the reader into oral language so that the reader can find and understand the ideas presented by the author.

Counting skills of autistic children vary greatly. It has been found that there are autistic children who have low IQ and high IQ, are associated with cognitive abilities that are uneven and can also be associated with delayed language development [31]. Autistic children have worse abilities compared to children with learning difficulties in

applied mathematics problems [32]. Analysis of autistic children aged 6-9 years shows that mathematics skills are 20% above average and 39% with low achievement [33]. This low achievement may be due to low socioeconomic and cognitive abilities.

B. CBM

The CBM is based on the general education curriculum, which is used to measure progress and predictions of future performance, and most of it is used by teachers to make learning decisions. The CBM provides facilities for teachers who are technically enough to collect data so that they can monitor the child's progress. The CBM allows the teacher to evaluate during the intervention [34]. The teacher decides on the response based on the baseline data and the level of progress of the child. The CBM is a progress monitoring system in the academic field that uses adequate technical steps to assess progress [4] in the areas of cognitive, language, social-emotional development, and skills in learning literacy and numeracy [35]. Use of these individual steps to ensure the achievement of specific learning goals and monitor progress directly in the curriculum taught [36].

CBM measurement measures are applied based on valid and reliable matrices. The development of reading skills is measured using eight forms, namely the smooth naming of letters, naming of letter sounds, phoneme division, smoothness of difficult words, identification of word recognition, flat oral reading or continuous reading of paragraphs, labyrinths [3], and matching correct vocabulary [4]. Each matrix in this reading skill represents specific skills assessed. The smoothness of the letter naming pattern values the ability in naming the symbol of the message that is spelled. The letter naming sound matrix is used to assess skills when naming the most common sounds for a given letter symbol. In the phoneme division matrix, the assessed abilities are cutting phonemes in words. In the smoothness matrix of difficult words, the skills assessed are the relationship between letter sounds and phoneme mixing. The word recognition identification matrix evaluates vision in word recognition. The fluency of oral reading or eloquence in reading paragraphs assesses the child's ability to read orally. In the labyrinth, matrix evaluates the understanding of the meaning of the word in a sentence. And, the last pattern is matching vocabulary that assesses knowledge of vocabulary and comprehension.

Writing skills are measured using three matrices namely dictation of words [3], help with pictorial words, and help with stories [4]. Of the three matrices, representing each specific skill that is assessed on writing skills. In the dictation matrix, the word skill that is determined is spelling when writing. The illustrated word help matrix evaluates the results of the text at the sentence level. And, the story help matrix assesses the effects of the book at the paragraph level.

Calculating skills are measured using seven matrices, namely verbal calculation, number identification, differentiation of numbers, missing numbers, calculations, concepts & applications [3], and algebra [4]. The seven matrices also represent specific skills to be assessed. Calculation matrix verbally estimates the numerical

calculation. In the identification matrix, the number of skills valued is number recognition. In the pattern, the difference in the name of skills assessed is the difference between larger and smaller numbers. The missing number matrix estimates sequence recognition skills and identifies the numbers needed to complete the sequence. The calculation matrix assesses basic arithmetic skills, such as addition, subtraction, multiplication, and division. In the concept matrix and application of skills that are valued are applied mathematics, namely children's skills using mathematical concepts in the context of everyday life. And, the last matrix is an algebraic matrix that assesses the use of algebraic concepts.

In addition to the skills assessed, each matrix that is an aspect of CBM measurement has been completed with a description of the analysis, the grade level determined, the time of execution, and the scoring. This information will facilitate the teacher in implementing CBM. By implementing CBM, the teacher can get more detailed data about reading, writing and counting skills based on the data collected. The CBM will undoubtedly make it easier for teachers to adapt the material to the curriculum used by autistic children.

The steps of implementing CBM to make learning plans consist of five, namely screening using CBM, setting goals, diagnostic assessment, making hypotheses about interventions, and developing learning plans [4]. These five steps are carried out as an effort to make learning decisions based on data obtained based on CBM measurements. The levels of CBM use have been applied by Hosp *et al.* (2014) entitled Using CBM with postsecondary students with intellectual and the developmental disabilities. The aim study indicates that CBM in reading, mathematics, and writing has the potential as an indicator of academic performance for children in higher education and primary with intellectual and developmental disorders [3]. The results of this study reveal the valid and reliable CBM measurement matrices. This CBM measurement can be applied to children who experience developmental disorders, namely children with autism.

III. RESEARCH METHODS

This research is a mix of the method of analysis, with a quantitative approach to answer the first problem formulation and a qualitative approach to solve the second problem formulation. This study uses a stepwise mixed method strategy, especially following explanatory procedure. So, the first stage in this study is conducting interviews and participatory observation and performing qualitative data analysis. The first stage was carried out to find out the initial development of the research subject as well as the supporting factors and obstacles to the implementation of CBM to answer the second problem formulation. The second stage in this study is to do a test that is measuring reading, writing and counting skills using CBM techniques. The second stage was conducted to find out the application of CBM for autistic children as an effort to answer the first problem formulation.

The analysis in this study is gradual quantitative-qualitative. So, data analysis is done on quantitative data

and then followed by qualitative data analysis. Quantitative data analysis was carried out using narrative analysis techniques, while for qualitative data, the Miles and Huberman models were analyzed using the stages of data reduction, data presentation, and conclusion drawing. This research was conducted in April-May 2018 at SLB Bantul. The subjects in this study were autistic girls of eighth-grade junior high school with the initials YZ.

IV. RESULT

This section presents the results obtained.

A. Implementation Of CBM

a) Screening Using CBM

Screening using CBM measurement is the initial measurement stage used to see specific areas needed for intervention. The results of this measurement will provide valuable information to the teacher to determine learning objectives. The results of measuring the academic development of reading, writing, and arithmetic in children with autism are presented in tables and diagrams. Table 1. is a data recapitulation of the test results of reading, writing and counting skills on YZ subjects. Based on table 1. can be given the following explanation. Measurements are carried out on three academic aspects, namely reading, writing and counting. Each educational character consists of several matrices which are then developed into Student Worksheets (LKS) composed of 18 parts. Scores obtained from YZ subject test results work on LKS. Scores are presented in the form of the percent (%) received from the total correct answers divided by the maximum total score and multiplied by 100%.

TABLE I. DATA RECAPITULATION OF YZ SUBJECT READING, WRITING AND CALCULATING SKILLS TEST RESULTS

Academic Aspects	CBM Assessment Matrix	Score (%)
Reading	The smooth naming of the letter	98
	Naming the message	88
	Distribution of phonemes	100
	Smoothness on difficult words	50
	Word recognition identification	28
	Quiet oral reading	45
	Maze	0
	Correct matching vocabulary	0
Writing	Dictation Word	85
	Picture Word Help	0
	Help Story	0
Counting	Counts orally	100
	Identify the number	100
	Amount	100
	Missing number	100
	Calculation	57
	Concepts and applications	0
	Algebra	0

From the Table I above, developmental data on writing skills that have been measured using three matrices namely

word dictation, help with pictorial words, and story assistance. The highest score is found in the phrase dictation matrix which means that the YZ subject can write words that are dictated verbally. The development of writing skills in the picture word help matrix and story assistance has not developed with a score of 0, which means that YZ subjects have not been able to write simple sentences with the help of pictures and writing paragraphs based on the support of the previous story. The development of numeracy skills has been measured using seven matrices, namely verbal calculation, number identification, differentiation of numbers, missing numbers, calculations, concepts & applications, and algebra. The oral calculation matrix, number identification, number differentiation, and missing number get a high score.

That is 100%. That is, the YZ subject can calculate verbally loudly starting from number one, able to mention a series of numbers chosen randomly from one to twenty, able to accurately specify more than the two numbers presented, and ready to correctly identify the amount lost in three-digit sequence. At present, the YZ subject counting skill is in the calculation matrix with a score of 58%. However, the concept and application and algebraic forms have not developed with a score of 0. This result indicates that the YZ subject has begun to be able to do calculations but has not been able to solve the concept problems and calculation applications. Also, YZ subjects have never learned about the algebraic material so that the algebraic matrix scores 0. In general, the development of YZ subject academic skills can be summarized into the following table. Overall, data on the development of YZ subjects' academic skills in reading, writing, and arithmetic is currently in the eighth grade of junior high schools in the individual schools. The most significant development is numeracy skills with a percentage of 65%. The development of reading skills was 51%, and writing skills developed 28%. Calculation of the rate of academic growth in reading, writing, and arithmetic of YZ subjects is calculated based on the total score of CBM measurements in each educational aspect.

b) Determination of Goals

Learning objectives in this study were carried out using an intraindividual framework. Individual frameworks using individual children's data are used to project reasonable goals within the time specified using the expected growth rate. Determination of goals in reading, writing, and numeracy skills of YZ subjects is determined based on CBM measurement data within one year. The reading skills of YZ Subjects on the meaning of words that have not developed, so that the learning objectives in this one-year term are to increase the meaning of words and their use in a sentence. The success of learning goals in this aspect of reading will be marked by the success of YZ Subjects in completing tasks in the maze matrix and word matching. In writing skills, the goal set for YZ Subjects within one year is to write sentences with the help of pictures. This goal setting is also considered with the current level of child fluency. Innumeracy skills, the goal set within one year is that YZ Subjects can apply a count operation to a more relevant case of completion. The success of YZ Subjects in achieving this

goal is characterized by good measurement values in the concept matrix and application.

c) Diagnostic Assessment

The third step of identifying needs is determining the strengths and weaknesses of autistic children in aspects of writing skills. The results of CBM measurements were analyzed so that the strengths and weaknesses of autistic children were found in writing skills. The third stage is the assessment of learning placement that uses the 2013 curriculum indicators. The gap of autistic children in writing skills that have been adapted to the 2013 curriculum will illustrate the grade level of autistic children's writing skills. This result will make it easier for the teacher to determine learning material and learning modifications in the fourth step.

d) Making Hypotheses about Interventions

The hypothesis is taken to provide ideas about interventions given to children. The theory produces the right method for individualizing instructions based on CBM results and appropriate diagnostic data. Educators must provide valid opinions about the type of intervention program, learning content, and delivery arrangements that are appropriate for the faithful. It is essential to consider the number and the number frequency of interventions not only the specific skills that students need to work.

e) Development of Learning Plans

Learning plans are developed based on hypotheses about intervention. Educators will develop learning plans based on the learning objectives designed. Responses will be provided for as much time as possible, relevant to skills needs. The higher the child's academic requirements, the more often the intervention must be carried out and for a longer time each session. By using progress monitoring data, educators can determine effective learning plans.

B. Early Development of YZ Subjects

Based on the results of the interview, it was found that YZ subjects experienced developmental problems at an early age. YZ subjects experienced difficulties during the birth process. The birth process is carried out by cesarean delivery. Before a decision is made to do a cesarean, the doctor first performs an induction action because at that time the membranes have ruptured. The induction action was carried out around 5:00 a.m. but did not show good progress, so the doctor decided to perform a cesarean section. Cesarean section surgery cannot be done because it has to wait for the queue to use the operating room so that the new surgery can be done at 2:00 p.m. So the YZ subject for approximately 9 hours in the state of amniotic rupture.

At the age of 4 months, the YZ subject said the first word "Umi." However, at the age of 5 months, YZ subjects experienced high heat due to measles. After an illness, sensory development, interaction, and language decline. The development of YZ subjects who suffered setbacks led to the diagnosis. Based on the doctor's diagnosis, YZ subjects showed symptoms of autism and suggested sensory

integration therapy. YZ's parents accept the YZ subject as a child with autism by providing appropriate education to improve early development [37].

Reading skills are measured using eight matrices, namely smooth naming of letters, naming of letter sounds, phoneme division, smoothness of difficult words, identification of word recognition, flat oral reading or fluency in reading paragraphs, mazes, and matching correct vocabulary. The highest score on the reading skill matrix is the phoneme division which means that the YZ subject can precisely cut the phoneme on the words that have been read. Reading skills of YZ subjects are currently developing at the stage of smooth oral reading or fluency in reading paragraphs. The development of reading skills in the labyrinth matrix and correct word matching has not improved with a score of 0. This result indicates that the YZ subject has not been able to choose the right word according to the context of the sentence and has not been able to use the word according to its function in the sentence of autistic children.

V. DISCUSSION

A. Application of CBM to Monitor Development of Reading, Writing and Counting Skills in Autistic Children

This study aims to explain and analyze the application of CBM to monitor the development of reading, writing and numeracy skills in children with autism and. The use of CBM as an effort to develop learning programs on basic academic skills is carried out in several stages, namely screening, goal setting, diagnostic assessment, making hypotheses about interventions, and improving learning plans [4]. In the screening phase, preliminary assessment using CBM requires instruments that have been prepared based on CBM matrices. The application of CBM to reading skills uses the following guidelines [4]. (1) The smoothness naming matrix of letters is used to measure the naming of letter symbols spelled at the kindergarten level with a duration of 1 minute. (2) The letter naming sound matrix is used to measure the child's ability to accurately produce phonological sounds of notes that are presented with a duration of 1 minute at the kindergarten level. (3) The phoneme division matrix is used to measure phoneme cutting in words at the level of the final level kindergarten with a duration of 1 minute. (4) The smoothness matrix on words is complicated to measure the relationship between letter sound and phoneme mixing. (5) A word recognition identification matrix is used to measure a child's ability to read accurately from a list of about 50 words - complicated words with 1-minute duration at class level 1. (6) A verbal reading fluency matrix (or a smooth reading of paragraphs) is carried out for 1 minute at grade 1-6 and grade 7-8 by measuring oral reading skills. (7) The labyrinth matrix is used to measure the understanding of the child in the seventh part of the word is removed, and the child must choose the right word from a series of distractors to fill in the missing words for 1 minute for elementary school grades 1-6 and 3 minutes for junior high or high school level. (8) The final reading skill matrix is the correct vocabulary

matching matrix to measure a child's ability to match correctly and choose answers with two distractors for 5-7 minutes at the junior or senior high school level.

The application of CBM to writing skills uses the following guidelines [4]. (1) Word dictation matrix is used to measure skills in grades 1-6 with a duration of 2-3 minutes. (2) The pictorial word help matrix is done to measure the test results at sentence level in categories 1-6 with a period of 3 minutes. (3) Story assistance matrix is done to measure text results at paragraph level with a duration of 3 minutes for grades 1-6 and 5-7 minutes for grades 7-12.

The application of CBM on numeracy skills uses the following guidelines [4]. (1) An oral calculation matrix is performed to measure the numerical calculation in kindergarten and grade 1 with a duration of 1 minute. (2) A number identification matrix is used to measure number recognition in kindergarten and grade 1 with a period of 1 minute. (3) The number differentiation matrix is done to measure the difference between larger and smaller numbers in kindergarten and grade 1 with a duration of 1 minute. (4) The missing number matrix is used to identify the sequence and identify the amount needed to complete the course in kindergarten and grade 1 with a duration of 1 minute. (5) The calculation matrix is performed to measure basic arithmetic (addition, subtraction, multiplication, division) in grades 2-6 with a duration of 2-3 minutes. (6) Measurement in concept matrix and application is done to measure the number of correct answers in classes 2-6 with a period of 6-8 minutes. (7) The algebraic form is carried out to measure basic skills and use of algebra at the junior and senior high schools with a duration of 5-7 minutes. Before discussing the results of CBM measurements on reading, writing, and counting skills, it will be addressed first about the cognitive development of YZ subjects that affect the development of these skills. Cognitive development is influenced by the development of children at an early age such as the birth process and illness at the age of the baby. The birth process performed by cesarean can affect health [38] and low cognitive level of children [39]. In small infants, high fever due to measles can be a predictive factor for severe bacterial infection [40]. Children become very susceptible to developmental problems due to bacterial infection. Signs of developing problems that lead to the diagnosis of ASD include walking disgusted, eye contact continues to decrease [41], rarely crying, not responding when invited to speak [42], [43], often flapping, and involvement in a limited social environment and more often interested in things that are not common [44]. Developmental problems that arise at an early age require parents to make an early diagnosis immediately. Early diagnosis has a significant effect on resolving some developmental issues [45]. Developmental tasks are missed because developmental problems can be overcome by conducting integration sensory therapy to train neural sensors and interaction with teaching staff in schools or adults to train spontaneous communication [46], [47].

Developmental problems at an early age cause developmental disruption at later ages, so a measurable test is needed to monitor the development of current reading, writing and numeracy skills. Measurements are made based

on CBM matrices and 2013 curriculum material. The development of reading, writing and numeracy skills can be described as follows:

a) Reading Skills

The CBM measurement results illustrate that the reading skills of YZ subject develop well in the smooth naming of letters, nomenclature of letter sounds, and phoneme distribution. The reading process requires a child to do the recording and decoding [48]. The recording process is done when the child associates words and sentences with the sounds by the writing system used. The decoding process refers to the process of translating a graphical series into words. Measurement on the smoothness of the letter naming matrix, the letter sound naming, and phoneme distribution using decoding and recording processes. This result is consistent with the study that autistic children have good strength in decoding skills (55%) and semantic knowledge (57%) [49].

Smooth reading difficult words, identification of word recognition and fluency in oral reading has developed but requires practice reading words that contain letters / k / n / m / ng /. Measurement of the three matrices gets a score below 50% because the YZ subject does not say clearly or omit the letter / k / n / m / ng /. The characteristics of the pronunciation of autistic children are in the development of phonological processes such as fluency, reduction of word groups, and often consonant elimination at the end of words and non-developmental errors in pronunciation such as nasal-specific phoneme emission and initial consonant deletion [50]. Autistic children need reading fluency because it can have a significant effect on reading comprehension [51] that shows the importance of smooth reading improvement interventions, especially in words that contain letters / k / n / m / ng / to improve reading comprehension of autistic children.

The development of reading skills in the labyrinth matrix and the correct matching of words has not developed at all. The subject has difficulty understanding the word in the context of the sentence presented. Given the challenges of different characteristics of autistic children and lack of knowledge about appropriate interventions, it is essential to know about the cognitive uniqueness and development profile of current reading skills [24]. The hope of learning outcomes and the quality of life of autistic children is increasing. The cognitive characteristics of autistic children in the area of executive function illustrate that autistic children need more intensive guidance in planning, managing, and maintaining behavior to achieve a goal.

The hypothesis is related to interventions to improve reading comprehension of autistic children. Three learning strategies are proven to be effective in improving reading comprehension of autistic children, namely question-making, graphic organization [20], [52], [53] and make predictions [20]. Interventions developed as learning plans are graphic organizations, mind mapping. Implementation of the learning plan in the form of mind mapping will be discussed in subsequent studies.

b) Writing Skills

Writing skills are closely related to children's independence in decision making (Self-Determination) [54]. Writing as a language skill used to communicate indirectly can increase intelligence in the sense of training the brain's work to express thoughts or ideas and improve children's creativity in expressing their feelings through writing [55]. Therefore, the measurement of writing skills is used by the teacher to determine the effectiveness of the intervention and modify the next learning process. The development of YZ subject writing skills is well developed in spelling out the dictated words with 85% success rate which means being able to write words correctly 18 of the 20 words dictated. When writing the word heard by the YZ subject, it still often removes the letter / n /. The skill of writing sentences in the matrix of pictorial help and writing stories about personal experiences has not developed at all. YZ subjects have been able to identify images well but have not been able to make communicative sentences. Writing based on the help of pictures and help stories requires an understanding of words so that children can use words by communicative sentences.

Characteristics of the cognitive abilities of autistic children in the Theory of Mind (ToM) is the difficulty of understanding the feelings and thoughts of others. Improving the writing skills of autistic children is expected to train the ability of autistic children to understand the feelings and opinions of others. Improvement in writing skills can be made by intervening in Language Experience Approach (LEA) learning, Writer's Workshop (WW), and sentence frame assistance or other assistance needed by autistic children [54]. Cognitive intervention can be combined with an emphasis on developing self-control and specific skills training [56]. The response that was designed as a learning plan is the help of sentence framework.

c) *Calculating Skills*

The development of numeracy skills YZ subjects develop very well in the verbal calculation, number identification, number differentiation, and completing missing numbers. The calculation matrix for YZ subjects has been able to calculate addition and subtraction problems without saving, as well as simple multiplication and division. The concept and application and algebraic matrices have not developed at all. Interventions to improve the ability to solve mathematical problems are using approaches to manipulate real objects and virtual media. These two manipulative forms succeed in helping autistic children in solving reduction problems accurately and independently and can generalize their reduction learning through real and virtual [57] by using a computer as an intervention support tool [58]. Virtual media learning strategies show greater accuracy regarding independence compared to real object manipulation. The intervention developed as a learning plan is using mobile learning virtual media. The most significant skill development is numeracy skills with a percentage of 65%. The development of reading skills was 51%, and writing skills developed 28%. Based on these results YZ subjects are faster in the event of numeracy skills. This development is consistent with the characteristics of autistic children who experience difficulties in aspects of communication and social interaction [59].

B. *Supporting Factors and Obstacles to the Application of CBM for Autistic Children to Monitor the Development Of Reading, Writing and Numeracy Skills*

The other objective of this study is to describe and analyze the supporting factors and inhibiting factors of CBM implementation to monitor the development of reading, writing and numeracy skills for autistic children. Writing, and counting, by the theory presented earlier, namely:

- First, ease in using CBM. Teachers can easily develop CBM content based on the curriculum used by autistic children. The CBM contents can be taken from a specific curriculum [35]. The curriculum used today is the 2013 curriculum with a thematic approach.
- Second, the right assessment results make it easy to determine the next program. The CBM measurement insures children gives team members an overall picture of children's strengths and weaknesses [35]. These children's strengths and weaknesses are used to determine appropriate interventions for children. The CBM makes it easy for the teacher to perform services with the response to intervention approach.
- Third, CBM measurement uses specific matrices in identifying developmental stages of reading, writing and numeracy skills. The CBM matrices are a measurable criterion [3]. These matrices will make it easier for the teacher to determine the ability to read, write and count at this time. Previously the teacher measured the ability to read, write, and count children with autism using general statements so that they cannot be measured clearly, for example the child is unable to read the words. The teacher does not know what letters the child has difficulty reading a word.

The inhibiting factor of the implementation of CBM is the change in mood that exists in children, both those affected by internal factors and external factors of children with autism. Characteristics of autistic children who have behavioral disorders add to the challenge of teachers to implement CBM [14]. This mood change implements CBM delayed so that it takes a longer time.

VI. CONCLUSION

CBM can be done on autistic children. The CBM for the development of learning plans has been carried out into four stages, namely screening, goal setting, diagnostic assessment, making hypotheses about interventions, and developing learning plans. The CBM measurement results to monitor the development of academic skills in children with autism are as follows. Reading skills in the labyrinth matrix and correct word matching have not developed at all, so the YZ subject needs to get an intervention for the meaning of the word in its use in a sentence. The skill of writing sentences with the help of pictures and writing paragraphs with the help of stories develops at all so that it needs to get interventions to write with communicative sentences. The development of numeracy skills in concepts and applications and algebra has not developed at all, so it is necessary to get interventions to apply concepts that have been mastered in the form of story problems by practicing making mathematical sentences. Responses that are milled

to develop reading skills are mind mapping, sentence frame assistance, and mobile learning. The supporting factors for CBM implementation are the ease of using CBM, the assessment results make it easy to determine the next learning program, and use measurable measurement criteria, while the inhibiting factors are children's mood changes that are influenced by internal factors and external factors of autistic children.

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