Identification of Children with Learning Disabilities of Math in Korea: With Special Regard to Early Numeracy*

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Abstract

The present study is a literature review that emphasizes the necessity of developing measure for child's early numeracy skills. First of all, the present study searched for evidences of effects of early identification and intervention through the literature review. Even though early identification of child with learning disabilities brings about very complex issues, we stress the need of early identification for at-risk children in mathematical learning. Since mathematical skills are generally developed hierarchically, deficits in informal math knowledge may cause problems in formal math knowledge in school. Thus, for early identification of at-risk children in mathematics, informal knowledge, such as number sense, need to be examined, and investigate normal development pattern. This work is to be the foundation for admitting the importance of early identification in early numeracy, and to be the step forward in developing a standard measure for children with difficulties in mathematical areas.

Key words: early identification, learning disabilities with mathematics, number sense

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I. Introduction

The importance of early identification of children who are likely to experience later academic difficulties in school has been emphasized in the field of special education. Early identification refers to the practice of screening infants and preschool children in an attempt to discover those likely to be at-risk of experiencing school problems at a later time (Mercer et al., 1996). The purpose of early identification is to determine which children have developmental problems that may be obstacles to learning or that place children at-risk (National Joint Committee on learning Disabilities, 2006). The importance in the practice is the assumption that problems in school can be decreased if intervention is initiated prior to schooling

Early identification in academic problems has been emphasized for couple of reasons (Lago, 2007). First, children are most receptive to positive changes during early developmental periods (Tramontana, Hooper, & Selzer, 1988). Second, research in early intervention has demonstrated that early identification and remediation could reduce the risk of later academic difficulties in preschool children (White, 1986). In addition, early identification has implications for families of exceptional children. When problems are identified early, family acceptance can quickly begin to provide additional support for intervention and service efforts for preventing serious condition (Hayden, 1974).

The purpose of this review paper is to stress the importance of early identification in mathematics and to suggest how this may be carried out. In this paper, effects of early identification and intervention are reviewed at first. Early identification of child with learning disabilities brings about very complex issues. However, results of related studies reported that efforts of early identification diminished the risks of future problems in school. Therefore, identification via confirmed system and measurement should be attempted. For these trials, system and measurement will be reviewed in the last section.

II. Early Identification of Learning Disabilities

A. Effects of Early Identification and Intervention

In general, results show that early identification links to extra support for development and readiness of at-risk children. For intensive support, child can be a server for early intervention. Early intervention refers to a broad array of activities planned to emphasize the child's development (Ramey & Ramey, 1998). Because researchers and practitioners agreed that poverty, slow cognitive development, and academic deficit were relevant to each other, researchers who stress the importance of early intervention have developed early childhood programs for economically disadvantaged children. There are evidences that early intervention prevents serious problems in the future. Bereiter and Englemann (1966) reported that children who showed delayed abilities in language and cognitive abilities recovered the normal level in both areas after they had intensive lessons for nine months. Even though they were only fifteen, it could be a good evidence for supporting early identification.

In addition, several projects have been implemented for children who were from low socioeconomic status and were considered at high risk. In one successful Portage Project (Shearer & Shearer, 1972), staff helped parents learn how to work with children at home. In the Milwaukee Project (Herber & Garber, 1975), low SES children from the age of three months to six years were provided with intensive intervention in preschool, and they attained IQ scores that were 30 points higher than the scores of children in a control group. Head Start has also conducted a longitudinal study of early intervention for children who were from low SES. Head Start began in 1964 and has provided compensatory educational experiences for children who might come to school unprepared and unmotivated to learn (Lerner, 1993). The follow-up studies of these children revealed that participants did significantly better than the control group. As a bonus, these Head Start programs were cost-effective. This evidence of efficient early intervention stresses the necessity of early identification.

B. Early Identification of Learning Disabilities

As mentioned above, early identification of at-risk child leads several advantages for future learning in school. Basically, researchers assumed that the earlier children start learning, the better it is for them (Hayden, 1974; Stimbert, 1971). By identifying at-risk child, early identification gives information for early intervention to prevent problems. Effects of early intervention for at-risk child are already proven by several projects (e.g., Shearer & Shearer, 1972; Herber & Garber, 1975; Lerner, 1993). In particular, early identification helps families prepare for their children's difficulties in school. When parents knew that their child could struggle with learning in school, they generally wanted to avoid and deny these situations at first and took a long time in accepting that their child needed special help. This delayed acceptance made the child miss the opportunity to develop appropriately, which resulted in the child lagging behind his/her peers. In this way, factors associated with early identification such as problems prevention and family's acceptance were shown to be effective in preparing families for their children's difficulties in school.

Even though there are several advantages of early identification, evaluators need to be careful about the effects of misdiagnosis. Measures for identification are unreliable for children with mild or moderate problems (Divoky, 1974). For example, researchers reported that in reading area individual with reading disabilities cannot be distinguished from individual with low achievement reliably (Algozzine, 1985; Ysselyke, Algozzine, Shinn, & McGue, 1982). In addition, some researchers insist that even though two groups can be distinguished, both of them get almost the same benefits from the same intervention (Algozzine, Ysseldyke, & McGue, 1995; Lyon, 2001). Another problem related to misdiagnosis is that developmental/maturational differences are varied early in life (Mercer et al., 1979). The early childhood is a period of rapid growth and there are large differences in developmental rate and pattern. Thus, differential developmental patterns make it difficult to determine whether a child is truly at-risk or simply a slow learner who could be an efficient learner later on

In addition, identification is related to the eligibility issue. Identification is originally to serve intensive supports, but identification often is linked to labeling only, and not associated with intervention. Many children who do not have disabilities are labeled as children with disabilities and mistaken labeling have negative effects on children and family. There are evidences that teachers and parents have negative stereotypes toward children who are labeled as children with disabilities (Algozzine et al., 1977; Foster & Ysseldyke, 1976; Foster, et al., 1975; Salvia, et al., 1973). Especially, Foster, Schmidt, and Sabatino (1976) reported that learning disabilities label generated negative expectation compared with normal label.

The early identification of learning disabilities is a more complex issue because children in preschool and kindergarten have not failed in school learning. Because learning disabilities are viewed as an academic problem, some argue that formal academic instruction should not begin in kindergarten (Mercer et al., 1979). In addition, since children with mild disabilities are confused with other conditions with disabilities such as emotional disturbance or mental retardation, early identification is more difficult for learning disabilities. Nevertheless, we can predict that these children are likely candidates for school failure (Lerner, 1985). That is, the problems should not lessen efforts at developing best practice which lead to the identification of learning disabilities which leads to placement in programs that prevent or reduce the learning and social-emotional problems of young children (Mercer et al., 1979).

C. Early Identification in Mathematical Area with Number Sense

The distinguishing mark of mathematics is that skills are developed hierarchically. That is, basic skills and concepts are required for understanding more complex procedures (Aunola et al., 2004). For example, in order to perform complex problems, such as multi-digit addition and subtraction, children must become fluent with simple one-digit addition and subtraction problems. Simultaneously, a failure to acquire basic numerical concepts during early childhood might negatively influence learning of advanced skills in mathematics.

Soon after infancy, children are able to demonstrate an understanding of numbers and their dynamic nature (Baroody, 2004; National Research Council, 2001). For example, infants can discriminate between a group of two objects and a single object (Clements & Sarama, 2007). Gelman and Gallistel (1978) have shown that even 2- and 3-year-olds develop preliminary notions and skills of addition and subtraction. By 4 or 5 years of age, the child is relatively proficient in practical arithmetic (Carpenter, Moser, & Romberg, 1982; Ginsburg, 1982). The 4-year-old may know that 5 is greater than 3 and may be able to add 5 and 3 objects mentally. For example, 4-year-old children can count all numbers (5 and 3 is 1, 2, 3, 4, 5, and then 6, 7, 8), even though they usually cannot deal in any way with written representations of these problems.

Griffin and Case (1996) reported that preschool children should develop verbal counting and an understanding of the concept of global quantity comparisons earlier than understanding and operating whole numbers. By 6 years of age, children should be able to coordinate two structures to yield a mental number line representation, which children should be able to notate in a conventional manner (Moss & Case, 1999). The mental number line representation is an important developmental achievement that provides the conceptual foundation for using arithmetic strategies and lays the groundwork for subsequent mathematical learning.

Ginsburg & Baroody (2003) also classified informal and formal knowledge types in mathematical development. Informal knowledge is defined as the important notions and procedures acquired outside the context of schooling (Ginsburg & Baroody, 2003). Informal knowledge appears to build a foundation and thus extends the formal knowledge of children (National Research Council, 2001), whereas formal knowledge refers to the knowledge learned as a result of formal schooling (Ginsberg &

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Researchers have also mentioned that a number sense is a prerequisite skill to developing more complex mathematical abilities (Lago, 2007) and an outcome of informal early math instruction (Clarke, 2002). Many researchers agree that a number sense is important to learn mathematics in school. However, the definition of a number sense has not been settled, yet. For example, cognitive scientists tend to adopt the idea of a basic, fundamental number sense construct that becomes more developed as it is connected with other cognitive structures through experience and education. Alternatively, math educators generally define a number sense more broadly, including complex mathematical skills, understanding, and disciplines in the construct, as well as fundamental numerical abilities (Berch, 2005).

Several researchers have offered conceptual definition of number sense. NCTM (1989) defined number sense as the ability to understand the meaning of numbers, define different relationships among numbers, recognize the relative size of numbers, use referents for measuring objects and events, and think with numbers in a flexible manner. Case (1998) defined number sense as the ability to move seamlessly between the real world of quantities and the mathematical world of numbers and numerical expressions. In addition, Gerstern & Chard (1999) define number sense as a child's fluidity and flexibility with numbers, the sense of what numbers mean, and an ability to perform mental mathematics, and to look at the world and make comparisons.

There are various definitions of number sense, but in general, children with number sense can recognize the relative size of numbers, use referents for measuring objects and events and think and work with numbers in a flexible manner that treat numbers as sensible system (Resnick, 1989). In addition, children with number sense have the ability to understand the meaning of numbers and define different relationships among numbers (Commission on Standards for school Mathematics, 1989). These relationships, the essence of number sense, provide an important foundation for mastery of basic facts, mental computation, and a general facility with numbers (John et al., 1993). Early number relationships in number sense are as follows ; more than/less than relationship; relationships to five and ten; relationships to real quantities; relative magnitude relationships; part-part-whole relationships; fraction relationships (Table 1).

Table 1. Number relationships in early numeracy

	Definition/ example
More than/less than relationship	Knowing what is the number less/more than given number without counting again. Ex) Knowing that 7 is two less than nine and one more than six.
Relationships to five and ten	Thinking every number as five or ten and rest number. Ex) Five and two more is 7.
Relationships to real quantities	Judging or estimating a quantities Ex) Is a randomly arranged set of fourteen objects close to ten or to twenty-five?
Relative magnitude relationships	Knowing where a given number is relatively in mental number Ex) 31 may be large with respect to 4, about the

line.	same as 28 or 35, yet quit small in comparison to 500.
Part-part-whole relationships	Knowing which number facts made a given number. Ex) 7 can be composed of three and four or of two and five.
Fraction relationships	Understanding of fraction with pictures or physical models at first and then whole numbers. Ex) Five thirds is 1/3 and 1/3 and 1/3(that's one whole) and 1/3 and 1/3 (3, 33).
Note. This table is based on John, A., Walle, D. V., & Watkins, K. B. (1993). Early development of number sense. In Jensen, R. J. (Ed.), Research ideas for the classroom: Early childhood mathematics (pp.127-150). NY: Macmillan.	

Number sense is an essential tool for comprehension through the development of higher order insights when working on mathematical problems. Baker et al. (2002) reported that number sense could be an indicator to predict subsequent performance in arithmetic, and they developed the number sense battery to identify the children with difficulties in mathematics. It was suggested that poorly consolidated number sense was one of the causes for calculation deficits (Gersten et al., 2005; Mazzocco & Thompson, 2005), and the ability of number sense in preschool age was highly correlated with first-grade mathematic achievement (Jordan et al., 2007).

Number sense is, according to Case et al. (1992), a conceptual structure that relies on many links among mathematical relationships, mathematical principles, and mathematical procedures. The linkages act as essential rules for promoting children to think about mathematical problems and to develop higher order insights. Research reported that students in elementary school who have difficulties in mathematics may lack number sense, as compared to their peer (Geary, Bow-Thomas, & Yao, 1992). For example, in Baker et al.'s study (2002), results have shown moderately strong correlations (ranging from .52 to

.73) between a brief kindergarten screening measure, the Number Knowledge Test and a first-grade standardized measure of math achievement, the Stanford Achievement Test (SAT 9). There is more evidence that number sense can be a predictive indicator for formal mathematical learning. In recent study, researchers report that number sense performance in kindergarten, as well as number sense growth from the start of kindergarten through the middle of first grade, accounted for 66 percent of the variance in first grade math achievement (Jordan et al., 2007). They also propose that number sense is a reliable and powerful predictor of math achievement at the end of first grade.

D. Number Sense and Mathematical Difficulties

There is increasing evidence that poor ability in a child's number sense causes deficits in learning mathematics which begins in early childhood (Fuchs, Fuchs, & Karn, 2001). The acquisition of basic numerical concepts in childhood serves as a foundation for the acquisition of later higher order mathematical concepts (Ginsburg & Allardice, 1984). Accordingly, early identification in the number sense is important to prevent an academic crisis and to minimize risks associated with learning.

The cognitive research shows many children with mathematical learning disabilities (MLD) are delayed in the development of procedure skills, such as counting (Geary, 1993). Children with MLD use the immature counting-all or counting skills on procedures and make more errors than children without MLD. This pattern is the same as remembering arithmetic facts and continues until the end of elementary school years (Geary, 1987). In addition, in one-to-one correspondence tasks, children with MLD have shown an immature understanding of some basic number concepts, relative to their academically normal peers (Geary et al. 1992).

Some studies also support that instruction including the number sense activities leads to significant reductions of failure in early mathematics (Griffin et al., 1994). Yang et al. (2004) found that instruction including the number sense activities for 6th graders led to progress in mathematics. In addition, the number sense instruction with 2nd grade students with mathematics learning disabilities had a positive effect on students' fact retrieval performance (Shih, 2005). Gestern and Chard (1999) also reported that simultaneously integrating the number sense activities with increased number fact automaticity is more efficient for children with MLD compared to teaching these skills sequentially.

These findings indicate a promising direction for efficient and early identification of children who may require intervention to prevent the diagnosis of learning disabilities in the area of mathematics. To identify these children early, evaluation of the number sense could be a predictive indicator of formal mathematical learning and mathematical difficulties.

Ⅲ. For Early Identification of Learning Disabilities in Mathematics

In terms of reading, early identification of children who are most likely to encounter reading problems may constitute the first step in reducing the incidence or severity of reading difficulties (Jenkins, 2002). Because schools tend not to identify these children until the middle elementary grades, these children's reading difficulties become more serious, and possibly become more intractable. For the most effective intervention, schools must find ways to identify these children much earlier than they usually do. By the same token, early identification in mathematics is also important for preventing serious risk. As noted earlier, the development of mathematics occurs in a hierarchical manner. Namely, basic skills and concepts should be acquired for understanding more complex procedures (Aunola et al., 2004). With the exception of evidence in the number sense research, there is still reliable evidence that early identification is influential on reducing the number of children with mathematical difficulties and the seriousness of these mathematical difficulties. For example, Campbell and Ramey (1995) reported that they identified at-risk children with mathematical difficulties in preschool and elementary school and provided early interventions. After seven to ten years, children who had an intervention in preschool scored significantly higher on individually administered tests of mathematics and had fewer instances of grade retention and assignments to special education than students who had an intervention in elementary treatment.

A. For Framework of early identification

To prevent serious academic problems in school, early identification plays a very critical role, but we still need a careful approach to avoid misidentification. The effects of misidentification of learning disabilities are minimized through the continuous or frequent monitoring of each child's progress (Mercer et al., 1979). Unlike the low achievement model for learning disabilities, Response to Intervention (RTI) considers not only a child's performance level but also the growth rate and is an alternative model to identify children with learning disabilities. RTI is a process of implementing high-quality, scientifically validated instructional practices based on the learner's needs. It involves monitoring progress and providing instruction based on the student's need (Bender & Shore, 2007).

RTI not only provides early intervention for children who are at-risk for school failure but also develops more valid procedures for identifying children with disabilities (Gestern & Dimino, 2006). As indicated in Figure 1, most students (80%) receive interventions in a general classroom without further assistance (Tier 1). Tier 1 is universal intervention and is available to all students (Wright, 2007). Tier 2 is also a general education responsibility, but it involves more intensive intervention and perhaps more intensive progress monitoring (Bender & Shores, 2007). Students in Tier 2 fail to respond successfully to Tier 1 intervention. Typically, Tier 2 involves some outside assistance from other teachers and/or experts in the subject area. In Tier 3, the most intensive intervention is provided. Generally, students with chronic and severe academic delays are served in Tier 3 and they are called "non-responders." In many schools, Tier 3 intervention is available only through special education (Wright, 2007).

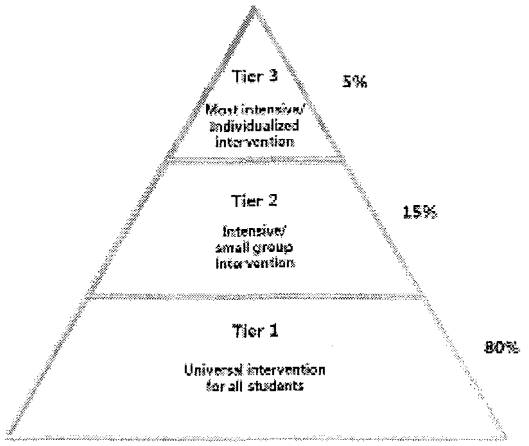

Figure 1. RTI pyramid
Source: Bender, W. N., & Shores, C. (2007). Response to Intervention, a practical guide for every teacher. Thousand Oaks, CA: Corwin Press

Under RTI, there are several methods for identification of non-responders (Fuchs & Deshler, 2007). The first method is the median split in which teachers measure students several times during a multiyear tutoring program and use hierarchical linear modeling to obtain the slope of improvement for each child (Vellutino et al., 1996). After determining the median, any student whose slope is at or above this median is designated as responsive to the tutoring; those whose slopes are below the median are labeled as non-responders. The second method is the normalization method in which teachers compute standard scores after intensive intervention and then identify students who are below the 25 percentile as non-responders (Torgesen et al., 2001). The third method is the final benchmark method based on performance level at the end of intervention. This method employs a criterion-referenced benchmark associated with appropriate future performance (Fuchs & Deshler, 2007). To define responders, Good, Simmons, and Kam´eenui (2001) compared raw scores on the measure against a criterion-referenced benchmark associated with future success on a high stakes assessment and identified students who were below the score of 40 as non-responders. The fourth method is the dual discrepancy model developed by Fuchs and Fuchs (1998). Speece and Case (2001) applied the method to identify non-responders. They summarized student responses in two ways: slope of improvement during treatment and performance level at the end of treatment. Non-responders were required to demonstrate both slope and performance levels at the end of treatment more than one standard deviation (SD) below that of classroom peers.

Generally, in the dual discrepancy model, the first discrepancy criterion is the low performance level: the child must be significantly below his or her same-grade peers on measures of academic performance. Usually a curriculum-based measurement (CBM) is used to make this decision, because the target student's discrepancy from peers can be readily assessed by comparing the student's performance on CBM measures with locally developed norms from the student's school or school district (Kovaleski, & Prasse, 2004). The second discrepancy criterion is the growth rate. Although the child is provided carefully planned and precisely delivered intervention, if the child performs poorly in response to intervention, he or she is identified as LD. For this step, the use of CBM as an ongoing performance measure is also most frequently recommended (Shinn, 2002).

In the present study, we selected underachieving children in the number sense based on the dual discrepancy model because some researchers have already found evidence that students with dual discrepancy are the lowest achievers among other underachievers (Case et al., 2002; Deno et al., 2001; Speece et al., 2003). However, RTI is a model for students who study with formal and effective curriculums in school. Although students receive effective intervention, when they do not respond, non-responder children could be identified as learning disabilities. That is, it is difficult to apply dual discrepancy for identification of a learning disability in kindergarten because they have not yet been provided with intensive and qualifying intervention with a standard curriculum. In spite of these limitations, the dual discrepancy model was adopted for identifying non-responders. Although all subjects received preschool and school-standard curriculum and no one had any experience with special education, if some children show dual discrepancy in early mathematics, they may face problems in formal math learning. Accordingly, in this study, to identify underachieving children, the dual discrepancy model was adopted.

B. For Measure of early identification

Early identification can be an examination of children for readiness in certain critical areas of development (Gredler, 1992). At the same time, early identification plays a fundamental role in decision making (Methe, 2005). For decision making in the educational field, monitoring students' progress is important because results of ongoing measures in content areas help teachers decide what to teach and how to establish and change the goals. Formative evaluation is appropriate for monitoring a student's progress. Children's progress can also be monitored and evaluated to determine whether these critical skills are improving. The data gathered in formative evaluations can be used to design and modify interventions to maximize their effectiveness (Fuchs & Fuchs, 1999).

Curriculum-based Measurement (CBM) is a formative evaluation form. CBM is a reliable and valid assessment system for monitoring a child's progress in basic academic skill areas, such as reading, writing, spelling, and mathematics (Deno, 2003; Shinn, 1989). CBM is an alternative assessment system that also borrows some features from standardized, norm-referenced assessments.

Curriculum-based assessment refers to a wide range of informal assessment procedures. However, curriculum-based measurement also refers to a specific set of standard procedures that include the following characteristics. CBM has a formative evaluation characteristic, so that performance is repeatedly sampled across time. The reliability and validity of CBM have been achieved through using standardized observational procedures for repeatedly sampling performance on core reading, writing, and arithmetic skills. Unlike most informal measures, the psychometric concepts of reliability and validity are primary characteristics of CBM (Shinn, 1989). In addition, because the materials used for assessment in CBM may be obtained from the instructional materials used by the local school, the results of CBM help teachers decide what to teach and how to teach (Deno, 2003). To add to these advantages, it is easy to use for professionals, para-professionals, and parents and data are reliable, because using CBM takes for a short time (1 to 3 minutes). CBM represents an assessment method that can provide the multiple sources of documentation needed for a) modeling academic growth, b) distinguishing between ineffective general education environments and unacceptable individual student learning, c) informing instructional planning, and d) evaluating relative instruction effectiveness (Fuchs & Fuchs, 2006). This allows for early and ongoing identification of students who are behind their same class and same-grade peers.

Ⅳ. Conclusion

Mathematics affects not only students' successful scholastic performance in school but also their productivity in their careers. Although mathematics ability has been emphasized in the last two decades, a number of children still struggle with math problems in school. Mathematical skills develop hierarchically. That is, basic skills and concepts must be acquired in order to understand more complex procedures (Aunola et al., 2004). Therefore, early identification of at-risk children in informal mathematical knowledge is important to prevent an academic crisis before they struggle with formal math knowledge in school. The purpose of early identification is to determine which children have developmental problems that could become obstacles for learning and to provide appropriate interventions (National Joint Committee on Learning Disabilities, 2006). Because preschoolers' development is characterized by broad variability in rates and patterns, no clear distinction can be made in the early years among children. However, it is not in the child's best interest to wait and see or hope that the child will grow out of his or her problems. Screening, evaluation, enhanced learning opportunities, and possible intervention services should be provided as soon as possible when a child shows immaturities (National Joint Committee on Learning Disabilities, 2006).

For early identification of at-risk children in mathematics, we need to examine informal knowledge, such as early numeracy. Many researches show that early numeracy skills are often represented as the number sense (Gersten, Jordan, & Flojo, 2005). In addition, researchers reveal that the outcome of informal early mathematics instruction is the number sense (Clarke, 2002). Although there is some disagreement among researchers about the conceptual definition of the number sense, it is understood as skills that provide a foundation for the acquisition of later mathematical abilities, and result from experiences acquired prior to school entry (Gersten et al., 2005; Griffin et al., 1994). A number sense is an essential tool for comprehension through the development of higher order insights when working on mathematical problems. Baker et al. (2002) reported that the number sense could be an indicator to predict subsequent performance in arithmetic, so researchers developed the number sense battery to identify children with difficulties in mathematics. Proceeding from these facts, for early identification of at-risk children with difficulties in mathematics, measures with the number sense could be the tool for predicting deficits in formal mathematical knowledge.

Early identification could be carried out through an examination of children for readiness in certain critical areas of development (Gredler, 1992). At the same time, early identification should play a fundamental role in decision making (Methe, 2005). Accordingly, early identification should be based on data for educational accountability (Ysseldyke et al., 1997). For decision making in the educational field, monitoring students' progress is important because the results of ongoing measures help to decide what to teach, and how to establish and change the goals for individual children. Monitoring students' progress gives information abOut which children have difficulties reaching their peers' performance and about their growth rates, all of which are important to identify at-risk children.

In order to monitor students' progress, an assessment form should be a formative evaluation. Among several formative evaluation forms, CBM is a representative form for the RTI approach within a general problem-solving methodology. That is, CBM is a valid indicator of monitoring students' progress and can be used to examine the responses to the instruction repeatedly and can aid in decision making. CBM was developed for testing the effectiveness of a special education intervention model called data-based program modification (Deno & Mirkin, 1977; Deno, 2003). CBM is a set of methods used to assess reading and mathematics skills development in which short-duration reading passages and computation are sampled from specified curriculum and individually administered to students.

Proceeding from these facts, even though early identification of learning disabilities is very difficult for mineralizing deficits, efforts for identifying at-risk child especially in mathematical area are still needed. Because the early childhood is a period of rapid growth and there are large differences in developmental rate and pattern, early identification should be performed carefully with progress monitoring. Moreover, the number sense can be the measure to investigate children's development and deficits. This measure could help prevent serious deficits in acquisition of formal mathematical knowledge. Furthermore, CBM is a susceptive measure for recognizing infinitesimal changes. In the further studies, researches related to what components the number sense consists of and the development of a real measurement with CBM will be needed. After developing the measurement, establishing standards will help the researchers and practitioners understand

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