

Vygotsky's Sociocultural Theory and its Implications to the Role of Teachers in Students' Learning of Mathematics

Jeon, Kyungsoon

Department of Mathematics Education, Chonbuk National University, Jeonju 561-756, Korea;
Email: kjeon72@hotmail.com

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The purpose of this paper was to introduce sociocultural theory which is a different epistemological perspective from constructivism and to understand the sociocultural theory in a systemic way by providing four specific criteria for a sociocultural theory from the analysis of Vygotsky's ideas. The four criteria are the followings: First, the origin of learning is not at the individual level, but at the social. Second, Learning takes place in a sociocultural framework through ZPD and there exists the stage of pseudo concept before it gets to a true concept. Third, a clear focus on action, especially mediated action, and the concept of psychological tools should be discussed in the boundary of a sociocultural theory. Fourth, actors in a learning process are not an individual child alone. In consequence, the role of adults, particularly teachers, are significant in a child's learning, and this fact provides a great potential for the active role of teachers in the students' learning of mathematics from the sociocultural perspective.

한글 초록(Abstract in Korea): 본 논문은 한국 수학 교육학계에서 사회적 구성주의자로서 소개되어지고 있는 Vygotsky 의 이론의 재분석을 통해 우리에게는 아직 낯선 그의 이론인 **사회문화주의 이론(sociocultural theory)**을 소개하는 것을 그 주목적으로 하였다. 특히 아동의 수학 학습에 있어 교사의 역할의 중요성을 어떻게 Vygotsky 가 사회문화주의 이론이라는 렌즈를 통해 설명하고 있는지를 분석하였다. Vygotsky 는 '사회문화주의'를 주장함으로써 Piaget 와 같은 아동 중심적 학습이론과 그 색채를 매우 다르게 취하고 있는데, 첫째, 그는 수학 학습이란 아동의 개인적인 수준에서보다는 사회적 수준에서 이루어진다고 주장하고 있다. 이는 본질적으로 Vygotsky 가 왜 구성주의자로서 이해될 수 없는가를 보여주는 근본적인 이유이다. 둘째, 어떻게 사회문화적인 구조(예: 학교, 교실) 속에서 학습이 일어나는가를 설명하기 위해 '근접 발달 영역' (Zone of Proximal Development: ZPD)이라는 개념을 도입하였다. 이는 아동이 누군가의 도움을 통해 도달할 수 있는 잠재적 발달 영역을 의미하며 Vygotsky 이론의 핵심이 되는 개념이다. 셋째, 사회문화주의 이론은 행동(mediated action)과 심리학적 도구(psychological tool)를 강조하며 결과적으로 학습의 아동 내부에서의 독립적이고 내재적인 생성보다는 외부적인 환경과의 제휴된 모습과 그

결과들을 강조한다. 넷째, 따라서 아동의 수학 학습 과정에 있어 주체는 아동 홀로가 아니며, 교사와 보다 우수한 아동들의 역할이 매우 중요함을 강조하고 있다. 본 논문에서는 이러한 사회문화주의 이론에 대한 이해를 돕는 것과 아울러, 이를 통해 수학 학습에서 교사의 역할에 대한 그 이론적 기반을 제공하고 있다. 구성주의가 활성화 시켜 온 아동 스스로의 지식의 건설이라는 중요성에 비추어, 사회문화주의 이론의 제안을 통해 아동의 수학 학습에서의 교사의 적극적인 역할의 가능성을 제시하고 있다.

INTRODUCTION

In mathematics education we have heard about various learning theories (e.g., Thorndike's theory of stimulus and response, Piaget's theory of learning, Bruner's theory of conceptual development based upon the concept of cognitive representation, radical constructivism by von Glasersfeld, and Cobb's social constructivism and so on). In my opinion, it is true that they hardly exist without some ideas in common. For example, many of Piaget's ideas are imbedded in radical constructivism and social constructivism. And further, even though I frequently hear of two "super frame" in theories of learning when people talk about Piaget and Vygotsky, a Russian psychologist who has currently drawn much interest among many western mathematics educators, it is true that some of their explanations have things in common. This paper, however, focuses on mainly Vygotsky's work and his explanations on how learning takes place. According to Valsiner (1988), Vygotsky's intent was to "get across to his pedagogically-minded listeners a more basic theoretical message which is the "interdependence of the process of child development and the socially provided resources for that development" (p. 145). Hence, it is acceptable to say that Vygotsky viewed thinking not as a characteristic of the child only, but of the child-in-social-activities with others (Minick, 1985) which is quite different from Piaget's view points at many angles.

For the purpose of this paper which is to propose a better understanding of Vygotsky and his theory, I adopt two simplifications of vocabularies in explaining learning theories. One is "an individual theory of learning" represented by Piaget, and another is "a sociocultural theory of learning". From my saying of the nonexistence of different theories with no shared part (at least, influences), you may be able to guess that it is not easy for me to make to draw a clear line between an individual theory of learning and a sociocultural theory of learning. However, this simplified vocabularies will help me address criteria for a learning theory to be sociocultural. This has an underlined assumption that people are more familiar with characteristics of individual theories of learning through our experiences of them compared to those of sociocultural theories of learning. From now on, four specific criteria for a sociocultural theory of learning will be

presented. Each criterion may contain somewhat different characteristics (more specific explanations within the each criterion), but those characteristics will be closely tied to each criterion.

1. WHERE DOES LEARNING TAKE PLACE?

Learning takes places not at the individual level, but at the social level.

For a learning theory to be sociocultural, first, it should understand that mental action is situated in cultural, historical, and institutional settings, and learning should be understood at the social level first. The basic premise of a sociocultural approach to learning is to believe that the social dimension of consciousness is primary in time and in fact. Therefore, the individual dimension of consciousness is derivative and secondary (Vygotsky, 1978). Although the learning process itself is considered to be very individualistic, a sociocultural theory of learning looks at the social dimension of the learning in the first place.

This belief in the social dimension has a strong consequence in a sociocultural theory's approaches to the explanation of what learning is about and how learning happens. Another basic goal of a sociocultural approach to learning is to create an account of human mental processes that recognizes the essential relationship between these processes and their cultural, historical, and institutional settings. So although a primary interest of a sociocultural theory is human mind (development of human mind), the theory tries to provide accounts of human mind through processes that the human mind adopts. Learning can not be explained without the examination of social interactions that the human makes. This is a clear distinction between a sociocultural theory and a non-sociocultural theory of learning. For example, Piaget's theory of learning is not a sociocultural theory because Piaget's primary interest in a child's learning is not at the social level.

Wertsch (1991) used the expression of "a sociocultural approach to mind" in his book entitled *Voices of mind*. According to his explanation, a sociocultural theory of learning wants to study human mind, mental processes, and a human activity, primarily at the social level. He suggests that there does not exist a whole individual construction of knowledge without interactions outside of an individual.

Let me make a warning here for a reader. What Wertsch says is not to ignore the role of individual activities in learning, but to give primary focus on the role of social activities in the learning process of a child. In my opinion, a separation of learning and the social is untenable. But what I try to make as a point here by providing Vygotsky and Wertsch's explanations about the importance of the social activities is that the focus of a

sociocultural theory of learning at the social level is appropriate. I think it is appropriate particularly if I consider the current feature of education where schooling plays an important role in a child's learning of mathematics than the past.

Vygotsky's general genetic law of cultural development shows how he put the priority in the social level. He started that any function in the child's cultural development appears twice, or on two planes. First it appears on the social plane, and then on the psychological plane. First it appears between people as an *interpsychological category*, and then within the child as an *intrapyschological category* (Vygotsky, 1981, p. 163). I noticed that a sociocultural theory of learning acknowledges the individualistic feature of learning, too, but it is secondary. Therefore, the orientation of a sociocultural theory is clearly different from that of an individual theory of learning.

In fact, a sociocultural theory goes further than acknowledging individualistic features of an individual theory of learning. A sociocultural theory actually provides a criticism to learning theories which are based upon individual construction of knowledge. It criticizes individual theories of learning for examining human mental processes in learning of mathematics as if they exist in a cultural, institutional, and historical vacuum. Interestingly, this criticism is not new. John Dewey (1901), almost a century ago, argued that the discipline could not deal with the many phenomena it sought to examine if it continued to focus so exclusively on the individual organism. But it seems that learning theories have heavily focused on individualistic orientation particularly in American psychology. According to Rommetveit (1979), one devastating effect of the tendency to study the isolated individual or mental process "in vacuo" has been to cut psychology off from dialogue with other academic disciplines and with the general public.

2. HOW DOES LEARNING TAKE PLACE IN A SOCIOCULTURAL FRAMEWORK?

It is through ZPD and conceptual development goes through the stage of "pseudo concept" before it gets to a true concept.

For a learning theory to be sociocultural the idea of ZPD in a child's learning should be understood, and the existence and the value of "pseudo concept" before a true concept in a child's concept development should be acknowledge. The focus of a child's learning is at the level of potential development not just at the level of "where a child is at". In the framework of an individual theory of learning, especially for the case of Piaget, it is considered to be critical to know where a child is. Then consequently, any learning environment for a child is devised to fit with his or her developmental stage. But in a sociocultural theory, a child's learning is expected to go beyond his or her actual

performance level. Naturally, an instruction should be tied more closely to the level of potential development than to the level of actual development. Vygotsky introduces the "Zone of Proximal Development (ZPD)" in explaining the potential learning: This zone is defined as the distance between a child's "actual developmental level as determined by independent problem solving" and the higher level of "potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p. 86).

Vygotsky's general claim about the social origins of higher mental functioning in the individual surfaces most clearly in connection with the "zone of proximal development," a notion that has recently received a great deal of attention in the West (Tharp & Gallimore, 1988). I think perhaps we will be able to obtain more practical goals in theories of learning in mathematics education by the understanding of the ZPD. Because we expect more from learners now under a sociocultural theory than we have anticipated under individual theories of learning. Perhaps those goals will have better access to the assessment of children's abilities in learning of mathematics and the evaluation of instructional practices which have not explained well enough by individual theories of learning.

Since a child is expected to learn knowledge at the potential level, his or her conceptual development go through a process called "pseudo concept" which has an "imitation" process of adults' mode of understanding. The process of developing a true concept comes, for Vygotsky, when the child begins to abstract out the concept. Vygotsky argued that the way children outside the experimental setting pick up the adult use of language and use it correctly syntactically before a more complete conceptual development has been achieved is an instance of the use of a pseudo concept. This process is an essential stage of development and is based on imitation. According to Confrey (1994), Vygotsky postulated that concepts develop via heaps (unorganized categories) to complexes (family resemblance, collections, chain complexes, and pseudo concepts) to true concepts. He wants that a pseudo concept can appear to be the same as a true concept; however, it does not hold up to intense scrutiny. For Vygotsky, the movement from pseudo concepts to true concepts requires the assistance of an adult.

Let us look at Brown and Ferrera's (1985) explanation about the process of learning in a sociocultural. Their explanation is similar to Confrey's, but it is easier than hers. They introduce the process of "internalization", but this is not as same as Piaget's idea of internalization: Vygotsky's theory of cognitive development rests heavily on the key concept of internalization. Vygotsky argues that all higher psychological processes are originally social processes, shared between people, particularly between children and adults. The child first experiences active problem-solving activities in the presence of others but gradually comes to perform these functions independently. The process of internalization is gradual; first the adult or knowledgeable peer controls and guides the

child's activity, but gradually the adult and the child come to share the problem-solving functions, with the child taking the initiative and the adult correcting and guiding when she falters. Finally, the adult cedes control to the child and functions primarily as a supportive and sympathetic audience.

Some people, particularly, constructivists may attack the notion of pseudo concept for not having a conceptual learning of the concept. In addition, they may criticize that the "imitation" explained in a sociocultural approach is of little significance in itself. But in my opinion, they are undervaluing a fundamental importance of the imitation process of a child in his or her learning making. And this imitation is an evidence of showing that a child can go well beyond the limits of his or her own capacities which is what constructivists may not consider.

3. WHAT IS THE STUDY FOCUS OF A SOCIOCULTURAL THEORY?

A sociocultural theory has a clear focus on action, "mediated action", and "psychological tool" and consequently interdisciplinary features of learning are emphasized.

A sociocultural learning theory has a clear focus on action of a learner, "mediated action" of a learner in context. The concept of "psychological tools" is useful in understanding how one can use them to influence another. So learning takes place in the use of psychological tools available to a learner in his or her environment. In consequence, interdisciplinary features of learning are emphasized. I stated earlier that a fundamental assumption of a sociocultural approach to mind is that what is to be described and explained is human action. Thus action, rather than human beings or the environment considered in isolation provides the entry point into the analysis (Wertsch, 1985, p. 8). Therefore, at the application level of sociocultural theories of learning, human action, particularly actions by learners in the mathematics learning process in classroom are studied in a detailed way. For example, a child's speech, thinking, and utterance in the child's learning making are considered as actions, so they are carefully studied. A sociocultural approach begins with the assumption that action is mediated and that it cannot be separated from the milieu in which it is carried out. Learning is viewed as an action, therefore, it should be studied in context where the action takes place.

The concept of *communicative action* by Habermas (1984) is another good example showing the importance of actions in research in a sociocultural theory. The concept of communicative action refers to the interaction of at least two subjects capable of speech and action who establish interpersonal relations. It is clear that different accounts of action are assumed to arise from quite different sets of environments. Therefore, different

accounts of learning of a child arise from different factors of the environment of the child. This explains better why learners are different in their level of learning even at seemingly same interactional environment.

The sociocultural approach is concerned with mediated action, too. Consider human action typically employs “mediational means” such as tools and language, and that these mediational means shape the action in essential ways. According to Wertsch (1991), it is possible, as well as useful, to make an analytic distinction between action and mediational means, but the relationship between action and mediational means is so fundamental that it is more appropriate, when referring to the agent involved, to speak of “individual(s)-action-with-mediational-means” than to speak simply of “individual(s).” (Wertsch 1991, p. 12).

Vygotsky used “psychological tools” to represent the mediational means. To Vygotsky, psychological tools are things that one can use to influence another. It is important for me to understand that he extends the idea of tool beyond physical tools to include psychological tools. Therefore, the concept of psychological tools provide us much implication on educational activities in a child’s learning as well as educational materials which are generally considered tools. Strength of this concept of psychological tools particularly in learning of mathematics is that it provides us a diverse mode of thinking what we should look for in a child’s learning of mathematics as appropriate tools. Many mathematical ideas such as various systems for counting, mnemonic techniques, and algebraic symbol systems, as well as non-mathematical ideas such as language, works of art, writing, schemes, diagrams, and maps can be considered as a part of the theory of learning.

Since a sociocultural theory has its focus on mediated actions in a child’s learning and pursues understanding of what kind of psychological tools are used in a child’s learning, in consequence, it gets more interdisciplinary. That is, learning process is explained in interdisciplinary ways. For example, more studies on classroom discourse related to learning of mathematics have done. When Ana Sfard (1996) did a study on discursive construction of mathematical objects, she claimed that through linguistic associations, the new symbol may evoke some old meanings which, in their turn, would suggest certain ways of use rather than some others. In her concluding remarks, Sfard said that the extremely important point to stress is the issue of context. Whether “real-life” or purely mathematical, it is the context which makes growing ideas meaningful and helps in establishing object mediation (p. 151).

This interdisciplinary feature of a sociocultural theory expands our interest about learning mathematics into a more broad setting. Cultural, social, and political issues in mathematics education are discussed in the hands of theories of learning mathematics. Bishop’s (1988) idea of mathematical enculturation, D’Ambrosio’s (1985) studies on mathematics learning in cultural settings, Skovsmose’s (1990) interest in mathematics

education and democracy are good examples of those. That is, I think sociocultural influences, thoughts on a theory of learning broadened their perspectives.

4. WHO ARE MAIN ACTORS IN LEARNING PROCESSES?

Actors in a learning process are not an individual child alone. The role of adults (teachers particularly) and advanced peers are significant in a child's learning.

A sociocultural theory of learning views learning not within a world of a child only, but of the child-in-social-activities with others, a teacher and other children. In particular, a sociocultural theory values the role of adults (teachers particularly) and advanced peers in a child's learning by the notion of the ZPD. Formal instruction in the classroom by a teacher, with its special organization in its institutional context, through its mediated actions, provides children with the resources to develop the capacity to consciously learn knowledge. Therefore, teaching is not considered separate from learning. By the notion of the ZPD, conception of knowledge acquisition of a child is tried to be explained not by construction, but by instruction (or possibly the combination of both construction and instruction). Since instruction is not understood separately from classroom, it is clear that the classroom is taken as a sociocultural system where both children and a teacher interact each other in the sociocultural system. A sociocultural theory expects both sides to be active participants in learning making processes.

Particularly where a child is concerned, his or her activities are peopled by others, an adult and peers in particular. I think this importance of others in a child's learning provides a significant message to teachers. I think, in the individual theories of learning, especially under the influences of constructivism, teachers don't get enough support in terms of how much is right for them to be engaged in a child's learning process. In many sense, they are likely to be left with a guilty feeling that they do not let the children construct their own meaning by themselves through "meaningful" activities. Contrary to constructivist paradigm, a sociocultural perspective asserts a value in having learning in the class and introducing them the "expert method" so that the learners can participate in the classroom discussion. I believe this expert method is strength of a sociocultural theory which has not supported by many other learning theories. Now teachers in a sociocultural perspective don't have to be afraid of playing an active role in a child's learning by using the expert method (e.g., Now it is understood that a teacher's direct instruction is not necessarily bad when it is used appropriately in the classroom.).

Another strength of a sociocultural theory is that it recognizes the intergenerational character of teaching and learning through the emphasis on the adult/child relationship in learning. In other words, I say that a sociocultural theory of learning brings a new

meaning to theories of teaching. Now teachers themselves are interpreted as learners through the process of adult/child relationship, and this is quite an important change in our notion of teaching from the traditional view, say, a facilitator, to a participatory view of teaching. The ZPD tells teachers that learning should lead development, a failure to allow it to do so slows down and limits a child's potential. I think this also throws an important message to learn that a true learning implies coping with difficulties.

Saying every child can learn mathematics because it is carefully selected by a teacher at the child's level is different from saying every child can learn mathematics because its difficulty can be coped by the child by the help of the teacher. And the latter is supported when it comes to a child's learning of mathematics. It is essential for learners to expect lapses in learning of mathematical concepts. Because then the learners are to seek for assistance from other people (teachers and advanced peers) even in the individual construction of learning, and teachers are legitimate to be ready to provide the help needed. A sociocultural theory of learning demands dialectical feature of learning mathematics among the participants. Therefore, learners affect and create through their challenges through the participation in learning processes, and a teacher evolves through the participation in learning processes, too. In addition, a sociocultural theory demands carefully attention to the institutional context of social interaction not only in the classroom but also in the school, and societies. So the dialectical feature is not limited to the classroom level. In a sociocultural theory, one of the most important key elements of children's learning of mathematics is the crucial role of the teacher in the classroom.

CONCLUSION

So far, the four specific criteria for a learning theory to be a sociocultural theory have been explained. First, the origin of learning is not at the individual level, but at the social. Second, Learning takes place in a sociocultural framework through ZPD and there exists the stage of pseudo concept before it gets to a true concept. Third, a clear focus on action, especially mediated action, and the concept of psychological tools should be discussed in the boundary of a sociocultural theory. Fourth, actors in a learning process are not an individual child alone. In consequence, the roles of adults, particularly teachers, are significant in a child's learning.

Albert Einstein sharply put it that: "It is always the theory which decides what can be observed" (Mehra, 1973, p. 269). This probably means that different theories do produce different concerns and actions, and, in turn, different realities to mathematics educators. In that sense, Vygotsky's sociocultural theory has a great potential as we lead ourselves to try to understand better the mathematics teacher education because of its potential in

understanding teachers and their role in students' learning of mathematics.

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