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ABSTRACT

This paper discusses the relationship between Lev Vygotsky's zone of proximal development and cooperative learning. Vygotsky (1896-1934), a Russian psychologist, formulated a theory that children first develop lower mental functions such as simple perceptions, associative learning, and involuntary attention; then, through social interactions with more advanced peers and adults, they eventually develop high mental functions such as language, counting, problem solving skills, voluntary attention, and memory schemas. Central to Vygotsky's theory of cognitive development is his theoretical construct of the zone of proximal development. He proposed that a child's immediate potential for cognitive growth is bounded on the lower end by what the child can accomplish on his/her own and on the upper end by what the child can accomplish with the help of a more knowledgeable other, such as a peer or teacher. This region of immediate potential is the zone of proximal development. As a child learns to complete tasks with less and less assistance, the child's cognitive skills develop. Vygotsky's ideas concerning the zone of proximal development provide strong support for the inclusion of cooperative learning strategies in classroom instruction. The five components of cooperative learning (positive interdependence, face-to-face interaction, individual accountability, small groups and interpersonal skills, and group self-evaluation) are discussed in the context of Vygotsky's theories, and a series of suggestions for using cooperative learning are included. The paper concludes that cooperative learning is an effective formal education strategy for presenting social and cultural experiences in a systematic manner. (Contains 19 references.) (ND)

# Understanding Cooperative Learning Through Vygotsky's Zone of Proximal Development

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## Understanding Cooperative Learning

## Through Vygotsky's Zone of Proximal Development

The purpose of this paper is to discuss the relationship between Lev Vygotsky's zone of proximal development and the current instructional strategy of cooperative learning. In recent years, Vygotsky's ideas regarding cognitive development as a social phenomena have become quite popular with educational psychologists, while cooperative learning remains a favored instructional strategy. Vygotsky's zone of proximal development provides a robust theoretical background and framework from which to understand the potential contributions of cooperative learning.

### Vygotsky's Zone of Proximal Development

Lev Vygotsky (1896-1934), a Russian psychologist, formulated a theory of cognitive development that is based on a child's ability to learn socially relevant tools (e.g., hands, hammers, computers) and culturally based signs (e.g., language, writing, number systems). From birth, children engage in interactions with other children and adults who socialize them into their culture. According to Vygotsky (1978), children first develop *lower* mental functions such as simple perceptions, associative learning, and involuntary attention; however, through social interactions with more knowledgeable others, such as more advanced peers and adults, children eventually develop *higher* mental functions such as language, counting, problem solving skills, voluntary attention, and memory schemas. Alex Kozulin, in his introduction to Vygotsky's (1986) *Though and Language*, stated "The lower functions do not disappear in a mature psyche, but they are structured and organized according to specifically human social goals and means of conduct. Vygotsky used the Hegelian term "superseded" (*aufgehoben*) to designate the transformation of natural functions [lower mental functions] into cultural ones [higher mental functions]" (p. xxv).

Vygotsky emphasized this process of internalization, where children first experience an idea, behavior, or attitude in a social setting, and then internalize this experience so that the experience becomes a part of the child's mental functioning. Vygotsky (1978) suggested that children in their earlier years think the way they perceive and remember, while in subsequent

years children perceive and remember the way they think. Ultimately, according to Vygotsky, "humans are internalized culture" (Blanck, 1990, p. 47).

Central to Vygotsky's theory of cognitive development is his theoretical construct of the zone of proximal development. Vygotsky proposed that a child's immediate potential for cognitive growth is bounded on the lower end by that which the child can accomplish on their own and on the upper end by that which the child can accomplish with the help of a more knowledgeable other, such as a peer, tutor, or teacher. This region of immediate potential for cognitive growth is the zone of proximal development.

Vygotsky (1978) defined the zone of proximal development as "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more knowledgeable others" (p. 86).

The zone of proximal development is a dynamic construct addressing the issue of not only learning, but cognitive *development*.

> The zone of proximal development defines those functions that have not yet matured but are in the process of maturation, functions that will mature tomorrow but are currently in an embryonic state. These functions could be termed the "buds" or "flowers" of development rather than the "fruits" of development. (Vygotsky, 1978, p.86)

Consequently, a child develops cognitively by first being exposed to tasks or situations in the upper end of the zone of proximal development, those tasks or situations that at first require a significant amount of assistance in order to be completed; as the child learns to complete the task with less and less assistance, and eventually with no assistance, the child's cognitive skills develop (see Figure 1). Vygotsky (1987) has stated "What lies in the zone of proximal development at one stage is realized and moves to the level of actual development at a second. In other words, *what the child is able to do in collaboration today he will be able to do independently tomorrow* [italics added]" (p. 211).

To fully understand the zone of proximal development and its educational implications, three aspects of the zone must be understood: the use of whole activities, the need for social interaction, and change (Moll, 1990).

First, Vygotsky believed that we must not reduce higher mental functions, such as reading and writing, critical thinking, or problem solving, into a study of their component parts; but rather, we need to study, teach, and learn higher mental functions in whole activities. Vygotsky emphasized the role of play as one of these whole activities that allows for significant learning and development.

> Play creates a zone of proximal development of the child. In play a child always behaves beyond his average age, above his daily behavior; in play it is as though he were a head taller than himself. As in the focus of a magnifying glass, play contains all developmental tendencies in a condensed form and is itself a major source of development. (Vygotsky, 1978, p. 102)

Vygotsky (1978) went on to say that these whole activities must be relevant to the child and embody authentic situations. There must be a need for development to occur, even if the need is cradled within an overall atmosphere of play. With regard to learning culturally relevant writing skills, Vygotsky (1978) stated,

> Teaching should be organized in such a way that reading and writing are necessary for something...Reading and writing must be something the child needs. Here we have the most vivid example of the basic contradiction that appears in the teaching of writing...that writing is taught as a motor skill and not as a complex cultural activity...Writing must be "relevant to life." (p. 117-118)

According to Vygotsky, children are empowered as readers and writers when they use reading and writing in authentic situations where the children are engaged in purposeful and meaningful use of language. The authentic situation, or whole activity, establishes the environment in which the zone of proximal development is embedded.

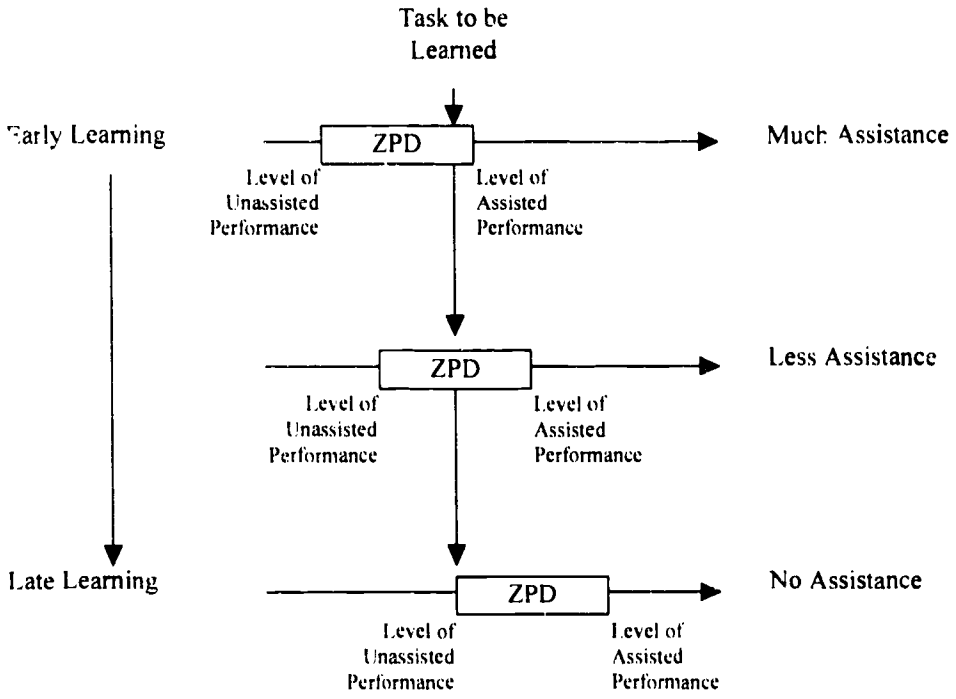
Second, Vygotsky concluded that children learn through their interactions with others. Vygotsky (1981) stated, "Any higher mental function necessarily goes through an external stage in its development because it is initially a social function" (p. 162). He believed that children initially experience knowledge and skills through interactions with other children and adults. Children internalize the knowledge and skills experienced during these interactions and eventually use the knowledge and skills to guide and direct their own behavior. Thus, social interactions, between those less experienced and those more experienced, are at the very heart of the zone of proximal development.

In addition, *the social context of the zone of proximal development suggests that the zone must be viewed as not solely relative to the child, nor to the teacher, but of the child immersed in a cooperative activity within a specific social environment.* The essence of the zone of proximal development is the social system in which the child learns; a social system that is actively *constructed* by both the child and the teacher. It is this interdependence that is central to a Vygotskian view of the educational process.

Third, Vygotsky believed that the goal of the zone of proximal development was change and growth in the individual (see Figure 1). The purpose of instruction, whether formal or informal, is to stimulate growth and development. "*The only good instruction received in childhood is the one that precedes and guides development* [italics added]" (Vygotsky, 1987, p.48). Vygotsky believed that the zone of proximal development represented a dynamic system, always undergoing change. As the child learns and develops the zone of proximal development moves, indicating the mastery of some tasks (at the lower end of the zone) and the appearance of other tasks that can now be accomplished with significant help (at the upper end of the zone). In the end, collaboration with another individual, whether it be an adult or a more knowledgeable peer, leads to development in culturally appropriate ways.

These three aspects of the zone of proximal development, whole and authentic activities, social mediation, and change, all influence functional pedagogy. For Vygotsky, formal education was a catalyst for the transmission of cultural ideas, values, and behaviors. Within an academic

Figure 1 - The dynamic nature of the zone of proximal development is represented by the zone moving past the task to be learned. Early in learning a student will require much assistance in accomplishing a task that is in the student's upper end of their zone. However with practice and understanding the student's zone will move, as the result of cognitive development, in the direction of the instruction. Later in learning the student will be able to accomplish on their own what they were only able to accomplish before with much assistance. (Note that the degree of difficulty of the task to be learned remains constant while the skill of the learner increases.)



setting, children are provided with an organized structure from which to experience and internalize their culture.

> From this point of view, instruction cannot be identified as development, but properly organized instruction will result in the child's intellectual development, will bring into being an entire series of such developmental processes, which were not at all possible without instruction. Thus instruction is a necessary and general factor in the child's process of development. (Vygotsky, 1982, p. 121)

Thus, "the developmental process is towed by the learning process and any pedagogy that does not respect this is sterile" (Blanck, 1990, p. 50).

Vygotsky's ideas concerning the zone of proximal development's role in cognitive development provide strong support for the inclusion of cooperative learning strategies in classroom instruction.

## Cooperative Learning

Cooperative learning is a form of small group instruction where students work in a social setting to solve problems (Slavin, 1991). While the essence of cooperative learning is easily understood, theorists are less in agreement as to what constitutes cooperative learning, specifically.

Table 1 illustrates the different components deemed necessary for a cooperative learning experience. From Table 1 it can be seen that five factors seem to be paramount in a cooperative learning experience, positive interdependence, face-to-face interaction, individual accountability, small group & interpersonal skills, and group self-evaluation.

The first element of cooperative learning, positive interdependence, is achieved when each group member comes to understand and value the need for group cooperation in the attainment of their own personal goals, the other individual group member's goals, and the goals of the entire group. Interdependence may take several forms, including goal interdependence, task or labor interdependence, resource interdependence, role interdependence, or reward interdependence. The result of positive interdependence is that students will be more highly

Table 1 - Components and attributes of cooperative learning according to various theorists and authors.

| Johnson, et al, 1984 | Rottier & Ogan, 1991 | Ormrod, 1995 | Sharan, 1990 |
|---|---|---|---|
| positive interdependence | group cohesion | interdependence of group members | positive interdependence |
| face-to-face interaction | face-to-face interaction | | face-to-face interaction |
| individual accountability | individual accountability | individual accountability | individual accountability |
| small group & interpersonal skills | social skills development | | small group & interpersonal skills |
| | group accountability | | |
| | teacher monitoring | teacher monitoring | |
| | group self-evaluation | group self-evaluation | group self-evaluation |
| | | clear group goal | |
| | | small group size | |

motivated to work cooperatively when task success depends on the participation of other group members.

Cooperative learning's second element, face-to-face interactions, works in conjunction with positive interdependence. Face-to-face interactions involve individual group members encouraging and facilitating other group members' efforts to complete tasks and achieve in order to have successful group goals. According to Johnson and Johnson (1991), face-to-face interaction is characterized by students

> (a) providing each other with efficient and effective help and assistance, (b) exchanging needed resources such as information and materials and processing information more efficiently and effectively, (c) providing each other with feedback in order to improve their subsequent performance on assigned tasks and responsibilities, (d) challenging each other's conclusions and reasoning in order to promote higher-quality decision making and greater insight into the problems being considered, (e) advocating efforts to achieve mutual goals, (f) influencing each other's efforts to achieve mutual goals, (g) acting in trusting and trustworthy ways, (h) being motivated to strive for mutual benefit, and (i) feeling less anxiety and stress. (see Sharan, 1990, p. 30-31)

Individual accountability, the third basic element of cooperative learning, involves holding each student accountable for mastering relevant material. Individual accountability involves both completing one's task within the group, and supporting the work of other group members. According to Johnson, Johnson, Holubec, & Roy (1984), "The purpose of a learning situation is to maximize the achievement of each individual student. Determining the level of mastery of each student is necessary so students can provide appropriate support and assistance to one another" (p. 8). Individual accountability also prevents situations where select group members do most of the work and other group members become "free loaders."

The fourth basic element of cooperative learning requires and teaches students how to use interpersonal and small group social skills. The social skills that are necessary for a student to perform competently in a small group are taught directly during cooperative learning. Often it is

assumed, by teachers, that students can interact in a small group setting with little or no help - this is rarely the case. Simple small group social skills such as staying with one's group, speaking in a low conversational voice, trusting other group members, managing intragroup conflict, and the sharing of leadership responsibilities usually require specific and direct attention by the teacher.

Finally, the fifth basic element of cooperative learning involves group self-evaluation. The purpose of group self-evaluation is to clarify and improve the productiveness of all group members in contributing to the cooperative efforts of achieving the group's goals. Group self-evaluation provides for a type of group metacognition, a process of evaluating the group's own processing. Group self-evaluation should result in describing what group member actions were beneficial and detrimental, and what group member actions should be continued or changed.

These five characteristics or components of cooperative learning differentiate cooperative learning groups from traditional learning groups. Johnson et al (1984) distinguishes nine primary differences between cooperative group learning and traditional group learning:

1. Cooperative learning groups are based on positive interdependence among group members, while traditional learning groups only focus on task completion regardless of member contributions.
2. In cooperative learning groups individual accountability is stressed so that each group member is held responsible for knowing the assigned material, while in traditional learning groups individuals are often allowed a "free ride" while other groups members complete the assigned task.
3. In cooperative learning groups, the membership is typically heterogeneous in ability and personal characteristics, while traditional learning groups are often homogeneous in membership.
4. In cooperative learning groups leadership is shared, while in traditional learning groups a leader is often appointed and remains leader throughout the group activity.

5. In cooperative learning groups members share responsibility for each others learning, while in traditional learning groups members are rarely held accountable for other group member's learning.
6. Cooperative learning groups have two main purposes, completion of the task at hand and proper group functioning, traditional learning groups only focus on task completion.
7. In cooperative learning groups, the small group social skills students need in order to work collaboratively are directly taught, while in traditional learning groups, group members are assumed to possess small group social skills.
8. In cooperative learning groups the teacher acts as a mediator in both the completion of the group task and the group's internal functioning, while in traditional learning groups the teacher only mediates the completion of the group task.
9. In cooperative learning groups group self-evaluation is an integral part of the overall group experience, while in traditional learning groups group functioning is not a priority.

Cooperative learning has proved a successful instructional strategy in many domains (see Bossert, 1988; Cohen, 1994; Johnson and Johnson, 1991). The reasons for this success may be many. Ormrod (1995) suggests the success of cooperative learning may be due to (a) students receive help and support from many sources (e.g., teachers, peers, tutors), (b) cooperative learning group members are more likely to provide social support for achievement and less likely to support "freeloaders," and (c) cooperative learning encourages discussion and social interaction which in turn encourages meaningful information processing and elaboration (processes which facilitate long term memory encoding).

The presence of the five basic components of cooperative learning, positive interdependence, face-to-face interaction, individual accountability, small group and interpersonal skills, and group self-monitoring may all be accounted for within the theoretical framework provided by Vygotsky's zone of proximal development.

## The Zone of Proximal Development and Cooperative Learning

The zone of proximal development may be used to provide a theoretical base from which to understand cooperative learning. The preceding two sections discussed the basics of each. In the following section, each of the five basic components of cooperative learning is discussed in light of the tenets of Vygotsky's general sociogenetic theory and the zone of proximal development in particular (see Table 2). A graphic representation of the relationship between the components of cooperative learning and the tenets of Vygotsky's sociogenetic theory is presented in Figure 2.

### Positive Interdependence

The cooperative learning construct of positive interdependence refers to each group member being dependent upon every other group member in their quest for achieving individual and group goals. Metaphorically, this is interpreted as the group "sinking or swimming together."

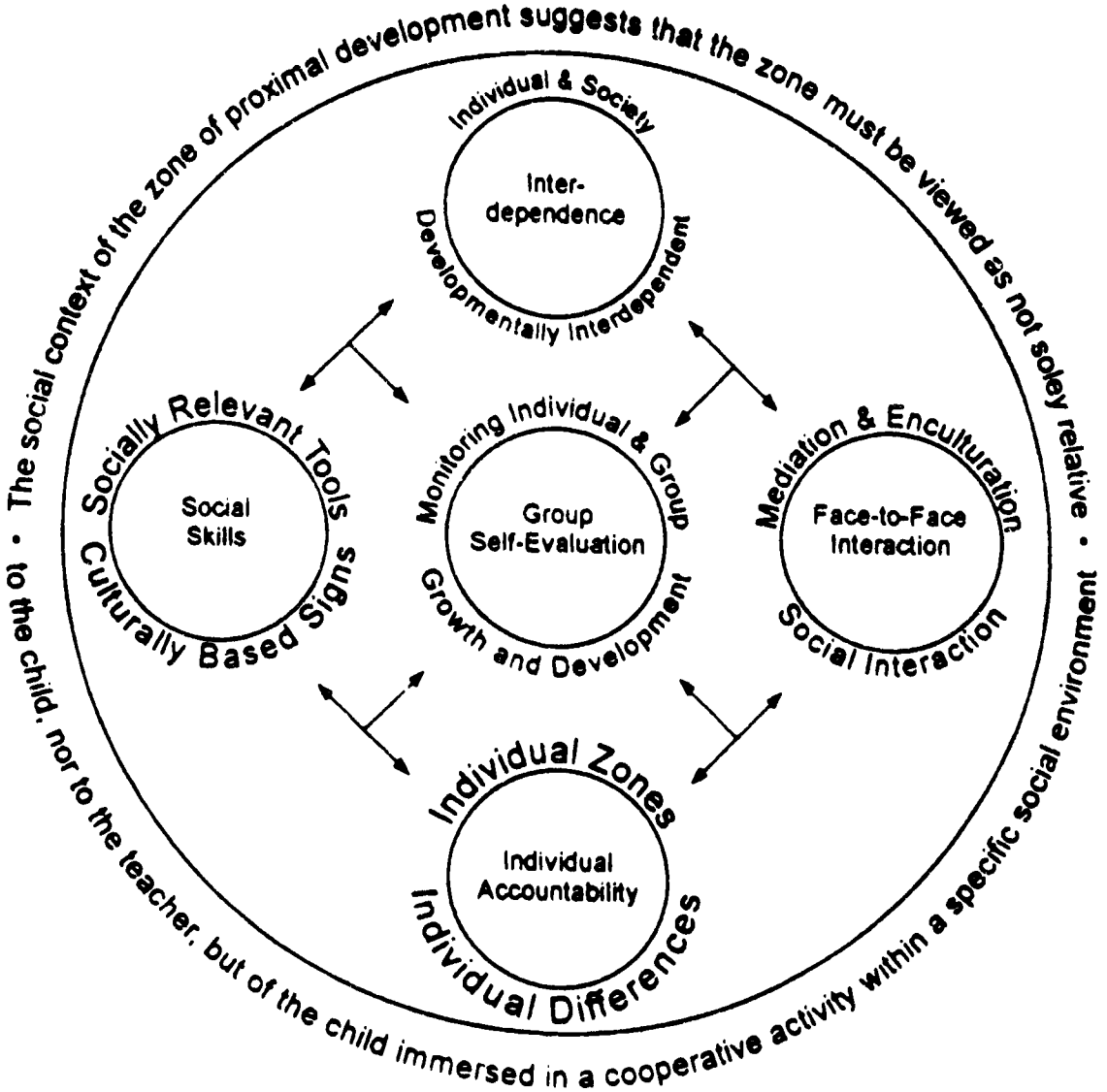
The construct of interdependence is a concept so basic to Vygotsky's sociogenetic theory that it is often overlooked. Vygotsky's theory rests upon the principle that a child's development is dependent upon interactions with other children and adults. That is, that each member of society is dependent upon other members of society to provide the resources necessary for development. Valsiner (1988) has stated that the sociogenetic theory provides for the "interdependence of the process of child development and the socially provided resources for that development" (p. 145). Therefore, children and adults are developmentally dependent, and thus interdependent.

The zone of proximal development provides a basis from which to discuss this interdependence. Each child has their own zone of proximal development for each social context in which they will find themselves. Development of the child involves presenting activities that stimulate the child within their zone of proximal development. Teaching consists of presenting activities, stimulating the child within their zone of proximal development, and then providing the resources necessary for the child to succeed, achieve, and develop.

Table 2 - The relationship between the essential concepts of cooperative learning and the theoretical constructs of Vygotsky's sociogenetic theory.

| Cooperative Learning Concept | Vygotskian Sociogenetic Construct |
|---|---|
| Positive Interdependence | Developmental Interdependence |
| Face-To-Face Interaction | Social Mediation and Enculturation |
| Individual Accountability | Individual Development |
| Small Group Social Skills | Culturally Based Signs and Tools |
| Group Self-Evaluation | Monitoring Growth and Development |

Figure 2 - A graphic representation of the relationship between Vygotsky's zone of proximal development and the basic components of cooperative learning.



Diaz, Neal, and Amaya-Williams (1990) have stated that

> within the zone of proximal development the child is not a mere passive recipient of the adult's teachings, nor is the adult simply a model of expert, successful behavior. Instead, the adult-child dyad engages in joint problem-solving activity, where both share knowledge and responsibility for the task. (p. 140)

However, while the children are busy being dependent upon other children and adults, the adults and teachers themselves are busy developing within their own zones of proximal development with the assistance of other adults and children. A teacher that is interested in understanding cooperative learning and using cooperative learning in their classroom may consult with another teacher that is more expert in the area of cooperative learning. Yet this dependence need not be restricted to adult-adult interactions, indeed, an adult that is interested in becoming more proficient at performing a computer game or programming their VCR would be wise to consult their own child. In addition, children often reflect or imitate the behaviors of adults, the observant adult may use these reflections as a means for stimulating their own personal development. Thus, children and adults are all interdependent in their quest for attaining the goal of personal development.

**Face-to-Face Interaction**

Face-to-face interaction, within cooperative learning, refers to group members supporting, assisting, influencing, motivating, trusting, and challenging other group members in an attempt to facilitate the achievement of the group's goals. Face-to-face interaction is interpreted within the Vygotskian system as social mediation and enculturation

Social mediation involves the acquisition of knowledge and skill through a child's social interaction with other children and adults. Vygosky (1982) wrote, "The central fact about our psychology is the fact of mediation" (p.116). Leontiev and Luria (1968), peers of Vygotsky, have stated that social mediation provides the "main means of mastering psychological processes that have a decisive influence on the formation of man's psychological activity" (p. 342).

Vygotsky believed that the academic environment provided the preeminent environment for exposing children to the tools and signs of a particular culture. According to Blanck (1990), "Within the context of an active, systematic interaction between the child and the pedagogue, children are provided, in an organized way, with the psychological tools that will determine the reorganization of their mental functions" (p. 47). This learning of signs and tools relevant to one's own culture Vygotsky termed enculturation. Enculturation refers to *what* is learned, while social mediation refers to *how* it is learned.

The zone of proximal development provides the vehicle through which enculturation takes place, with the assistance of social mediation. A social encounter creates the zone of proximal development in which learning, development, and enculturation grow and change. The need for social interaction as a prerequisite for learning and development was stated by Vygotsky (1981):

> Any higher mental function necessarily goes through an external stage in its development because it is initially a social function. This is the center of the whole problem of internal and external behavior...When we speak of a process, "external" means "social." Any higher mental function was external because it was social at some point before becoming an internal, truly mental function. (p. 162)

**Individual Accountability**

Individual accountability within cooperative learning involves holding each group member accountable for mastering the relevant material. Within the framework of Vygotsky's theory, individual accountability would be reflected in each group member being responsible for developing within their own unique zone of proximal development.

The essence of instruction is to provide the means and resources necessary for each individual to progress beyond the task to be learned, that is, each group member's zone of proximal development must move in the direction of instruction and eventually beyond the task at hand. While several individuals may be engaged in a collaborative effort, Vygotsky believed that each member should grow and develop - the members should be able to do today, what they could only do in collaboration yesterday.

In light of this concern for the development of each individual, the concept of the zone of proximal development may also be used as a mechanism for understanding the role individual differences in instruction. Unfortunately, not much research has been conducted in this area; however, it is easy to see that a teacher that is interested in each individual developing within their own personal and unique zone of proximal development must address the issue of how best to stimulate that individual in their own zone and what resources that that individual will need in order to become successful. Thus individual accountability reflects the desire, if not a mandate, that each cooperative learning group member develop to a point where their zone of proximal development has moved beyond the task to be learned.

**Small Group & Interpersonal Skills (Social Skills)**

The social skills that are necessary for effective cooperative learning groups are directly taught in cooperative learning environments. The acquisition of social skills in cooperative learning is what Vygotsky refers to when he states that humans use socio-cultural signs and tools to mediate and navigate their interactions with others.

Signs and tools are not the same. Signs refer to internal processes that affect the thinker's state of thought, such as language, mathematics, and reasoning skills, while tools are mechanisms for altering one's environment, such as computers, automobiles, and telephones. Vygotsky (1978) stated

> A most essential difference between sign and tool, and the basis for the real divergence of the two lines, is the different ways that they orient human behavior. The tools function is to serve as the conductor of human influence on the object of activity; it is externally oriented; it must lead to change in objects...The sign, on the other hand, changes nothing in the object of a psychological operation. It is a means of internal activity aimed at mastering oneself; the sign is internally oriented. (p. 55)

The zone of proximal development was an attempt by Vygotsky to provide a framework or method from which individuals could learn or develop signs and tools. Vygotsky first developed the idea of signs and tools as a component of development, then in his last couple of years of life

created the zone of proximal development as a means of developing and transmitting these culturally relevant signs and tools. Vygotsky argued that human behavior was mediated by these signs and tools.

Vygotsky believed that acquiring culturally relevant signs and tools was necessary for successful social mediation and that social mediation also taught more complex and socially relevant signs and tools.

> Signs and words serve children first and foremost as a means of social contact with other people....The specifically human capacity for language enables children to provide for auxiliary tools in the solution of difficult tasks, to overcome impulsive action, to plan a solution to a problem prior to its execution, and to master their own behavior. (Vygotsky, 1978, p. 28)

Thus, both cooperative learning and Vygotsky's sociogenetic theory posit that the development of social skill is a necessary, although not entirely sufficient criterion for human development and growth.

**Group Self-Evaluation**

Group self-evaluation in cooperative learning refers to a group's efforts aimed at evaluating and monitoring their own group progress and the processes that are or are not being effective in the pursuit of the group's and the individual's goals. For Vygotsky, part of instruction involves the constant monitoring of each student's growth within their zone of proximal development.

The teacher, the student, and the student's group members are all actively engaged in the learning process, thus the teacher, student, and group members must all monitor how current instruction is affecting each student's zone of proximal development. Instruction, or an activity, that is below the lower limit of the zone of proximal development will have already been mastered by the student and the student will be bored. Instruction, or an activity, that is above the upper limit of the zone of proximal development will be beyond the student's capacity and the student

will be "lost." Only instruction that is *in* the student's zone will be effective for growth and development.

Thus, constant self-evaluation and monitoring is necessary for groups to continue to be successful and for individuals to be constantly challenged within their zones of proximal development.

**Vygotskian Suggestions for the Use of Cooperative Learning**

Theories, such as Vygotsky's theory of the zone of proximal development, provide a general basis for explaining and predicting a particular phenomenon. A theory is a work in progress; something to be nurtured and developed as it is applied, understood, and investigated. As a theoretical foundation for cooperative learning, Vygotsky's theory provides a series of recommendations for the use of cooperative learning (see Doolittle, 1995). These recommendations include:

1. **Teach using whole and authentic activities.** Cooperative learning activities should be genuine in nature, not contrived or artificial. For example, a cooperative learning activity where a group of 4 students dissect sentences such that one person circles the verbs, one person circles the nouns, one person circles the objects, and one person circles the articles, is not a whole and authentic activity. This type of activity is a "seatwork" activity that has been modified to be a group work activity.

   A whole and authentic cooperative learning activity may involve the learning of backgammon as a way of exploring probability. In playing backgammon successfully, it is necessary to understand the probability of rolling certain numbers. After learning the basics of playing backgammon (and actually playing a few games), in groups of four students, each group may explore the probability of rolling a particular number by first determining all possible outcomes of rolling the 2 dice. Two of the four students may then be paired to determine the probability of each outcome using only mathematical probability. In this dyad, one student may be responsible for determining the number of different ways a number may

be obtained, using the numbers on each die, while the second student is responsible for recording this datum and generating the actual probability percentage.

The remaining two students may also be paired to determine the probability of each outcome using only experimental probability (i.e., actually rolling the dice and recording the results for a large number of rolls). In this dyad, the first student may roll the dice, while the second student records the results. After a large number of rolls, the first student must sum the tallies for each possible outcome, while the second student generates the actual probability percentage.

Following these tasks the group then reconvenes and explains there findings to the group as a whole. This explaining process should also be equally divided among the four group member. Finally, each group may then play a series of games first declaring what roll of the dice they would like before rolling and then announcing the probability of that roll.

2. **Create a "need" for what is to be learned.** In order to increase motivation and positive affect, students must see the need for learning material. A common comment from students is "When am I ever going to need to know this?" A very good question. In the backgammon example above, students could easily comprehend the need to understand probability in order to be more successful. Once students understand the need for probability in backgammon it should be easier to motivate students to understand the need for probability in winning the lottery, dying from a new drug, or guessing a correct answer on a multiple choice question.
3. **Create classroom exercises that require social interaction with peers, parents, teachers, or professionals.** Cooperative learning activities should be just that - cooperative. Activities should be structured to foster interaction between group members. Continuing the backgammon example, each student was required to socially interact in both the dyad and quadrumvirate (group of four). This social interaction allows students to exchange ideas, experience new behaviors, and ultimately, through verbalization, internalization these ideas.
4 **Encourage self-talk or egocentric speech.** Talking aloud to oneself facilitates internal organization and problem solving. A quiet classroom is not necessarily an efficient

classroom. Self-talk, or thinking aloud, is an efficient and common means used by both children and adults to organize material, elaborate on material, and eventually to problem solve. Often teachers discourage students from self-talk by stating "Bobby, think to yourself." While the students are involved in the backgammon activity, allow for and even foster self-talk as a legitimate problem solving tool.

5. **Provide opportunities for verbal interactions.** Language provides the conduit through which ideas and behaviors become internalized. As stated above, a quiet classroom is not necessarily a good thing. Language serves many purposes in the acquisition of knowledge and cognitive skill. Language allows us to plan behaviors, to understand another's thinking, to elaborate on that to which we are currently attending, and restructure our mental functions. The backgammon activity is specifically designed to promote verbal interactions between both the dyads and quadrumvirates; teachers should view this new level of sound in the classroom as a positive sign of learning.
6. **Closely monitor student progress in order to avoid assigning tasks that are not within a student's zone of proximal development.** Teachers need to closely monitor students in cooperative groups for two main reasons; first, to insure that each student is being sufficiently challenged, and second, to determine that each student is learning the intended material. Teachers need to be careful in assigning tasks that are in each child's zone of proximal development. Tasks that are either below or above a child's zone will be ineffective. A student that is an experienced backgammon player may already know the probabilities of each roll, this student may need to be assigned a different task or a different role within the activity.

Also, teachers need to monitor students to verify that they are learning the intended material. Simply because students are working in cooperative groups does not mean that they will learn the material that the activity is designed to teach. In the backgammon example, if the students determining the probability of different rolls are not counting the variations of

each roll correctly, their ultimate probabilities will be incorrect. Continual assessment and verification is needed.

7. **Instruction or activities must precede a student's development.** Cooperative learning activities should be designed to lead a student to new knowledge and understanding. Tasks should be constructed at the upper end of each student's zone of proximal development so that the student must develop in order to master the task. The backgammon probability activity should be used at a time when students are acquiring the ability to think abstractly and predict future events.

8. **Present tasks that students can perform successfully only with assistance.** In order for teaching and learning to be effective and efficient students needs to be continually challenged, this means that students should often be presented with tasks that require outside help or assistance. By presenting activities that require the student to seek assistance, the activity will lie within the student's zone of proximal development and will foster social mediation. The assistance needed in the backgammon example may take several forms. For the dyad working on the mathematical probability, assistance may be in the form of direct instruction concerning the role of sample space, outcomes, and trials as they relate to calculating probability. For the experimental probability dyad, assistance may be in the form of providing a chart for organizing the recording of the experimental trials.

9. **Provide sufficient support to enable the student to perform challenging tasks successfully, then gradually withdraw support as the student becomes more skilled.** As previously mentioned, students should be confronted with activities that require some type of assistance; however, in order for learning to occur, this assistance needs to be available. Assigning tasks beyond the student's current ability, and not supplying assistance, will only lead to frustration and helplessness. In addition, as students begin to learn the task in which they are engaged the assistance needs to be withdrawn so that the may student take over more of the responsibility of performing the task independently. While the teacher may supply assistance in the form of knowledge and organizational materials for the backgammon

activity, the teacher may not supply this assistance when the groups do the same type of activity to determine the probability of guessing a multiple choice question correctly.

10. **Students must be given the opportunity to demonstrate learning independent of others.** The ultimate goal of a cooperative learning activity is for each group member to acquire the knowledge and skill to perform each aspect of the activity independently. In order for student's to have the confidence to perform an activity independently, they must be given the opportunity to attempt an activity independently. Giving a student a task to complete independently also provides a method of assessment for the teacher to determine if the student has mastered the task at hand. Following the backgammon activity, and any other group probability activities, each student may then be asked to determine the probability of obtaining three "heads" when three coins are flipped.
11. **Construct activities that are designed to stimulate both behavioral changes and cognitive/metacognitive changes.** Activities should be structured in such a way as to develop not only the ability to perform certain behaviors, but also to develop the ability to plan, organize, and control behavior. Students should be encouraged to construct their own mental representations of tasks being learned. This constructivist approach leads to better elaboration, retrieval, and transfer of knowledge. In order for this construction process to be complete the student must construct not only the knowledge itself (and its relationship to other knowledge), but also the processes necessary to use this knowledge effectively.

    In the case of the backgammon activity, students should understand the nature of probability, be able to calculate various types of probability, and apply the concept of probability to various tasks in various domains.

These concepts may be applied to numerous cooperative learning activities, in a variety of domains, in virtually any classroom. An advantage of using cooperative learning as a classroom strategy is its remarkable flexibility and applicability to all subject areas. As a framework for cooperative learning, these concepts should provide a guide for constructing meaningful and significant activities.

## Conclusion

Vygotsky believed that cognitive development was essentially a form of enculturation, we develop through the internalization of our culture. For Vygotsky, formal education was an important instrument of enculturation. Formal education allows for the presentation of social and cultural experiences in a systematic manner. Cooperative learning is an effective formal education strategy for transmitting these cultural experiences. Cooperative learning, and its social basis, is a strategy well suited to the tenets of Vygotsky's theory of human development. According to Vygotsky (1978), "*human learning presupposes a specific social nature and a process by which children grow into the intellectual life of those around them*" (p. 88).

Finally, Vygotsky (1978) summarized the role of social interaction, and the basis for the effective use of cooperative learning, in the development of a child's mental functioning:

> From the very first days of the child's development his activities acquire a meaning of their own in a system of social behavior and, being directed towards a definite purpose, are refracted through the prism of the child's environment. The path from object to child and from child to object passes through another person. This complex human structure is the product of a developmental process deeply rooted in the links between individual and social history. (p. 30)

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