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Complex Instruction: Higher-Order Thinking in Heterogeneous Classrooms

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Students at Washington Middle School are members of over twenty different ethnic groups and come from a wide range of economic backgrounds. They represent the full spectrum of percentile rankings on standardized achievement tests. To capitalize on this diversity and to minimize the number of students who may get lost in the system, the school community has taken bold steps. Classes have been detracked, and teachers use Complex Instruction, designed to develop higher-order thinking in academically heterogeneous classrooms.

Ms. Wilson teaches mathematics at Washington Middle School. Her classes fully reflect the diversity of the student body. She uses a curriculum that challenges each of her students in its demand for mathematical reasoning. Terry, Kiante, Alicia, and Robbie are working on the Mathematical Tug-of-War,¹ an activity that involves functional relationships, inequalities, and equivalence. First, the group read a story about two tug-of-war matches involving giant frogs, athletic grandmas, and a frisky kangaroo. In the story, the students found that an even tug-of-war is five grandmas of equal strength pulling against four giant frogs, also of equal strength. Another even match results when the kangaroo pulls against two grandmas and a giant frog. The group's task is threefold: (a) to use characters from the story to create a tricky tug-of-war match that would not come out even, (b) to provide a written account of two different ways to verify mathematically which side would win the tug-of-war it had created, and (c) to make a poster that presents its tug-of-war as a problem for others to solve.

Ms. Wilson approaches the group. She is particularly concerned about

Terry, who is doodling different tugs-of-war with kangaroos, grandmas, and frogs. As usual, Terry seems withdrawn, excluded from the animated conversation among the other members of her group. Kiante, Alicia, and Robbie like the match they came up with. Kiante solved the problem using fractions and is making the case for this approach. Alicia used percentages and is arguing for her method. Robbie is demanding that they help him understand both approaches.

Ms. Wilson: I see that you found two different ways to solve your problem match. How will you decide if your solution and approaches make sense, and how are you going to help everyone in the group understand the solutions?

Kiante: Me and Alicia did the work and we know that the side with the two grandmas and kangaroo will beat the side with one grandma and four frogs. Alicia is going to show us how she figured it out after I explain how I got my answer.

Ms. Wilson: That sounds like a good plan. How will you make sure everybody in your group understands?

Alicia: Well, I'm the facilitator, so I'll make sure that everybody listens to everybody else. Then Terry can start drawing the picture.

Terry: Ms. Wilson, I think that actually the side with the grandma and four frogs might win. In my picture, these four frogs are like five grandmas, so this side has like six grandmas. (Terry points to her drawing.) This side will win because . . . see, the other side with the two grandmas and a kangaroo is like two grandmas and two more grandmas and a frog . . . 'cause the kangaroo is with the frog and two more grandmas. Look, at my picture.

Ms. Wilson: Group, please pay attention to Terry's solution. Terry reasoned out the problem through visual representations of the characters. She has an alternative approach to solve the match with visual substitution, and her argument that the frogs and grandma might win has merit.

Ms. Wilson stepped into this group because she had detected that a status problem was operating. In this academically heterogeneous classroom, unequal participation rates during groupwork lead to unequal learning. Students like Kiante and Alicia are thriving, while students like Terry might be losing ground. Fortunately, three components necessary to address the status problem are operating in Ms. Wilson's classroom: (a) a management system that frees Ms. Wilson from directly supervising students, (b) a multiple-abilities curriculum that fosters the development of higher-order thinking skills, and (c) specific attempts made by Ms. Wilson to treat the status problem. These components form the three legs of the Complex Instruction stool. In the following sections of this chapter, we describe these three components and address the ways in which school-level support and staff development enhance the implementation of Complex Instruction.

TREATING STATUS PROBLEMS IN COMPLEX INSTRUCTION

Ms. Wilson viewed cooperative learning as an appropriate and promising instructional strategy for her academically and linguistically diverse classrooms. When students are involved in cooperative learning, they interact and use one another as resources. Those who do not read or speak the language of instruction may get help from their peers. They have greater access to understanding than they might during traditional teacher-directed instruction. Peer interaction increases interest and engagement in the task and provides a strong potential for learning.

These assertions, however, mask an instructional dilemma inherent in groupwork: that of unequal influence on, and participation in, the task, a dilemma illustrated in the case of Terry. This problem is rooted in the students' perceptions of themselves and each other.

Expectation states theory (Berger, Cohen, & Zelditch, 1972) describes how status characteristics come to affect interaction and influence in group situations. A status characteristic is an agreed-upon social ranking where everyone feels that it is better to have a high rank than a low rank. Status characteristics may be diffuse, based upon general social distinctions such as race and gender; or they may be specific, based upon perceived ability relevant to a specific task. Reading ability is an example of a specific status characteristic operating in the classroom.

According to the theory, status characteristics of individuals become a basis for the groups' expectations for competence of the individual. Status problems are the result of differing expectations for competence: low expectations for low-status students, and high expectations for high-status students. These expectations for competence are held by teachers, by classmates, and by the students themselves. Students who lack traditional academic skills or proficiency in the language of instruction or who are social isolates are too often perceived as low-status students. When low-status students are in groups, they barely participate, are often ignored, and frequently are not given a share of the materials or a turn at the activity. When this occurs, we recognize a status problem (Cohen, 1986, chap. 3).

When students are given a new cooperative task, these expectations are activated and become self-fulfilling even if the task does not require traditional academic abilities. Students who are expected to be good at school talk more, have greater access to the materials, and are more influential in group discussions. Their ideas are adopted by the group, often regardless of their quality. Simultaneously, students who are perceived to be poor at schoolwork or who are unpopular are given few opportunities to participate, and their ideas are poorly evaluated and often ignored. Had Ms. Wilson not stepped in, the students in Terry's group would not have benefited from Terry's insights. Sometimes, low-status students are literally

"elbowed out"; they can't even get their hands on the materials. Their problems are often compounded by frustrated teachers who attribute the off-task behavior of low-status students to lack of motivation.

Status problems can lead to learning problems. Research on Complex Instruction has shown that the rate of interaction in the group is a strong predictor of learning gains. Individuals who test below grade level especially benefit from talking with members of the group. As high-status students interact more in the group, they learn more from the task; as low-status students interact less, they in turn learn less (Cohen, 1984). Paradoxically, in a setting designed to promote equity, the rich get richer while the poor get poorer. Complex Instruction offers two strategies to treat status problems in the classroom: (a) the multiple-abilities status treatment and (b) assigning competence to low-status students.

The Multiple-Abilities Treatment

How can we reap the benefits of cooperative learning while minimizing the problem of unequal access and learning for low-status students? One answer lies in widening our own and the students' conception of what it means to be "smart." The multiple-abilities treatment is grounded in a multiple-abilities curriculum and based on the teacher's public recognition of a wealth of intellectual abilities that are relevant and valued in the classroom and in daily life. For instance, consider some of the numerous abilities needed to complete the Mathematical Tug-of-War task: organizing information, using and understanding multiple representations of a mathematical situation, and justifying an argument.

Rather than assuming that all students can be ranked along a single dimension of ability, we need instead to consider different kinds of intellectual ability. Students will have different strengths and weaknesses among these multiple abilities. For example, the highly verbal student may have difficulty with tasks that require spatial and visual ability. Likewise, the student who scores poorly on vocabulary tests may be an astute scientific observer. This view of ability is compatible with recent work in psychology that suggests that intelligence is multidimensional (Gardner, 1983; Sternberg, 1985).

In Complex Instruction, a multiple-abilities treatment typically occurs during orientation to the day's work in groups. The teacher starts by naming the different skills and abilities necessary for successful completion of an activity and then establishes the link or relevance of these abilities to the task. Depending on the task, she or he might discuss such specific visual spatial abilities as diagramming mathematical concepts, expressing an idea as a cartoon, or creating a three-dimensional model. A challenging multiple-abilities task calls for reasoning abilities such as hypothesizing, estimating, analyzing problems logically, figuring out how something works

mechanically, or translating a musical or visual message into words. In an effective multiple-abilities treatment, students become convinced that the task in which they are about to engage is fundamentally different from traditional classroom tasks because it relies on many different kinds of intellectual abilities.

The next goal is to create a mixed set of expectations for each student approaching the task. By this we mean explicitly telling the students, "No one will have all the abilities necessary to do this task, but everyone will have some of the abilities." Herein lies the premise of Complex Instruction: Each individual brings valuable and different abilities to the task. All are needed to succeed. This message is not a simplistic "Cooperate because it is the nice thing to do." Rather, it is "Cooperate because you need each other."

When successful, the multiple-abilities treatment leaves each student thinking, "I may not have all the abilities, nobody does, but I certainly have some of them. I have something to contribute to this task." The teacher can raise new expectations for the competence of low-status students and help students to understand that, like all human beings, high-status students have their strengths and weaknesses as well.

Assigning Competence to Low-Status Students

Unfortunately, the status order in the classroom is deeply ingrained. Even with the multiple-abilities treatment, it is difficult to change students' notions about who is competent and who is expected to fail. While research has shown that a multiple-abilities orientation can help to equalize interaction between high- and low-status students (Cohen, Lotan, & Catanzarite, 1990), a second treatment shows even stronger potential to boost the participation of low-status students.

Assigning competence is a public statement that specifically recognizes the intellectual contribution different students make to the groupwork task. Teachers can assign competence to any student in the classroom, but we recommend especially focusing attention on low-status students. When Ms. Wilson told the group to listen to Terry because she had reasoned out the problem through visual substitutions, she was assigning competence to Terry.

Assigning competence is a positive evaluation. It relies on the teacher's power as a legitimate source of evaluation. Students are likely to believe the teacher's opinion. In order to change the expectations students hold for themselves and each other, assigning competence must be *public* so that the student's classmates hear it. It is important to remember that we are not just trying to raise one student's self-concept, but are attempting to raise the group's expectations for that student. Assigning competence must be *specific* so that the student and the group know exactly what he

or she did well. Finally, it must make the intellectual ability demonstrated by the student *relevant* to the work of the group.

Assigning competence has the potential to increase expectations for competence of low-status students and to increase their rate of interaction. It is strongest when it is made on the spot during groupwork; however, many teachers find it easier to take notes on students' contributions and assign competence later, during wrap-up or orientation the next day.

Assigning competence validates the message of the multiple-abilities orientation. The teacher is, in essence, demonstrating to the students that they each have intellectual abilities that are highly esteemed in society, such as planning, organizing, creating, performing, reasoning, or inventing. She or he does so by specifically tying students' performance in the group to such a valued intellectual ability. For students, the evidence of their expertise is their own performance. It is irrefutable.

Public recognition means that other students know that the teacher thinks that this student is competent in a particular skill or ability. Emphasizing the relevance of this skill or ability to the task will raise expectations even more powerfully. It will make it more likely that the group will talk to that student. When low-status students have access to the interaction, they also have greater access to learning.

TRANSFORMING THE CLASSROOM FOR COMPLEX INSTRUCTION

In Complex Instruction, treatment of status problems takes place in the context of a transformed classroom; there is a special management system, and the curricular materials are designed to enable students to excel using multiple intellectual abilities. This transformation is evident in Ms. Wilson's classroom. Her students used cooperative norms and a set of roles that helped get their job done. In addition, the group was working on a multiple-abilities task that emphasized higher-order thinking.

The Classroom-Management System

Ms. Wilson's class typically has up to six or seven different groups of four or five students, with each group working on a different task simultaneously. Because the tasks are uncertain and open-ended, it becomes necessary to delegate authority to the students. When the teacher delegates authority, students talk with each other to find out what they should be doing and how to solve the challenging problems they have been assigned. Otherwise, the students will constantly run to the teacher for help.

Delegation of authority occurs through (a) use of an activity card with instructions for the task and individual reports to be completed by each member of the group, (b) the development of a set of cooperative norms

guiding student behavior, and (c) a set of procedural roles that helps the group get its work done.

The Activity Card and Individual Report

So that the teacher does not have to go from one group to the next telling each one what to do, she or he transfers her or his authority and assigns tasks through written instructions on an activity card (Figure 6.1). Instructions can be written in English and in other languages used in the classroom; they can include visuals that depict the tasks for those students who have difficulty reading. With an activity card, the students can work on their own to decide what and how they are to do their work. They can use each other as resources. Students also complete an individual report at their learning stations to ensure individual accountability.

Developing Cooperative Norms

As with other models of cooperative learning, Complex Instruction stresses preparation of students for the new behaviors needed for working in small groups. If students come to feel that they ought to behave in these new ways, they will teach, reinforce, and enforce cooperative behaviors with their peers. When this happens, the teacher has successfully developed a new set of norms (written or unwritten rules for how one ought to behave) that will do much to control behavior in desirable ways. The two central norms that Complex Instruction uses as basic rules of the classroom are the following: (a) "You have the right to ask anyone else in your group for assistance," and (b) "You have the duty to assist anyone in your group who asks for help."

Cooperative behaviors do not develop overnight. Before starting groupwork, students need to learn these behaviors and to practice them in selected skill-building activities (see Cohen, 1986, chap. 5, for more details). During groupwork, it is essential to observe how well students are doing in cooperative behaviors. They will need feedback and will benefit from discussion on how to use these norms in specific situations. Feedback can be addressed both to individuals and to groups, but it must be specific so that it makes clear to the students which behaviors the teacher saw or failed to see.

Use of Student Roles

Delegation of authority is supported by giving each student a procedural role to play. The most widely used roles are facilitator, materials manager, recorder/reporter, safety officer, and harmonizer. It is important to rotate these roles so that everyone gets a chance to play every role. Each role is designed to help the group function and work together more efficiently. Many of these roles are roles the teacher plays in the whole-class setting. Instead of asking the students "to mind their own business," as in the

conventional classroom, in groupwork, we are asking the students to mind each other's business.

The roles selected depend on the age of the student and the nature of the task. However, we always use the facilitator, who sees to it that all get the help they need. Even a second grader can be taught to play this important role successfully. The facilitator makes sure that somebody reads the activity card, that all the group members participate, and that the group turns to the teacher only if no one knows the answer. Through the use of the facilitator role, the group takes responsibility for its own behavior rather than constantly turning to the teacher for assistance and mediation.

The roles are designed to encourage interaction and discussion and to take care of the business of the group. They do not represent a division of labor that permits people to split off from the group to do their job. For example, the reporters are directed to discuss their report with the group rather than prepare it individually.

It is not enough to assign roles; roles must be developed at all grade levels. To do so, teachers discuss with their students effective strategies for acting out these roles, insist that students play their roles, and try not to let the most dominant students take away roles (such as facilitator or reporter) from the quiet students.

Role of the Teacher

The teacher's role changes dramatically when students are engaged in groupwork. One of her or his major functions is to encourage and stimulate student interaction concerning the task. According to research on Complex Instruction, the more that students talk and work together, the more they learn (Cohen, Lotan, & Leechor, 1989). Therefore, teachers will want to see as many students as possible at any given moment engaged in task-related discussion while at the learning stations. Based on data from numerous classrooms, we found that it is highly desirable to have more than 35% of the students interact at any one time.

How are students persuaded to interact? Part of this job is done by intrinsically interesting, engaging, and rich tasks that require students to exchange ideas and materials. Having a facilitator also helps to foster interaction. Just as important, the teacher avoids hovering over the groups and giving them detailed directions and extensive information while they are at work. Our research has shown that direct instruction through verbal presentations and directions by the teacher cuts down on the amount of students' talking and working together, and thus on favorable learning outcomes. Recall how Ms. Wilson carefully took stock of the Tug-of-War group before she stepped in, and while in the group, she stayed the minimum time, stimulating the group to interact and to retain intellectual ownership of the problem.

Teachers who use this management system often say to us, "I feel like

I've been done out of a job. The students do very well without me." Not exactly. This management system frees the teacher to play a more sophisticated instructional role: First, while students are at learning stations, she or he devotes time to asking higher-order questions, extending the group's thinking on its activities, and taking care of status problems. Second, during orientation and wrap-up (at the beginning and end of the lesson), the teacher provides information, summarizes, makes connections, and frames the overall lesson.

Delegating authority does not mean giving up control of the classroom. In Complex Instruction, we insist on both group and individual accountability. The group is responsible for seeing to it that its members remain engaged and complete their work. Individuals are held accountable to play their roles and to complete an individual report based on the group's discussion, experiment, or discovery. The individual reports provide each student an opportunity to demonstrate what he or she has learned in the activity.

Designing Curriculum for Complex Instruction

In Complex Instruction classrooms, promoting equal access to information and fostering higher-order thinking is paramount. To do so requires specialized curricula. We use the following criteria when creating curricula for groupwork or when adapting existing materials to follow the Complex Instruction model: (a) we organize activities around a central concept or "big idea," (b) activities are open-ended and uncertain, and (c) we ensure that students use multiple intellectual abilities to complete tasks.

Thematic Organization of Units

To foster conceptual understanding of content material, we organize Complex Instruction units around a central concept, theme, or "big idea." Students encounter this concept or idea in different contexts; thus they have multiple opportunities to grapple with the material. When we are deciding on the conceptual content of a unit, we draw upon the fundamental principles and methods of a discipline. For instance, a seventh-grade unit on the Reformation is organized around the question often debated in history and political science, "How do you challenge the authority of an institution?" Students rotate through different group activities that address this question. One activity focuses on the role art and political cartoons play in forming and reforming public opinion; one on the role individuals, like Martin Luther, play in catalyzing change; and another on the role the printing press or the media play in spreading ideas. Student learning goes well beyond the facts and dates of the Reformation; indeed, students learn how a combination of factors reshape people's ideas and lead them to seek reform. Studying this question as it applies to the specific situation of the

Reformation prepares students both to ask and to respond thoughtfully to the same issue as it applies in other situations, such as the American Revolution or the 1989 student rebellion in China.

Uncertain or Open-ended Tasks

In Complex Instruction, learning tasks are open-ended in two ways: in their solution as well as in the process by which students arrive at the solution. For example, for the Tug-of-War task, the number of legitimate solutions is virtually unlimited. With respect to process, each group decides which and how many characters to include and how to structure an unequal match. There is no answer sheet here for the teacher.

Open-ended and inherently uncertain tasks increase the need for interaction since students draw upon each other's expertise and repertoire of problem-solving strategies. Given the intellectual heterogeneity of the students in the group, these repertoires are rich and varied. When working with Complex Instruction activities, we encourage students to explore alternative solutions, communicate their thoughts effectively, justify their arguments, and examine issues from different perspectives. These are the processes that contribute to the development of higher-order thinking and to other desired outcomes of learning.

A good example of an open-ended task is an activity found in *Finding Out/Descubrimiento* (DeAvila & Duncan, 1982), an English-Spanish math and science curriculum for the elementary grades². To learn about measurement, students are asked first to estimate and then to measure different body parts of a big inflatable dinosaur. The most interesting conversations occur when second graders figure out where exactly the waist of a dinosaur is. Wouldn't a belly button be the irrefutable indicator? Furthermore, how does one measure something round with nothing but a ruler and some yarn?

Multiple Abilities

Multiple-abilities tasks are a necessary condition for successful status treatments. For example, in our integrated social studies and language arts unit for middle grades "How do historians know about the Crusades?" we have attempted to incorporate many intellectual abilities. Students rotate among different tasks to learn how historians examine texts, artifacts, and the music and art of the period to make sense of historical events. In the first type of task, students examine visual representations of historical artifacts: photos and a floor plan of the ruins of a castle built by the Crusaders in Syria (see Figure 6.1). Students analyze the pictures, hypothesize about the architectural strengths and weaknesses of the castle, and speculate why the Crusaders might have chosen that particular location. Next, the students design and build a three-dimensional model of a fortress that will protect their group from enemy invaders. Designing this

Figure 6.1
Activity Card

Unit: CRUSADES

HOW DO HISTORIANS KNOW ABOUT THE CRUSADES?

Activity 1:
Crusader Castle, Crac des Chevaliers, Syria, 12 C
Activity Card

Historians often turn to art, architecture, and craftwork of the period they are studying for clues about how people lived and what they wanted to remember.

As a team, look carefully at the photographs of Crac des Chevaliers and discuss the questions below.

1. Why would the Crusaders build a castle?
2. What does the architecture of this castle (the floor plan and interior/exterior structures) tell you about how warfare was conducted in the medieval times?
3. If you lived inside this castle, how would you defend it against enemy attacks?
4. If you were an enemy invader, how would you plan your attack of this castle?
5. What do you think were the roles of men and women inside the castle? What were the roles of children?

* * *

Design and build a castle or a fortress to protect your group from adverse forces. Present your castle to the class.

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model requires careful planning, mechanical ingenuity, and translating a two-dimensional sketch into a three-dimensional model, each an intellectual ability.

In the second type of task, students listen to medieval ballads, identify musical instruments, and describe the mood and the message of the songs. Among the intellectual abilities students use in these tasks are hearing or

creating melodies and rhythmic patterns, appreciating musical expressions, and understanding how a song's melody and its lyrics play off one another.

The third type of task relies on understanding textual sources such as excerpts from Pope Urban II's speech calling the masses to join the Crusades and eyewitness accounts of the siege of Jerusalem. After thorough analysis of the text, students translate the verbal messages into different media: They create a mural or dramatize the siege from the Muslim point of view. These activities require a host of intellectual abilities: understanding sophisticated texts, detecting sources of bias, being empathetic, relating a single textual passage to the larger scheme of events, and translating the message of the text into nonverbal forms.

TRANSFORMING THE SCHOOL FOR COMPLEX INSTRUCTION

How long does it take to develop expertise in Complex Instruction? A long time. We do not see staff development as presenting a one- or two-day workshop and then abandoning teachers to the complexities of working within a radically different classroom structure. We envision a learning process involving the development of conceptual understanding, practice in applying new knowledge, and ongoing feedback and support at the school.

Staff Development

Groupwork is an instructional context that asks as much problem solving, intellectual flexibility, and creativity from the teacher as it does from the students. A teacher's conceptual understanding of the theory and principles underlying Complex Instruction is related to the quality of implementation in the classroom. Teachers who understand why they are delegating authority to the groups or how status problems come to affect interaction and learning are able to solve problems and adapt instructional strategies to meet the needs of their students. What kind of staff development prepares the teacher for this process?

Preparation for employing Complex Instruction involves participation in a yearlong program that provides teachers with the theoretical understanding and practical experience necessary to maintain high-quality implementation. Teachers attend a two-week summer seminar. During the first week, teachers learn the theory and apply its principles to classroom practice. They analyze vignettes of classroom situations, solve problems concerning appropriate teacher interventions in dysfunctional groups, and work in teams to study the curriculum and prepare to teach a lesson. During the second week, teachers participate in a practicum. They present a Complex Instruction lesson to a class of school-aged students. Systematic ob-

servations of student behaviors are made, along with the quality of teacher-student interaction. Videotapes of the lessons provide specific feedback to the teachers. They also observe one another during the practicum and learn how to use observation instruments during groupwork.

During the school year, we follow the teachers into their classrooms to provide feedback. A sound feedback process is built on an adequate sample of observations and grounded in clear criteria and standards. These criteria and standards are derived from the theoretical base that underlies Complex Instruction. At least three observations serve as the basis for calculating the average rates of students who talk and work together at learning centers and the types of teacher interaction we observe. The percentage of the teacher's speech acts that are focused on group management, questioning, and treating status is also calculated. These data are used to construct bar charts to provide a visual and specific framework that allows teachers to step back and assess their lessons. For example, if the bar chart shows that the average rate of talking and working together is less than 35%, or that most of the teacher's speech acts are focused around getting the students through the task, we work with the teacher, discussing strategies for using the system of norms and roles more effectively. We strive for three feedback meetings per teacher because there is evidence to the effect that the number of such meetings is positively related to the development of teachers' conceptual understanding as well as to the quality of classroom implementation.

Teachers return to Stanford for two days midyear. On the first day, we go into more depth on the treatment of status problems, probably the most challenging component of Complex Instruction. In small groups, teachers reflect on the status structure in their own classrooms and practice using status treatments. Another full day is devoted to curriculum adaptation and development, allowing teachers to capitalize on their subject-matter expertise and expand their use of Complex Instruction.

School-Level Support for Complex Instruction

Our collective experience, supported by the extensive research we have conducted in elementary schools, has taught us that teachers and administrators must collaborate to support successful implementation of Complex Instruction. Restructuring the classroom demands school-level support.

The implementation of multiple-abilities curricula requires resources beyond the classroom. For example, manipulatives are central to the hands-on, multimedia activities described earlier. Buying, storing, and replacing consumable materials necessitates allocation and coordination of resources such as staff time and money. It is unlikely that an isolated teacher will be able to collect and organize the materials alone. An instructional assistant, a resource teacher, or a team of teachers needs to be given time

to work on this task. Some principals have set aside a room exclusively for storing materials and have allocated staff time for coordination and maintenance of the materials.

When implementing Complex Instruction, teachers, like their students, benefit when they talk and work together. Team meetings provide teachers with an opportunity to exchange information and ideas about specific units or activities. For example, teachers' discussions range from practical concerns about safety to conceptual topics such as mainstreaming special-education students or developing a science orientation to the lesson. Repeatedly, teachers have reported to us that having opportunities to discuss such issues with colleagues is extremely helpful. The Meeting Tamer, a simple instrument used to structure meetings, is often used by teachers to keep themselves on task and to use meeting time efficiently. We also found that when teachers had the opportunity to visit each other's classrooms and provide systematic feedback to one another, the quality of implementation was maintained over time.

Teacher collaboration differs somewhat between elementary and secondary schools. For example, subject specialization at the secondary level suggests that teachers who implement Complex Instruction collaborate at three different levels: within their subject areas, at the grade level, and in schoolwide teams.

Successful principals also need to buffer teachers from competing demands, such as additional innovative programs that may jeopardize successful implementation of Complex Instruction. Some principals have resolved this dilemma by making Complex Instruction a schoolwide priority and by working closely with teachers. When principals send a clear message to teachers that they expect them to implement Complex Instruction, teachers implement more frequently and maintain a higher quality of implementation. With sufficient staff development and school-level support, the Complex Instruction model of cooperative learning can realize its goals.

NOTES

1. A Mathematical Tug-of-War comes from a Complex Instruction unit called Getting Started; it has been adapted from an activity by the same name created by Marilyn Burns.
2. This curriculum is commercially available from the Santillana Publishing Company.

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