In their remarkable little book, *The Children are Watching*, educators Ted and Nancy Sizer suggest that the classroom curriculum constitutes only a small part of what a youngster actually learns in school. Students pay close attention to and learn from just about everything that happens in and around their school. For example, if the building is drafty, has broken windows, unswept floors, grimy walls, cracked linoleum, and leaky toilets, the students get the message that the adult community does not care a lot about their education. I would add that, by the same token, students may learn as much from the style or process in which information is conveyed as they do from the information itself.

I hasten to explain. It goes without saying that there are a great many ways to convey information to students. Let us say we want the students to learn about World War II. The teacher can create two or three lectures about the causes and consequences of that war. Alternatively, the students can simply read the basic facts about World War II in a textbook. As a third alternative, the teacher can assign students to do their own research in the library, or have students interview people who served in the military or lived through the war period in the United States, Europe, and Asia. The teacher might require students to work individually or in groups. To demonstrate what they have learned, students might take a test, write a term paper, or give an oral presen-
The teacher might also run the class as if it were a quiz show where he or she asks questions and the students show their quickness and mastery of the subject by raising their hands as soon as they know the answer.

Each of these methods of conveying and retrieving information sends its own special message to students. Some of these messages may be unintended. Teachers who lecture send the message that they are an expert source of information and that the things that they know are the important things to learn. Teachers who dispatch students to the library send the message that it is useful for students to become skillful researchers as well as to learn about the topic at hand. Teachers who require students to interview a war veteran convey the implicit message that not all important information is contained in books or conveyed by people in the teaching profession. Teachers who run their class like a quiz show or contest indicate that quickness, assertiveness, and competitiveness are important aspects of the learning endeavor—and perhaps of life itself.

The point is that the learning students derive from the process of their educational experience is powerful indeed. In classes where students are expected to raise their hands as soon as they know the answer and take tests graded on a curve, the process encourages students to compete individually against each other. The implicit message is that the other students are competitors for scarce resources. It would not be surprising, then, if this process were to create tension among peers and tended to discourage trust or friendship among youngsters who were not already friends beforehand.

In American schools, this kind of competitive process is the predominant method employed in most classrooms most of the time. High school students who have gone through several years of participation in such a competitive process are likely to view the world (both inside and outside of school) as one gigantic game of musical chairs, as a dog-eat-dog place where the prizes go to those who are quickest, or strongest, or most aggressive, or most charming, or most athletic. Such a process may implicitly encourage students to look for weaknesses or flaws in their peers—to find reasons for excluding or taunting those who falter, or seem different, or socially awkward and to think of them as weird or as losers.

This may be a major reason why research reveals that most American high schools are clique-driven and exclusionary. Even casual observation of the social climate of the typical high school reveals a clear hierarchy of who is in and who is out that is remarkably similar in all parts of the country. In most high schools, the youngsters at the top of the social pyramid are athletes (especially football players), cheerleaders, class officers, attractive women, and "regular guys." Near the bottom of the social pyramid are those youngsters who are the "wrong" race or the "wrong" ethnic group; dress differently; are too short, too tall, too thin, too fat, too "nerdy", or just do not fit in easily. Interviews with high school students in all parts of the country indicate that just about every
student in a given school can name the hierarchy of in-groups and out-groups and can identify where each of their classmates can be placed in that hierarchy (Aronson, 2000; Gibbs & Roche, October 1999; Lewin, 1999; Townsend, 1999).

Those youngsters in the relatively small in-group want to differentiate themselves from the losers. They do not associate with them, sometimes they tease or taunt them; occasionally they bully them. In most cases, those near the bottom of the social pyramid suffer in silence, retreating further and further from the mainstream. The more they are ignored, excluded, or taunted, the further away they drift. For a great many youngsters, the high school atmosphere is extremely unpleasant. For some, it is a living hell. Given this kind of social atmosphere, and given the fact that teenagers spend almost half their waking hours embedded in that atmosphere, it should not be surprising that occasionally, some of these students go over the edge—doing serious damage to themselves or others. The most recent statistics are chilling: One of five teenagers has seriously contemplated suicide; one of ten has made an attempt at suicide (Goldberg & Connelly, 1999).

In recent years, when we think of students going over the edge and doing serious damage to themselves or others, we are immediately reminded of Columbine High School in Littleton, Colorado. You will recall that, in April of 1999, two students, Eric Harris and Dylan Klebold, armed with an arsenal of guns and explosives, went on a rampage, killing a teacher and 12 of their fellow students before turning their guns on themselves. While tragic events of this sort are not everyday occurrences, they are not as rare as we would like to believe. At the turn of the century, there were nine rampage killings in high schools and junior high schools in a period of 18 months.

What is to be done? How does a society protect its students from these senseless killings? In the aftermath of a horrendous event like the Columbine massacre, we are tempted to look for instant solutions before we fully understand the cause of the problem. Thus, following the Columbine massacre, Congress voted to tack onto the crime bill an amendment giving states the right to allow the display of the Ten Commandments on school walls and bulletin boards. In the interest of making schools safer, there was a rush to install metal detectors. School administrators have also asked students to report other students who threaten violence or who even seem different (dress strangely, keep to themselves, and so on). Some school officials have ordered personality tests to be administered to all students—tests aimed at profiling those students who might be most apt to go on a murderous rampage.

Some of these interventions are silly. Others are harmful. Still others, while harmless, miss the point by a wide margin. Here, I would like to make a distinction between root cause solutions and what I like to call "pump handle" solutions. Here is what I regard as the defining example of this distinction. In 1854, Dr. John Snow, England's leading epidemiologist, was charged with the task of stanching a cholera epidemic that was devastating London. Dr. Snow needed to act quickly. He first determined that most of the cases of cholera
clustered around a particular well near the center of the city. But he made no attempt to educate the local residents or to convince them that it might be dangerous to drink from that well. He simply removed the pump handle so that water could no longer be drawn from it. It worked. In many respects it was a perfect solution—for that particular epidemic, in that particular place, at that particular time.

But Dr. Snow did not stop with this measure. After ending the immediate threat, he proceeded to do some systematic sleuthing, trying to get at the root cause of the epidemic. That is, he raised the scientific question: Why was that particular well contaminated and not others? Within a few months, he was able to conclude with a high degree of certainty that the contamination was caused by fecal matter from nearby latrines leaking into the water supply being tapped by the well. This discovery led to legislation requiring latrines to be built at a reasonable distance from wells. By getting at the root cause of the problem, Dr. Snow succeeded in preventing future epidemics not only in London but throughout England and, eventually, throughout the entire civilized world.

With this in mind, let us take a close look at the solutions to the school shootings proposed by policymakers:

1. Posting the Ten Commandments. This intervention may be politically expedient, because it creates the illusion that Congress is doing something; but, as public policy, it is pathetically feeble. Needless to say, the Ten Commandments is a magnificent code of ethics; but posting it on a school’s bulletin board will have very little impact on the behavior of any students hell-bent on murdering their classmates. Every high school student knows about the Ten Commandments. I am reasonably certain that most could even recite the most relevant items on the list. They know they are not supposed to kill or steal. They know they are supposed to honor their fathers and their mothers. They probably even know they are not supposed to mention God’s name in vain, although my guess is that few are certain what that one means. But being able to recite the Ten Commandments and living by the Ten Commandments are two very different things. Those students who already have a moral compass have no need of posters to remind them that one should not kill or steal. Those who do not have a moral compass will not be prevented from killing or stealing by seeing a piece of paper tacked to the wall.

2. Metal Detectors. There is no doubt in my mind that installing metal detectors in every entrance to every school in the country will reduce killings, but it is far from ideal. The downside of this action is that it makes the school seem like a scary place and suggests that, as a society, we cannot trust our own kids not to kill each other. Moreover, installing metal detectors is far from a perfect pump-handle solution. It would not make the schools perfectly safe. If teenagers with grievances and guns are motivated to shoot their fellow
students, they can easily accomplish their mission without even entering the school building. For example, in Jonesboro, Arkansas, the shooters fired on their classmates from behind trees surrounding the school after first luring their victims out of the building by setting off the school’s fire alarm. Metal detectors do not get anywhere near the root of the problem; needless to say, the cause of the recent rash of school shootings is not the lack of metal detectors in schools.

3. Profiling Potential Troublemakers. Identifying the youngsters who are loners, different, or awkward either by asking other students to point them out and turn them in or by forcing them to take some sort of personality test will not solve the problem. Indeed, singling out these youngsters—the very youngsters who are most hurt by having been excluded—is likely to exacerbate the root problem by increasing their level of exclusion. Moreover, personality tests simply are not as accurate or as precise as the general public thinks they are. Using such tests in an attempt to identify troubled youngsters will undoubtedly target a great many who are not troubled at all, while allowing some seriously troubled individuals to slip by undetected.

TAKING A CLOSE LOOK AT THE CLASSROOM ATMOSPHERE

I should point out one obvious fact: Young mass murderers are not shooting people in their neighborhood, or in the local video arcade, or in the fast food outlet. They kill their classmates and teachers, and sometimes themselves, in or around the school building itself. Looking for root causes in individual pathology is an approach that seems sensible on the surface but it does not get to the root of the problem. What is it about the atmosphere in the schools themselves that makes these young people so desperate, diabolical, and callous? Why do they seek revenge, or a twisted notion of turning humiliation into pride, by shooting their classmates? In what ways have they felt rejected or, humiliated at school? Are schools doing the best they can to develop students' characters as well as their intellects? Can schools do better at creating inclusive, caring communities with positive role models for students?

As suggested earlier, my observations of the typical classroom atmosphere suggest that it is highly likely that the perpetrators were reacting in an extreme and pathological manner to a general school atmosphere—an atmosphere of exclusion—that many if not most of the student body find unpleasant, distasteful, difficult, and even humiliating (Aronson, 2000).

My observations receive strong support from the way high school students from all parts of the country reacted to the tragic events in Littleton. Shortly after the Columbine massacre, a search of the Internet revealed powerful
feelings being expressed by large numbers of teenagers. The overwhelming majority fairly crackled with expressions of anguish and unhappiness, describing how awful it feels to be rejected and taunted by their more popular classmates. Several weeks before the contents of the Harris/Klebold videotapes were released, many of the writers were convinced that Harris and Klebold must have had similar experiences of rejection and exclusion. I hasten to add that none of these teenagers condoned the shootings; yet their Internet postings revealed a surprisingly high degree of understanding and empathy for the suffering that Harris and Klebold must have endured. While none of the students posting their comments on the Internet had any intention of following the lead of Harris and Klebold, some admitted that they had had fantasies of doing similar things. That should make us sit up and take notice, not so that we can track down those kids and hospitalize them, but rather, to try to figure out how to improve the atmosphere of the school so that youngsters might become prone to have such violent fantasies.

**CHANGING THE CLASSROOM ATMOSPHERE**

Our policymakers framed the question in the context of the Columbine massacre: How can we prevent such events in the future? But, as implied above, the question is a far broader one. How can we change the process of the typical classroom so that our schools can transform themselves into more humane social environments for all students? The general answer is to change the dynamic of the classroom from dog-eat-dog competition to a more cooperative, more caring one. Easier said than done. Many schools have actively attempted to counteract the negative influences of excessive competition by asking kids to try to cooperate with one another. It would be hard to find a preschool or elementary school that did not actively encourage children to share, to work harmoniously with their peers, and to behave respectfully and cooperatively with one another. Many elementary schools now have students sit in small groups at tables, rather than in rows of individual desks.

But simply assigning students to work together in groups to produce a joint report does not guarantee true cooperation. Unstructured attempts to encourage cooperation in the classroom usually fail to accomplish their ultimate goal and might even backfire if not carefully designed. Most often the group dynamics of an unstructured "cooperative" situation mirror the larger competitive classroom dynamic. The one or two most able or most motivated students put themselves forward to do most of the work while simultaneously resenting the fact that they are carrying the load for the entire group. And the less able or less motivated students end up doing little, learning little, and feeling inadequate. These so-called cooperative groups are cooperative in name only.
THE JIGSAW CLASSROOM

The problem with cooperative learning assignments is not that they do not work. It is that they need to be carefully designed and rigorously structured for them to have the intended effect. One successful model, with a three-decade track record, is the jigsaw classroom. Jigsaw is a specific type of group learning experience wherein each student must cooperate with his or her peers to achieve his or her individual goals. Just as in a jigsaw puzzle, each piece—each student’s part—is essential for the production and full understanding of the final product. If each student’s part is essential, then each student is essential; and that is precisely what makes this strategy so effective.

Here is how it works: The students in a history class, for example, are divided into small groups of five or six students each. Suppose their task is to learn about World War II. In one jigsaw group let us say that Sara is responsible for researching Hitler’s rise to power in pre-war Germany. Another member of the group, Steven, is assigned to cover concentration camps; Pedro is assigned Britain’s role in the war; Melody is to research the contribution of the Soviet Union; Willie will handle Japan’s entry into the war; Clara will read about the development of the atom bomb.

Eventually each student will come back to his or her jigsaw group and will try to present a vivid, interesting, well-organized report to the group. The situation is specifically structured so that the only access any member has to the other five assignments is by listening intently to the report of the person reciting. Thus, suppose Steven does not like Pedro and thinks Sara is a nerd. If he heckles them, or tunes out while they are reporting, he cannot possibly do well on the exam that follows.

To increase the probability that each report will be factual and accurate, the students doing the research do not immediately take it back to their jigsaw group. After doing their research, they must first meet with the other students (one from each of the jigsaw groups) who had the identical assignment. For example, those students assigned to the atom bomb topic will meet together to work as a team of specialists, gathering information, discussing ideas, becoming experts on their topic, and rehearsing their presentations. We call this the “expert” group. It is particularly useful for those students who might have initial difficulty learning or organizing their part of the assignment, for it allows them to benefit from paying attention to and rehearsing with other “experts,” to pick up strategies of presentation, and generally to bring themselves up to speed.

After this meeting, when each presenter is up to speed, the jigsaw groups reconvene in their initial heterogeneous configuration. The atom bomb group teaches the other group members what she has learned about the development of the atom bomb. Each student in each group educates the whole group about his or her specialty. Students are then tested on what they have learned from their fellow group members about World War II.
What is the benefit of the jigsaw classroom? First and foremost, it is a remarkably efficient way to learn the material. Our research shows that elementary school students learn the material faster and perform significantly better on objective exams than a control condition of students learning the same material in more traditional classrooms (Aronson, Stephan, Sikes, Blaney, & Snapp, 1978; Aronson & Patnoe, 1997; Lucker, Rosenfield, Sikes, & Aronson, 1977). But even more important, in terms of the present discussion, the jigsaw process encourages listening, engagement, and empathy by giving each member of the group an essential part to play in the academic activity. Group members must work together as a team to accomplish a common goal; each person depends on all the others. No student can achieve his or her individual goal (learning the material, getting a good grade) unless everyone works together well as a team. Group goals and individual goals complement and bolster each other. This "cooperation by design" facilitates interaction among all students in the class, leading them to come to value each other as contributors to their common task (Aronson, 2000; Aronson & Patnoe, 1997).

My graduate students and I invented the jigsaw strategy in Austin, Texas, in 1971. We invented jigsaw as a matter of absolute necessity to help defuse a highly explosive situation. The city's schools had recently been desegregated and, because Austin had always been residentially segregated, white youngsters, African-American youngsters, and Hispanic youngsters found themselves in the same classrooms for the first time in their lives. Within a few weeks, longstanding suspicion, fear, distrust, and antipathy between groups produced an atmosphere of turmoil and hostility, exploding into interethnic fistfights in corridors and schoolyards across the city. The school superintendent called me in to see if my students and I could possibly do something to help students learn to get along with one another. After observing what was going on in classrooms for a few days, we concluded that intergroup hostility was being exacerbated by the competitive environment of the classroom.

In every single classroom, the students worked individually and competed against each other for grades. Here is a description of a typical fifth grade classroom we observed:

The teacher stands in front of the class, asks a question, and waits for the children to indicate that they know the answer. Most frequently, six to ten youngsters raise their hands. But they do not simply raise their hands; they lift themselves a few inches off their chairs and stretch their arms as high as they can in an attempt to attract the teacher's attention. To say they are eager to be called on is an incredible understatement. Several other students sit quietly with their eyes averted, as if trying to make themselves invisible. These are the ones who don't know the answer. Understandably, they are trying to avoid eye contact with the teacher because they do not want to be called on.

When the teacher calls on one of the eager students, there are looks of disappointment, dismay, and unhappiness on the faces of the other students who were avidly raising their hands but were not called on. If the selected student comes up with the right answer, the teacher smiles, nods approvingly, and goes on to the next question. This is a great reward
for the child who happens to be called on. At the same time that the fortunate student is coming up with the right answer and being smiled upon by the teacher, an audible groan can be heard coming from the children who were striving to be called on but were ignored. It is obvious they are disappointed because they missed an opportunity to show the teacher how smart and quick they are. Perhaps they will get an opportunity next time. In the meantime, the students who didn’t know the answer breathe a sigh of relief. They have escaped being humiliated this time.

On interviewing several of the teachers we learned that virtually all of them started the school year with a determination to treat every student equally and encourage all to do their best, but the students quickly sorted themselves into different groups. The “winners” were the bright, eager, highly competitive students who fervently raised their hands, participated in discussions, and did well on tests. Understandably, the teacher felt gratified that these students responded to her teaching. She praised and encouraged them, continued to call on them, and depended on them to keep the class going at a high level and at a reasonable pace.

Then there were the “losers.” At the beginning, the teacher called on them occasionally, but they almost invariably did not know the answer, or were too shy to speak, or could not speak English well. They seemed embarrassed to be in the spotlight; some of the other students made snide comments—sometimes under their breath, occasionally out loud. Because the schools in the poorer section of town were substandard, the African-American and Mexican-American youngsters had received a poorer education prior to desegregation. Consequently, in Austin, it was frequently these students who were among the losers. This tended unfairly to confirm the unflattering stereotypes that the white kids had about minorities. They considered them stupid or lazy. The minority students also had preconceived notions about white kids: they were pushy show-offs and teacher’s pets. These stereotypes were also confirmed by the way most of the white students behaved in the competitive classroom.

After a while, the typical classroom teacher became discouraged in trying to engage the students who were not doing well. She also felt it was kinder not to call on them and expose them to ridicule by the other students. In effect, she made a silent pact with the “losers”; she would leave them alone as long as they were not disruptive. Without really meaning to, she gave up on these students, and so did the rest of the class. Without really meaning to, the teacher contributed to the difficulty the students were experiencing. After a while, these students tended to give up on themselves as well—perhaps believing that they were stupid, because they sure weren’t getting it.

It required only a few days of intensive observation and interviews for us to have a pretty good idea of what was going on in these classrooms. We realized that we needed to do something drastic to shift the emphasis from a relentlessly competitive atmosphere to a more cooperative one. It was in this context that we invented the jigsaw strategy. One of our first interventions was with fifth graders. First we helped several fifth grade teachers devise a cooperative jigsaw
structure for the students to learn about the life of Eleanor Roosevelt. We divided the students into small groups, diversified in terms of race, ethnicity, and gender, making each student responsible for a certain portion of Roosevelt’s biography. Needless to say, at least one or two of the students in each group were already viewed as “losers” by their classmates.

Carlos was one such student. Carlos was very shy and feeling insecure in his new surroundings. English was his second language. He spoke it quite well, but with a slight accent. Try to imagine his experience: After attending an inadequately funded, substandard neighborhood school consisting entirely of Hispanic students, like himself, through the fourth grade, he was suddenly bussed across town to the middle class area of the city and catapulted into a class with Anglo students who spoke English fluently, seemed to know much more than he did about all the subjects taught in the school, and were not reluctant to let him know it.

When we restructured the classroom so that students were now working together in small groups, initially, this was terrifying to Carlos. For now, he should no longer slink down in his chair and hide in the back of the room. The jigsaw structure made it necessary for him to speak up when it was his turn to recite. Although he had gained a little added confidence by rehearsing together with others who were also studying Eleanor Roosevelt’s work with the United Nations, he was understandably reticent to speak when it was his turn to teach the students in his jigsaw group. He blushed, stammered, and had difficulty articulating the material that he had learned. Skilled in the ways of the competitive classroom, the other students were quick to pounce on Carlos’ weakness and began to ridicule him.

One of my research assistants was observing that group and heard some members of Carlos’ group make comments such as, “Aw, you don’t know it, you’re dumb, you’re stupid. You don’t know what you’re doing. You can’t even speak English.” Instead of admonishing them to “be nice” or “try to cooperate,” she made one simple but powerful statement. It went something like this: “Talking like that to Carlos might be fun for you to do, but it’s not going to help you learn anything about what Eleanor Roosevelt accomplished at the United Nations—and the exam will be given in about 15 minutes.” What my assistant was doing was reminding the students that the situation had changed. The same behavior that might have been useful to them individually in the past, when they were competing against each other, was now going to cost them something very important: the chance to do well on the upcoming exam.

Needless to say, old, dysfunctional habits do not die easily. But they do die. Within a few days of working with jigsaw, Carlos’ groupmates gradually realized that they needed to change their tactics. It was no longer in their own best interest to rattle Carlos; he was not the enemy, he was on their team. They needed him to perform well to do well themselves. Instead of taunting him and putting him down, they started to gently ask him questions. But how? What kind of questions? In effect, they had to put themselves in Carlos’ shoes to find a way
to ask questions that did not threaten him but could facilitate his reciting in a clear and understandable manner. After a week or two, most of Carlos's groupmates developed into skillful interviewers, asking him relevant questions to elicit the vital information from him. They became more patient, figured out the most effective way to work with him, helped him out, and encouraged him. The more they encouraged Carlos, the more he was able to relax; the more he was able to relax, the quicker and more articulate he became. Carlos's groupmates began to see him in a new light. He became transformed in their minds from a "know-nothing loser who can't even speak English" to someone they could work with, someone they could appreciate, maybe even someone they could like. Moreover, Carlos began to see himself in a new light, as a competent, contributing member of the class who could work with others from different ethnic groups. His self-esteem grew and as it grew, his performance improved even more; and as his performance continued to improve, his groupmates continued to view him in a more and more favorable light.

Within a few weeks, the success of the jigsaw was obvious to the classroom teachers. They spontaneously told us of their great satisfaction with the way the atmosphere of their classrooms had been transformed. Adjunct visitors (such as music teachers and the like) were little short of amazed at the dramatically changed atmosphere in the classrooms. Needless to say, this was exciting to my graduate students and me. But, as scientists, we were not totally satisfied with these testimonials; we were seeking firmer, more objective evidence—and we got it. Because we had randomly introduced the jigsaw intervention into some classrooms and not others, we were able to compare the progress of the jigsaw students with that of the students in traditional classrooms in a precise, scientific manner. After only 8 weeks there were clear differences, even though students spent only a small portion of their class time in jigsaw groups. When tested objectively, jigsaw students expressed significantly less prejudice and negative stereotyping, were more self-confident, and reported that they liked school better than children in traditional classrooms. Moreover, this self-report was bolstered by hard behavioral data: For example, the children in jigsaw classes were absent less often than students in traditional classrooms. Finally, as mentioned earlier, on objective exams, the students in jigsaw classrooms performed significantly better than students learning the same material in traditional classrooms. Close inspection of the data revealed that the differences in objective exam performance were due primarily to improvements in the scores of minority students; the Anglo students performed equally well in jigsaw as in traditional classrooms (Lucker et al., 1977).

**COOPERATION: JIGSAW AND BASKETBALL**

You might have noticed a rough similarity between the kind of cooperation that goes on in a jigsaw group and the kind of cooperation that is necessary for the
smooth functioning of an athletic team. Take a basketball team, for example. If the team is to be successful, each player must play his or her role in a cooperative manner. If each player is hell bent on being the highest scorer on the team, then each would shoot whenever the opportunity arose. In contrast, on a cooperative team, the idea is to pass the ball crisply until one player manages to break clear for a relatively easy shot. If I pass the ball to Sam, and Sam whips a pass to Harry, and Harry passes to Tony who breaks free for an easy lay-up, I am elated even though I did not receive credit for either a field goal or an assist. This is true cooperation.

As a result of this cooperation, athletic teams frequently build a cohesiveness that extends to their relationship off the court. They become friends because they have learned to count on one another. There is one difference between the outcome of a typical jigsaw group and that of a typical high school basketball team, however, and it is a crucial difference. In high school, athletes tend to hang out with each other and frequently exclude nonathletes from their circle of close friends. In short, the internal cohesiveness of an athletic team often goes along with the exclusion of everyone else.

In the jigsaw classroom, we circumvented this problem by the simple device of shuffling groups every 8 weeks. Once a group of students was functioning well together, once the barriers had been broken down and the students showed a great deal of liking and empathy for one another, we would re-form the groupings. At first, the students would resist this re-forming of groups. Picture the scene: Debbie, Carlos, Tim, Patty and Jacob have just gotten to know and appreciate one another and they are doing incredibly good work as a team. Why should they want to leave this warm, efficient and cozy group to join a group of relative strangers?

Why, indeed? After spending a few weeks in the new group, the students invariably discover that the new people are just about as interesting, friendly, and wonderful as their former group. The new group is working well together and new friendships form. Then the students move on to their third group, and the same thing begins to happen. As they near the end of their time in the third group, it begins to dawn on most students that it is not the case that they happened to luck out and land in groups with four or five terrific people. Rather, they realize that just about everyone they work with is a worthy human being; all they need to do is pay attention to each person, to try to understand him or her and good things will emerge. That is a lesson well worth learning.

LONG-TERM EFFECTS?

Jigsaw works. Moreover, jigsaw is compatible with other teaching methods. If jigsaw is used for as little as one hour per day, it has been shown to have positive effects. How permanent are the effects? If students participated in the jigsaw classroom in the fifth or sixth grade, would the positive impact remain
even if they never experienced jigsaw again? Unfortunately, we do not have a definitive answer to this question. We do have some tangential evidence that the effects of jigsaw may become a permanent part of the individual's way of looking at the world. In a clever experiment, Diane Bridgeman showed that the empathy required by jigsaw takes on the form of a more or less permanent ability that generalizes and is used outside the confines of the classroom.

In Bridgeman's experiment, she worked with fifth graders, half whom had spent 2 months participating in jigsaw classes; the others had spent that time in traditional classrooms. Bridgeman showed them a series of stick-figure cartoons about a young boy their own age. In the first panel, the boy is looking sad as he waves good-bye to his father at the airport. In the next panel, a letter carrier delivers a package to the boy. In the final panel, the boy opens the package and finds a toy airplane inside and bursts into tears. Bridgeman asked the children why they thought the boy had burst into tears. Nearly all of the children could answer correctly, because the toy airplane reminded him of how much he missed his father and that made him sad. Then Bridgeman asked the crucial question: "What did the letter carrier think when he saw the boy open the package and start to cry?"

Most children of this age make a consistent error; they assume that everyone knows what they know. Thus, the youngsters in the control group thought that the letter carrier would know the boy was sad because the gift reminded him of his father leaving. But the children who had participated in the jigsaw classroom responded differently. Because they were better able to take the perspective of the letter carrier—to put themselves in his shoes; they realized that he would be confused at seeing the boy cry over receiving a nice present because the letter carrier had not witnessed the farewell scene at the airport.

Offhand, this might not seem very important. After all, who cares whether kids have the ability to figure out what is in the letter carrier's mind? In point of fact, we should all care—a great deal. The extent to which children can develop the ability to see the world from the perspective of another human being has profound implications for empathy, prejudice, aggression, and interpersonal relations in general. When you can feel another person's pain, when you can develop the ability to understand what that person is going through, it increases the probability that your heart will open to that person, and it becomes difficult to harm him or taunt him. Moreover, because Bridgeman's data suggest that empathy, is a skill—not unlike riding a bike—that can be used in a variety of situations, the implication is that the major impact of the jigsaw classroom might have long-lasting effects.

I do have some additional evidence but I am afraid that it is merely anecdotal. Nevertheless, I will mention it for what it may be worth. Over the past 20 years, I have received unsolicited letters from young men and young women who, many years earlier, had undergone such a transformation. To give you some of the flavor of this experience, I would like to share one such letter with you.
Dear Professor Aronson:

I am a senior at——University. Today I got a letter admitting me to the Harvard Law School. This may not seem odd to you but, let me tell you something. I am the 6th of 7 children my parents had—and I am the only one who ever went to college, let alone graduate, or go to law school.

By now, you are probably wondering why this stranger is writing to you and bragging to you about his achievements. Actually, I'm not a stranger although we never met. You see, last year I was taking a course in social psychology and we were using a book you wrote called The Social Animal, and when I read about prejudice and jigsaw it all sounded very familiar—and then, I realized that I was in that very first class you ever did jigsaw in—when I was in the 5th grade in Austin. And as I read on, it dawned on me that I was the boy that you called Carlos. And then I remembered you when you first came to our classroom and how I was scared and how I hated school and how I was so stupid and didn't know anything. And you came in—it all came back to me when I read your book—you were very tall—about 6½ feet—and you had a big black beard and you were funny and made us all laugh.

And, most important, when we started to do work in jigsaw groups, I began to realize that I wasn't really that stupid. And the kids I thought were cruel and hostile became my friends and the teacher acted friendly and nice to me and I actually began to love school, and I began to love to learn things and now I'm about to go to Harvard Law School.

You must get a lot of letters like this but I decided to write anyway because let me tell you something. My mother tells me that when I was born I almost died. I was born at home and the cord was wrapped around my neck and the midwife gave me mouth to mouth and saved my life. If she was still alive, I would write to her too, to tell her that I grew up smart and good and I'm going to law school. But she died a few years ago. I'm writing to you because, no less than her, you saved my life too.

Sincerely,
XXXX XXX

As you might imagine, I was deeply touched by this letter. It is just about the most moving letter I have ever received. But when I read the signature I was startled to discover that it did not belong to the boy that I had in mind—the boy who in my previous writings I had referred to as "Carlos." The young man who wrote me that lovely letter was mistaken.

I have a clear memory of sitting there with the letter in my hand thinking about that young man and how wrong he was. After a few minutes, I fell into a reverie in which I began to realize that perhaps that young man was not mistaken after all. That is, although I had a specific fifth grader in mind when I wrote about Carlos, there are a great many children who come pretty close to fitting that description. In my reverie I began to grasp the implications of the possibility that, all over America, there are thousands of youngsters who think they are Carlos. And, in the deepest possible way, they are all Carlos. Carlos is any child who has been the unhappy recipient of put-downs, taunting, and rejection at the hands of his or her peers, leading to a diminution of his or her self-esteem, and who has managed to turn that around because the structure of the classroom changed, paving the way for a different set of responses. To
the child involved, it feels like a miracle. To the social psychologist it is still another vivid example of the power of the situation: how what looks like a small, simple change in the structure of a social environment can have an enormous impact on the experience of the people in that environment. This is an experience that can last a lifetime.¹

A POSTSCRIPT

Following the Columbine massacre, there was a lot of negative publicity about the atmosphere at Columbine High School and how that atmosphere might have contributed to the tragedy. Some of it mentioned how athletes dominated the school and how unpopular students were taunted and excluded. The criticism, although not inaccurate, was unfair in the sense that the atmosphere at Columbine was no different than in almost every high school in the country. In response to the criticism, some of the Columbine students attempted to justify their exclusion of Harris and Klebold. Typical of these remarks was comment by a member of the Columbine football team:

Columbine is a good clean place except for those rejects. Most kids didn’t want them there. They were into witchcraft. They were into voodoo. Sure we teased them. But what do you expect with kids who come to school with weird hairdos and horns on their hats? If you want to get rid of someone, usually you tease ‘em. (Quoted by Gibbs & Roche, December, 1999)

It is my belief that if the jigsaw technique had been widely used in the Littleton school system a few years earlier, the young man and his friends might have developed some additional compassion and empathy as well as a greater tolerance for diversity. If so, they would undoubtedly have been delighted rather than angered by the diversity represented by the kids “who come to school with weird hairdos.” I may be wrong, but I am fairly certain that, if this had been the case, the Columbine massacre would never have occurred. Again, I may be wrong; but it certainly is worth thinking about.

Teachers’ Questions and Answers

Q: As a teacher, I often use the jigsaw method with my students and it works extremely well. But, often there are some students, usually mainstreamed special education students, who have tremendous difficulty relaying the content specifics to their groups even after prepping in their their mastery group. How can the jigsaw be adapted to accommodate these stu-

¹I should mention in passing that during the past two decades, educational researchers have developed and tested several alternative cooperative classroom methods. Although these alternative methods differ from jigsaw in several minor respects, they have in common a basic cooperative structure and produce similar positive effects. For a summary of these techniques, see Slavin, Aharan, Kagan, Hertz-Lazarowitz, Webb, and Schmuck (1985).
dents so that they can fully participate without their group missing essential information?

A: I have found that, in situations like this, it is helpful to assign another student in the jigsaw group to the special-ed student, someone to serve as a coach. This would need to be a very bright, mature student. In addition to learning her own paragraph, she would learn enough about the special-ed student’s paragraph to ask probing questions or to fill in where the special-ed student might have left something out. This is a special role that most bright, mature students take to like a duck to water. (If no such student exists in a particular jigsaw group, this is a role that the teacher might want to take on.)

Q: I have found that we do not always have enough time to complete all of the parts of the jigsaw within one period. What are some ways you would recommend to divide up the process over 2 days? Or is there a way to shorten the process so as to fit it into one period?

A: Needless to say, it works best if it can all be squeezed into one period. If not, I would do the learning of the material and the expert group in one period and save the final jigsaw group for the next period.

Q: It’s very clear to me that the jigsaw can be used effectively if the curriculum covers, say, the life of Eleanor Roosevelt. But I’m having trouble seeing how one could use the jigsaw method for teaching math. Is there a way to do so? Does it work as well as it does for more humanities-style curricula?

A: You are absolutely right. It is easier to work with social studies than with a progressive subject like math, where it is difficult for students to grasp step 3 without having gone through steps 1 and 2. At the same time, I am happy to report that some math teachers have had very good success using jigsaw to teach arithmetic, mathematics, and statistics. Just to take one stunning, recent example, David Perkins and Renee Saris at Ball State University have used jigsaw, to great effect, in an undergraduate statistics course (see *Journal of Teaching of Psychology*, 2001, Vol. 28, pp. 111–113).

References

Many people believe that intelligence is just inside the head. According to this view intelligence can be defined in terms of a fairly narrow set of cognitive skills of the kinds measured by conventional intelligence tests—answering vocabulary questions, solving mathematical reasoning problems, manipulating images of geometric objects in the head, and so forth. In this chapter I argue that the notion of intelligence as inside the head and as operationalized in narrowly based intelligence tests is incomplete. I argue for a concept of successful intelligence, according to which intelligence is the ability to achieve success in life, given one's personal standards, within one's sociocultural context. One's ability to achieve success depends on one's capitalizing on one's strengths and correcting or compensating for one's weaknesses through a balance of analytical, creative, and practical abilities in order to adapt to, shape, and select
environments (Sternberg, 1997, 1999). If we adopt this notion of intelligence, I argue, we immediately will have tools available to improve children’s performance in school and to enhance their achievements in life. This view requires us to view intelligence not just from a psychometric perspective or even a cognitive perspective, but from a social perspective as well.

I divide my argument into three main parts. First I argue that conventional notions of intelligence are incomplete. Second I suggest an alternative notion of successful intelligence that expands on conventional notions of intelligence. Finally I draw some conclusions about the nature of intelligence and its implications for schooling.

**INADEQUACY OF CONVENTIONAL NOTIONS OF INTELLIGENCE**

Conventional notions of intelligence are incomplete. To the extent that one wishes to define intelligence very narrowly, perhaps they work. But in the modern world, where so many skills are needed to thrive and even to survive, perhaps narrow notions of intelligence are no longer adequate. Moreover, they are based on a doubtful premise. This premise is of intelligence as a unitary construct, a view that dates back to a proposal by British psychologist Charles Spearman (1904) and a view that is most likely not entirely correct. So contemporary theories of intelligence based on this notion, such as those proposed by psychologists Arthur Jensen (1998) and John B. Carroll (1993), cannot be entirely correct either.

There now has accumulated a substantial body of evidence suggesting that, contrary to conventional notions, intelligence is not a unitary construct. This evidence is of a variety of different kinds. One of the main kinds of evidence traditionally adduced to support the unitary notion is the pattern of all positive correlations that is frequently observed among ability tests. The assumption has been that this pattern of all positive correlations among tests reflects an underlying common ability being measured by all the tests. This ability is often referred to as \( \text{g} \), or general ability. But I believe there is good evidence to suggest that the general factor is not a function of some inherent structure of intellect. Rather, it reflects limitations in the kinds of individuals tested, the kinds of tests used in the testing, and the situations in which the individuals are tested.

One kind of evidence suggests the power of situational contexts in testing. For example, David Carraher, Terezinha Nufíes, and their colleagues have studied a group of children that is especially relevant for assessing intelligence as adaptation to the environment (see Nufíes, 1994). The group comprised Brazilian street children. Brazilian street children are under great contextual pressure to form a successful street business. If they do not, they risk death at the hands of so-called "death squads," which may murder children who,
unable to earn money, resort to robbing stores (or who are suspected of resorting to robbing stores). The researchers found that the same children who are able to do the mathematics needed to run their street business are often little able or unable to do school mathematics. In fact, the more abstract and removed from real-world contexts the problems are in their form of presentation, the worse the children do on the problems. These results suggest that differences in social context can have a powerful effect on performance.

Such differences are not limited to Brazilian street children. Jean Lave (1997) showed that Berkeley housewives who successfully could do the mathematics needed for comparison shopping in the supermarket were unable to do the same mathematics when they were placed in a classroom and given comparable problems presented in an abstract form. In other words, their problem was not at the level of mental processes but at the level of applying the processes in specific environmental contexts.

Steve Ceci and Steve Liker (1986) showed that, given tasks relevant to their lives, men would show the patterns of effects similar to those shown by women in the Lave studies. These investigators studied men who successfully handicapped horse races. The complexity of their implicit mathematical formulas was unrelated to their IQ. Moreover, despite the complexity of these formulas, the mean IQ among these men was only at roughly the population average or slightly below. Ceci and Liker also subsequently found that the skills were really quite specific: The same men did not successfully apply their skills to computations involving securities in the stock market. Again, context matters.

In our own research, we have found results consistent with those described above. These results have emanated from studies we have done around the world.

For example, in a study in Usenge, Kenya, near the town of Kisumu, we were interested in school-aged children's ability to adapt to their indigenous environment. In collaboration with others (Sternberg et al., 2001), I was involved in studies of practical intelligence for adaptation to the environment. We devised a test that measured children's informal tacit knowledge for natural herbal medicines that the villagers believe can be used to fight various types of illnesses. We do not know if all or any of these medicines are actually effective. But from the standpoint of our study, the important thing is that the villagers think they are and therefore that knowledge about them is worth possessing.

We measured the children's ability to identify the medicines and what they are used for. Based on work we had done elsewhere, we expected that scores on this test would not correlate with scores on conventional tests of intelligence. To test this hypothesis, we also administered to the children the Raven Coloured Progressive Matrices Test, which is a measure of fluid or abstract-reasoning-based abilities, as well as the Mill Hill Vocabulary Scale, which is a measure of crystallized or formal-knowledge-based abilities. In addition, we
gave the children a comparable test of vocabulary in their own Dholuo language. The Dholuo language is spoken in the home, English in the schools.

We did indeed find no correlation between the test of indigenous tacit knowledge and scores on the fluid-ability tests. But to our surprise, we found statistically significant correlations of the tacit-knowledge tests with the tests of crystallized abilities. The correlations, however, were negative. In other words, the higher the children scored on the test of tacit knowledge, the lower they scored, on average, on the tests of crystallized abilities. This surprising result can be interpreted in various ways. But based on the ethnographic observations of the cultural anthropologists on our team, Geissler and Prince, we concluded that a plausible scenario takes into account the expectations of families for their children and the resultant ways in which the children are socialized.

Most families in the village do not particularly value formal Western schooling. There is no reason they should, as their children will for the most part spend their lives farming or engaged in other occupations that make little or no use of Western schooling. These families emphasize teaching their children the indigenous informal knowledge that will lead to successful adaptation in the environments in which they will live. At the same time, there are some families in the village that have different expectations for their children. They hope that their children eventually may be able to leave the village and to go to a university, perhaps the University of Nairobi. These families tend to emphasize the value of Western education and to devalue indigenous informal knowledge. Thus the families typically value and emphasize one or the other kind of knowledge but not both.

The Kenya study suggests that the identification of a general factor of human intelligence may tell us more about patterns of schooling and especially Western patterns of schooling than it does about the structure of human abilities. In Western schooling, children typically study a variety of subject matters from an early age and thus develop skills in a variety of skill areas. This kind of schooling prepares the children to take a test of intelligence, which typically measures skills in a variety of areas. Often intelligence tests measure skills that children were expected to acquire a few years before taking the intelligence test. But as Barbara Rogoff (1990) and others have noted, this pattern of schooling is not universal and has not even been common for much of the history of humankind. Throughout history and in many places still, schooling, especially for boys, takes the form of apprenticeships in which children learn a craft from an early age. They learn what they will need to know to succeed in a trade, but not a lot more. They are not simultaneously engaged in tasks that require the development of the particular blend of skills measured by conventional intelligence tests. Hence it is less likely that one would observe a general factor in their scores, much as we discovered in Kenya. The developing world provides a particularly interesting laboratory for testing theories of intelligence because many of the assumptions that are held as dear in the developed world simply do not apply. In particular, children receive
very different socialization from the socialization they receive in the United States.

Even in the United States, however, children can receive very diverse kinds of socialization. Lynn Okagaki and I did a study in San Jose, California, of parents’ and teachers’ conceptions of what it means to have an intelligent child (Okagaki & Sternberg, 1991, 1993). We found that parents of children of different ethnic groups have somewhat different conceptions (sometimes called implicit theories) of what it means to have a smart child. In particular, Latino parents more emphasized the importance of social-competence skills, whereas Anglo and Asian parents more emphasized the importance of cognitive-competence skills. Teachers, however, had conceptions of smart children that were more similar to the conceptions of the Anglo and Asian parents than they were to the conceptions of the Latino parents. We found that the more the parents’ conceptions of intelligence matched the conceptions of the teachers, the better the children performed in school. In other words, teachers are not evaluating children just on some “true” basis of what it means to be intelligent, but rather on their own conception of what it means to be intelligent. And of course, the teachers’ conceptions of intelligence are likely to reflect the way they were socialized.

Another kind of socialization effect stems from familiarity with testing in the first place, a point that Patricia Greenfield (1997) has very much emphasized in her writings. We agree with Greenfield. A study done in Tanzania in which I collaborated with Elena Grigorenko points out the risks of giving tests, scoring them, and interpreting the results as measures of some fixed underlying intellectual ability or abilities (Sternberg, Grigorenko, Ngorosho, Tuntufye, Mbise, Nokes, Jukes, & Bundy, in press). We administered to young school children in Bagamoyo, Tanzania, tests such as a form-board test and a Twenty Questions Test, which measure the kinds of skills required on conventional tests of intelligence. Of course, we obtained scores that we could analyze and evaluate, ranking the children in terms of their supposed general or other abilities. However, we administered the tests dynamically rather than statically, loosely following a procedure first set out by Russian psychologist Lev Vygotsky (1978) and later carried out as well by Israeli psychologist Reuven Feuerstein (1979). Dynamic testing is like conventional static testing in that individuals are tested and inferences about their abilities are then made. But dynamic tests differ from conventional static tests in that children are given some kind of feedback to help them improve their scores. Vygotsky suggested that the children’s ability to profit from the guided instruction the children received during the testing session could serve as a measure of children’s zone of proximal development (ZPD), or the difference between their developed abilities and their latent or underlying capacities. In other words, testing and instruction are treated as being of one piece rather than as being distinct processes.

In our assessments, children were first given the ability tests. Then they were given a brief period of instruction in which they were able to learn skills that
would potentially enable them to improve their scores. Then they were tested again. Because the instruction for each test lasted only about 15 minutes, one would not expect dramatic gains. Yet, on average, the gains were statistically significant. More importantly, scores on the pretest showed only weak although significant correlations with scores on the posttest. These correlations, at about the .3 level, suggested that when tests are administered statically to children in developing countries, they may be rather unstable and easily subject to influences of training. The reason, of course, is that the children are not accustomed to taking Western-style tests and so profit quickly even from small amounts of instruction as to what is expected from them. Of course, the more important question is not whether the scores changed or even correlated with each other, but rather how they correlated with other cognitive measures. In other words, which test was a better predictor of transfer to other cognitive performance, the pretest score or the gain from the pretest score to the posttest score? We found the gain score to be the better predictor, by a factor of 4. In other words, any general-factor score or, really, any other factor score obtained from the pretest, which was equivalent to a typical statically administered test, would be of substantially lower validity than would be a gain score measuring learning at the time of test as obtained from a dynamically administered test.

If intelligence is not just a single thing that can be measured by a conventional static test of intelligence, what is it? I argue that it comprises three things, each of which is a different aspect of intelligence.

THREE ASPECTS OF SUCCESSFUL INTELLIGENCE

The intelligence one needs to attain success in life comprises analytical, creative, and practical aspects (Sternberg, 1985). According to my theory of successful intelligence, a common set of processes underlies these three aspects of intelligence. Metacomponents, or executive processes, plan what to do, monitor things as they are being done, and evaluate things after they are done. Examples of metacomponents are recognizing the existence of a problem, defining the nature of the problem, deciding on a strategy for solving the problem, monitoring the solution of the problem, and evaluating the solution after the problem is solved. In writing a term paper on patterns of child rearing, for example, a student has to recognize the need to write the paper, define a topic on which to write the paper, decide on a strategy for getting the paper done, monitor how the paper is going while he or she is writing it, and then evaluate it to make sure it is ready to be handed in. Performance components execute the instructions of the metacomponents. For example, inference is used to compare and contrast different approaches, say, to child rearing. Knowledge-acquisition components are used to learn how to solve problems or simply to acquire knowledge in the first place. For example, selective
encoding is used to decide what information one is reading is relevant in the context of one's writing the term paper on which one is working.

Although the same processes are used for all three aspects of intelligence, these processes are applied to different kinds of tasks and situations depending on whether a given problem requires analytical thinking, creative thinking, practical thinking, or a combination of these kinds of thinking.

Analytical Intelligence

Analytical intelligence is involved when the components of intelligence are applied to analyze, evaluate, judge, or compare and contrast. It typically is involved when components are applied to relatively familiar kinds of problems where the judgments to be made are of an abstract nature.

In some of my early work, I showed how analytical kinds of problems, such as analogies and syllogisms, can be analyzed in terms of the core component processes underlying performance on these problems. In this research, I gave people problems such as testlike analogies or series problems, and collected their response times or error rates so that I could determine the underlying information-processing components people used when they solved these problems. The goal of this research was to understand the information-processing origins of individual differences in (the analytical aspect of) human intelligence.

Research on the components of human intelligence yielded some interesting results. For example, in a study of the development of figural analogical reasoning in second, fourth, and sixth graders, Bathsheva Rifkin and I found that although children generally became quicker in information processing with age, not all components were executed more rapidly with age (Sternberg & Rifkin, 1979). The encoding component, representing the time it takes to figure out what is in a stimulus, first showed a decrease in component time with age and then an increase. Apparently, older children realized that their best strategy was to spend more time in encoding the terms of a problem so that they would later be able to spend less time in operating on these encodings. A related finding was that better reasoners tend to spend relatively more time than do poorer reasoners in global, up-front metacomponential planning, when they solve difficult reasoning problems. Poorer reasoners, on the other hand, tend to spend relatively more time in local planning. Presumably, the better reasoners recognize that it is better to invest more time up front so as to be able to process a problem more efficiently later on.

The study with Rifkin also yielded another strange and totally unexpected finding. A substantial number of second graders received scores of zero on the analogical reasoning test. In other words, they got absolutely no problems correct. This was a puzzling finding indeed. Because it was hard to believe that the children could be so lacking in analogical reasoning skills, we decided to look closely at their data. We discovered that the children who got no problems
correct, instead of circling one of the two answer options printed at the right of each page, had circled one of the two givens of the problem, printed at the left of each page. What were they doing?

It turned out that the children, who were students in a Hebrew day school, were accustomed to reading English in the morning and Hebrew in the afternoon. English is read left to right, but Hebrew is read right to left. Unfortunately for us, we had tested in the afternoon. So the children did what they were accustomed to doing in the afternoon, that is, they read from right to left. Note how even in what appears to be a wholly cognitive test, socialization matters. The children were responding in a way that made sense in terms of their socialization in the school.

Some of our studies concentrated on knowledge-acquisition components rather than performance components or metacomponents. For example, in one set of studies, Janet Powell and I (Sternberg, 1987b; Sternberg & Powell, 1983) were interested in sources of individual differences in vocabulary. We were not content just to write these off as individual differences in knowledge, because we wanted to understand why it was that some people acquired this knowledge and others did not. What we found is that there were multiple sources of individual and developmental differences. The three main sources were in knowledge-acquisition components, use of context clues, and use of mediating variables. For example, in the sentence, “The blen rises in the east and sets in the west,” the knowledge-acquisition component of selective comparison is used to relate prior knowledge about a known concept, the sun, to the unknown word (neologism) in the sentence, “blen.” Several context cues appear in the sentence, such as the fact that a blen rises, the fact that it sets, and the information about where it rises and sets. A mediating variable is that the information can occur after the presentation of the unknown word.

We did research such as that described above because we believed that conventional psychometric research sometimes incorrectly attributed individual and developmental differences. For example, a verbal analogies test that might appear on its surface to measure verbal reasoning might in fact measure primarily vocabulary and general information. The analogy MITIGATE: EXACERBATE :: AMELIORATE: (a. worsen, b. improve, c. extend, d. contract), for example, is more likely to measure individual differences in vocabulary than individual differences in reasoning, at least for most populations. In fact, in some populations, reasoning might hardly be a source of individual or developmental differences at all. And if we then look at the sources of the individual differences in vocabulary, we would need to understand that the differences in knowledge did not come from nowhere. Some children had much more frequent and better opportunities to learn word meanings than did others. For example, they may have grown up in a house with more books or more opportunities to be exposed to print in the English language. Note, therefore, how socialization matters even when one tests something as cognitive as vocabulary.
The kinds of analytical skills we studied in this research can be taught. For example, in one study, we tested whether it is possible to teach people better to figure out meanings of unknown words presented in context (Sternberg, 1987a). In one study, we gave participants in five conditions a pretest on their ability to figure out word meanings. Then the participants were divided into five conditions, two of which were control conditions that lacked formal instruction. In one condition, participants were not given any instructional treatment. They were merely asked later to take a posttest. In a second condition, they were given practice as an instructional condition, but there was no formal instruction, per se. In a third condition, they were taught knowledge-acquisition component processes that could be used to figure out word meanings. In a fourth condition, they were taught to use context cues. In a fifth condition, they were taught to use mediating variables. Participants in all three of the theory-based formal-instructional conditions outperformed participants in the two control conditions, whose performance did not differ. In other words, theory-based instruction was better than no instruction and better than practice without formal instruction.

Research on the componential bases of intelligence was useful in understanding individual differences in performance on conventional tests of intelligence. But it became increasingly clear to me that this research basically served to partition the variation on conventional tests in a different way, rather than serving to uncover previously untapped sources of variation. Children develop intellectually in ways beyond just what conventional psychometric intelligence tests or even Piagetian tests based on the theory of Jean Piaget (1972) measure. So what might be some of these other sources of variation? Creative intelligence seemed to be one such source of variation, a source that is almost wholly untapped by conventional tests.

Creative Intelligence

Intelligence tests contain a range of problems, some of them more novel than others. In some of our work we have shown that when one goes beyond the range of unconventionality of the tests, one starts to tap sources of individual differences measured little or not at all by the tests. According to the theory of successful intelligence, (creative) intelligence is particularly well measured by problems assessing how well an individual can cope with relative novelty. Thus it is important to include in a battery of tests problems that are relatively novel. These problems can be either convergent or divergent in nature.

In work with convergent problems, some of it done in collaboration with Sheldon Tetewsky (Sternberg, 1982; Tetewsky & Sternberg, 1986), we presented individuals with novel kinds of reasoning problems that had a single best answer. For example, they might be told that some objects are green and others blue; but still other objects might be grue, meaning green until the year 2000 and blue thereafter, or bleen, meaning blue until the year 2000 and green
thereafter. Or they might be told of four kinds of people on the planet Kyron: *blens*, who are born young and die young; *kwefs*, who are born old and die old; *bails*, who are born young and die old; and *prosses*, who are born old and die young. Their task was to predict future states from past states, given incomplete information. In another set of studies with Joyce Gastel (Sternberg & Gastel, 1989a, 1989b), people were given more conventional kinds of inductive reasoning problems, such as analogies, series completions, and classifications, but were told to solve them. But the problems had premises preceding them that were either conventional (dancers wear shoes) or novel (dancers eat shoes). The participants had to solve the problems as though the counterfactuals were true.

In these studies, we found that correlations with conventional kinds of tests depended on how novel or nonentrenched the conventional tests were. The more novel the items, the higher the correlations of our tests with scores on the conventional tests. We also found that when response times on the relatively novel problems were componentially analyzed, some components better measured the creative aspect of intelligence than did others. For example, in the “grue–bleen” task mentioned above, the information-processing component requiring people to switch from conventional green–blue thinking to grue–bleen thinking and then back to green–blue thinking again was a particularly good measure of the ability to cope with novelty.

In collaborative work with Todd Lubart (Sternberg & Lubart, 1995) using divergent reasoning problems having no one best answer, we asked people to create various kinds of products where an infinite variety of responses were possible. Individuals were asked to create products in the realms of writing, art, advertising, and science. In writing, they would be asked to write very short stories for which we would give them a choice of titles, such as “Beyond the Edge” and “The Octopus’ Sneakers.” In art, they were asked to produce art compositions with titles such as “The Beginning of Time” and “Earth from an Insect’s Point of View.” In advertising, they were asked to produce advertisements for products such as a brand of bow tie and a brand of doorknob. In science, they were asked to solve problems such as one asking them how people might detect extraterrestrial aliens among us who are seeking to escape detection. Participants created two products in each domain.

We found that creativity is relatively although not wholly domain-specific. Correlations of ratings of the creative quality of the products across domains were lower than correlations of ratings and generally were at about the .4 level. Thus, there was some degree of relation across domains, at the same time that there was plenty of room for someone to be strong in one or more domains but not in others. More importantly, perhaps, we found, as we had for the convergent problems, a range of correlations with conventional tests of abilities. As was the case for the correlations obtained with convergent problems, correlations were higher to the extent that problems on the conventional tests were nonentrenched. For example, correlations were higher with fluid than with
crystallized ability tests, and correlations were higher, the more novel the fluid test was. Even the highest correlations, however, were only at the .5 level, suggesting that tests of creative intelligence tap skills beyond those measured even by relatively novel kinds of items on conventional tests of intelligence.

Creative-thinking skills can be taught, and in a collaborative endeavor with Wendy Williams, we have devised a program for teaching them. Insight skills, a form of creative-thinking skill, can also be taught. In collaborative work with Janet Davidson, we divided gifted and nongifted fourth grade children into experimental and control groups. All children took pretests on insightful thinking. Then some of the children received their regular school instruction whereas others received instruction on insight skills. After the instruction of whichever kind, all children took a posttest on insight skills. We found that children taught how to solve the insight problems using knowledge-acquisition components gained more from pretest to posttest than did students who were not so taught.

Tests of creative intelligence go beyond tests of analytical intelligence in measuring performance on tasks that require individuals to deal with relatively novel situations. But how about situations that are relatively familiar, but in a practical rather than an academic domain? Can we measure intelligence in the practical domain, and if so, what is the relation of practical intelligence to intelligence in more academic kinds of domains?

**Practical Intelligence**

Practical intelligence involves individuals' applying their abilities to the kinds of problems that confront them in daily life, such as on the job or in the home (Sternberg, Forsythe, Hedlund, Horvath, Snook, Williams, Wagner, & Grigorenko, 2000). Practical intelligence involves applying the components of intelligence to experience so as to (a) adapt to, (b) shape, and (c) select environments. Adaptation is involved when one changes oneself to suit the environment. Shaping is involved when one changes the environment to suit oneself. And selection is involved when one decides to seek out another environment that is a better match to one's needs, abilities, and desires. People differ in their balance of adaptation, shaping, and selection, and in the competence with which they balance among the three possible courses of action.

Much of our work on practical intelligence has centered on the concept of tacit knowledge. We define this construct, for our purposes, as what one needs to know to work effectively in an environment that one is not explicitly taught and that often is not even verbalized. We represent tacit knowledge in the form of production systems or sequences of "if-then" statements that describe procedures one follows in various kinds of everyday situations.

We typically have measured tacit knowledge using work-related problems that present problems one might encounter on the job. We have measured tacit knowledge for both children and adults and, among adults, for people in
Robert J. Sternberg

various occupations such as management, sales, academia, and the military. In a typical tacit-knowledge problem, people are asked to read a story about a problem someone faces and to rate, for each statement in a set of statements, how adequate a solution the statement represents. For example, in a paper-and-pencil measure of tacit knowledge for sales, one of the problems deals with sales of photocopy machines. A relatively inexpensive machine is not moving out of the showroom and has become overstocked. The examinee is asked to rate the quality of various solutions for moving the particular model out of the showroom. In a performance-based measure for sales people, the test taker makes a phone call to a supposed customer, who is actually the examiner. The test taker tries to sell advertising space over the phone. The examiner raises various objections to buying the advertising space. The test taker is evaluated for the quality, rapidity, and fluency of the responses on the telephone.

In collaborative studies with Richard Wagner, we found that practical intelligence as embodied in tacit knowledge increases with experience, but it is profiting from experience, rather than experience per se, that results in increases in scores (Wagner & Sternberg, 1986). Some people can have been in a job for years and still have acquired relatively little tacit knowledge. We also have found that subscores on tests of tacit knowledge—such as for managing oneself, managing others, and managing tasks—correlate significantly with each other. Moreover, scores on various tests of tacit knowledge, such as for academics and managers, are also correlated fairly substantially (at about the .5 level). However, scores on tacit-knowledge tests do not correlate with scores on conventional tests of intelligence, whether the measures used are single-score measures or multiple-ability batteries. Despite their lack of correlation with conventional measures, the scores on tacit-knowledge tests predict performance on the job as well as or better than do conventional psychometric intelligence tests. In one study done at a management training center, the Center for Creative Leadership, we further found that scores on our tests of tacit knowledge for management were the best single predictor of performance on a managerial simulation. In a complex statistical procedure, scores on conventional tests of intelligence, personality, styles, and interpersonal orientation were considered first and scores on the test of tacit knowledge were considered last in predicting success on two simulations of managerial performance. Scores on the test of tacit knowledge were the single best predictor of managerial simulation score. Moreover, they also contributed significantly to the prediction even after everything else was entered first into the equation. In recent work on military leadership with Jennifer Hedlund, Joseph Horvath, Colonel George Forsythe, Wendy Williams, and others, we found that scores on a test of tacit knowledge for military leadership predicted ratings of leadership effectiveness, whereas scores on a conventional test of intelligence and on our tacit-knowledge test for managers did not significantly predict the ratings of effectiveness (Sternberg et al., 2000).
Craig Smith, Michael Barnes, and I also have done studies of social intelligence, which is viewed in the theory of successful intelligence as a part of practical intelligence (Sternberg & Smith, 1988; Sternberg & Barnes, 1988). In these studies, individuals were presented with photos and were asked to make judgments about the photos. In one kind of photo, they were asked to evaluate whether a male–female couple was a genuine couple (i.e., really involved in a romantic relationship) or a phony couple posed by the experimenters. In another kind of photo, they were asked to indicate which of two individuals was the other’s supervisor. We found females to be superior to males on these tasks. Scores on the two tasks did not correlate with scores on conventional ability tests, nor did they correlate with each other, suggesting a substantial degree of domain specificity in the task.

Practical-intelligence skills can be taught. Williams, Blythe, White, Li, Gardner, and I have developed a program for teaching practical intellectual skills, aimed at middle-school students, that explicitly teaches students “practical intelligence for school” in the contexts of doing homework, taking tests, reading, and writing (Williams et al., 1996). We have evaluated the program in a variety of settings and have found that students taught via the program outperform students in control groups who did not receive the instruction.

Combining Analytical, Creative, and Practical Intelligence

The studies described above looked at analytical, creative, and practical intelligence separately. But a full validation of the theory of successful intelligence would require research that looks at all three aspects of intelligence in conjunction. To date, we have done two such sets of studies.

In one set of studies in collaboration with Michel Ferrari, Pam Clinkenbeard, and Elena Grigorenko, we explored the question of whether conventional education in school systematically discriminates against children with creative and practical strengths. Motivating this work was the belief that the systems in schools strongly tend to favor children with strengths in memory and analytical abilities (Sternberg, Ferrari, Clinkenbeard, & Grigorenko, 1996; Sternberg, Grigorenko, Ferrari, & Clinkenbeard, 1999).

We devised a test for high school students of analytical, creative, and practical abilities that consisted of both multiple-choice and essay items. The multiple-choice items required the three kinds of thinking in three content domains: verbal, quantitative, and figural. Thus there were nine multiple-choice and three essay subtests. The test was administered to 324 children around the United States and in some other countries who were identified by their schools as gifted by any standard whatsoever. Children were selected for a summer program in (college-level) psychology if they fell into one of five ability groupings: high analytical, high creative, high practical, high balanced (high in all three abilities), or low balanced (low in all three abilities). Students who came to Yale
were then divided into four instructional groups. Students in all four instructional groups used the same introductory psychology textbook (a preliminary version of Sternberg (1995)) and listened to the same psychology lectures. What differed among them was the type of afternoon discussion section to which they were assigned. They were assigned to an instructional condition that emphasized either memory, analytical, creative, or practical instruction. For example, in the memory condition, they might be asked to describe the main tenets of a major theory of depression. In the analytical condition, they might be asked to compare and contrast two theories of depression. In the creative condition, they might be asked to formulate their own theory of depression. In the practical condition, they might be asked how they could use what they had learned about depression to help a friend who was depressed.

Students in all four instructional conditions were evaluated in terms of their performance on homework, a midterm exam, a final exam, and an independent project. Each type of work was evaluated for memory, analytical, creative, and practical quality. Thus, all students were evaluated in exactly the same way.

Our results suggested the utility of the theory of successful intelligence. First, we observed when the students arrived at Yale that the students in the high creative and high practical groups were much more diverse in terms of racial, ethnic, socioeconomic, and educational backgrounds than were the students in the high-analytical group. In other words, just by expanding the range of abilities we measured, we discovered more intellectual strengths than would have been apparent through a conventional test. Moreover, the kinds of students identified as strong differed in terms of populations from which they were drawn in comparison with students identified as strong solely by analytical measures.

We found the general factor of intelligence to be very weak, suggesting that the general factor is probably relevant only when a fairly narrow range of abilities is measured, as is typically the case with conventional tests. We found that testing format had a large effect on results: Multiple-choice tests tend to correlate with other multiple-choice tests, almost without regard to what they measure. Essay tests show only weak correlations with multiple choice, however. We further found that after we controlled for modality of testing (multiple-choice versus essay), the correlations between the analytical, creative, and practical sections were very weak and generally nonsignificant, supporting the relative independence of the various abilities. We found that all three ability tests—analytical, creative, and practical—significantly predicted course performance. When multiple-regression analysis was used, at least two of these ability measures contributed significantly to the prediction of each of the measures of achievement. Perhaps as a reflection of the difficulty of deemphasizing the analytical way of teaching, one of the significant predictors was always the analytical score. (However, in a replication of our study with low-income African-American students from New York, Deborah Coates of the City University of New York found a different pattern of results. Her data indicated that the practical tests were better predictors of course performance than were
the analytical measures, suggesting that what ability test predicts what criterion depends on population as well as mode of teaching.) Most importantly, there was an aptitude–treatment interaction whereby students who were placed in instructional conditions that better matched their pattern of abilities outperformed students who were mismatched. In other words, when students are taught in a way that fits how they think, they do better in school. Children with creative and practical abilities, who are almost never taught or assessed in a way that matches their pattern of abilities, may be at a disadvantage in course after course, year after year.

In a follow-up study with Bruce Torff and Elena Grigorenko, we looked at learning of social studies and science by third graders and eighth graders (Sternberg, Torff, & Grigorenko, 1998a, 1998b). The third graders were students in a very low income neighborhood in Raleigh, North Carolina. The eighth graders were students who were largely middle to upper-middle class studying in Baltimore, Maryland, and Fresno, California. In this study, students were assigned to one of three instructional conditions. In the first condition, they were taught the course that basically they would have learned had we not intervened. The emphasis in the course was on memory. In a second condition, they were taught in a way that emphasized critical (analytical) thinking. In the third condition, they were taught in a way that emphasized analytical, creative, and practical thinking. All students' performance was assessed for memory learning (through multiple-choice assessments) as well as for analytical, creative, and practical learning (through performance assessments).

As expected, we found that students in the successful-intelligence (analytical, creative, practical) condition outperformed the other students in terms of the performance assessments. One could argue that this result merely reflected the way they were taught. Nevertheless, the result suggested that teaching for these kinds of thinking succeeded. More important, however, was the result that children in the successful-intelligence condition outperformed the other children even on the multiple-choice memory tests. In other words, to the extent that one's goal is just to maximize children's memory for information, teaching for successful intelligence is still superior. It enables children to capitalize on their strengths and to correct or to compensate for their weaknesses, and it allows children to encode material in a variety of interesting ways.

Thus the results of two sets of studies suggest that the theory of successful intelligence is valid not just in its parts but also as a whole. Moreover, the results suggest that the theory can make a difference not only in laboratory tests, but in school classrooms as well.

**CONCLUSION**

The time has come to move beyond conventional theories of intelligence and its development. In this chapter I have provided data suggesting that conven-
tional theories and tests of intelligence are incomplete. The general factor of intelligence may be an artifact of limitations in populations of individuals tested, types of materials with which they are tested, and types of methods used in testing. Indeed, our studies show that even when one wants to predict school performance, the conventional tests are fairly limited in their predictive validity. I have proposed a theory of successful intelligence that fares well in construct validations, whether one tests in the laboratory, in schools, or in the workplace. The greatest obstacle to our moving on is vested interests in a way of thinking that is no longer working, if it ever worked at all. If we want to maximize individuals' achievement in school and in the workplace, new notions are needed. We now have ways to move beyond conventional notions of intelligence; we need only the will.

**Teachers' Questions and Answers**

**Q:** As an elementary school teacher, how could I enhance my students' analytical, practical, and creative skills? What kinds of interventions and exercises would you recommend?

**A:** Fortunately, we have written a book that addresses this question. The book is *Teaching for Successful Intelligence* (Sternberg & Grigorenko, 2000). In the book, we show the kinds of strategies that can be used. To develop analytical skills, children are encouraged to analyze, compare and contrast, judge, critique, and evaluate. To develop creative skills, children are encouraged to create, invent, explore, discover, and imagine. To develop practical skills, children are encouraged to use, apply, implement, and put into practice.

**Q:** Often, especially in highly competitive colleges and universities, the importance given to SAT scores far outweighs any other parameter used in the admissions process. In my experience, high scores on these standardized tests do not necessarily translate to outstanding performance in college. Can you comment on the validity of this observation? In the light of your findings do you think that universities ought to expand their selection criteria to include dimensions of successful intelligence? Do you see any evidence that colleges and universities may be moving in this direction?

**A:** Yes to everything! We are currently working with the College Board to experiment with new tests that we have developed that measure creative and practical in addition to analytical abilities. We hope that someday these tests will supplement measures such as the SAT. Ultimately, we hope to see a test battery that measures the complete set of skills proposed in the theory of successful intelligence.
References


**Suggested Reading**


There can be little doubt that one of the primary concerns of parents and educators is that children under their care grow to develop a strong sense of moral responsibility. Within the past few years especially, a fear that something can go wrong—that the process by which children acquire this sense could fail—has led to increased attention to the formation of moral character. Nationwide, programs have been instituted that implement a standardized curriculum of moral and values education in classrooms. This has been due in part to the media exposure of shocking incidents involving children (in many cases very young children) acting violently in schools across the nation, but can also be understood as an attempt to apply what researchers have learned about moral development over the past decades to the home and the classroom. The topic itself has fascinated students of psychology for more than a century, and has inspired a great deal of research within the field. Indeed, it can be argued that moral development is one of the most important processes for psychologists to study, as one of the most critical conditions for the survival of society is that its members learn the differences between right and wrong.
The study of emotion in psychology, on the other hand, has ebbed and flowed, enjoying periods of flourishing theory and research, yet also spending time on the "backburner" of psychological thinking. Despite its cyclical nature, the study of emotion has yielded valuable information to our understanding of human thinking and behavior. In recent years, psychology has experienced a surge of interest concerning the role of emotions in various psychological processes, including their role in judgment and decision making, and motivation. Part of this rebirth in interest about emotions has been due to a public fascination with popular theories of emotional intelligence and emotional competency— theories that describe a set of emotional skills that are important for social functioning. The surge of public interest in emotional intelligence has been accompanied by a plethora of books and articles on the topic (reviewed by Mayer, Salovey, & Caruso, 2000). Emotional intelligence has been implicated by many as an important skill or set of skills necessary for social adjustment and happiness, yet until present times relatively ignored. Some have gone as far as to equate emotional intelligence with moral character, making the terms "emotionally intelligent" and "moral" nearly synonymous (e.g., Goleman, 1995; Saarni, 1999). This interest has raised intriguing questions concerning the role emotions and emotion-related skills play in our moral lives. This chapter seeks to shed light on some of these important issues. Among the questions we address are, What role do various emotions play in the moral development and education of children, as well as in the moral decision-making of adults? And, is it necessary to be emotionally intelligent to be a moral person? Before we do so, however, let us first take a look at what we mean by "emotional intelligence."

WHAT IS EMOTIONAL INTELLIGENCE?

Although emotions play a large role in the daily life of all people, it is clear that there are large individual differences in the way people deal with emotions; some people seem to be more adept emotional managers than others, for example. For instance, receiving a bad grade on a project might incite one child to intense anger, causing the child to act out in class, while another child, although angered at first, might use his or her feelings to motivate working harder on the next project. The various emotion-related skills that are employed by individuals have been grouped together and labeled emotional intelligence (Mayer & Salovey, 1997; Salovey & Mayer, 1990). The emotional intelligence framework was proposed as an attempt to organize the growing body of research on emotions and their influence on cognition and behavior into a single theory that highlighted the way individuals use these skills in their everyday lives. Emotional intelligence has been divided into four main branches, each focusing on a different set of emotional skills: (a) the ability...
to perceive, appraise, and express emotion; (b) the ability to use feelings in
cognitive activities; (c) the ability to understand emotion and emotional know-
ledge; and (d) the ability to regulate or manage emotions to promote emotional
and intellectual growth (Mayer & Salovey, 1997).

Many theorists, researchers, and journalists eagerly picked up on emo-
tional intelligence, and framed it as a skill that was of critical importance to be
a caring, moral, and otherwise well-adjusted person (e.g., Goleman, 1995).
This characterization is not at all surprising. After all, perceiving, generating,
and regulating emotions are generally things we do to maintain and improve
relationships with others. Very often we enlist our abilities at managing emo-
tions when we become angry with a best friend or have an argument with
our spouse, for instance. In these situations, the ability to understand how
the other person is feeling and to regulate our emotional reactions comes in
very handy, and serves to fulfill the goals we have of remaining friends or
of staying married for longer than a few months. It seems natural, then,
that understanding how emotion-related skills affect social relations should
be of primary importance to those interested in studying emotional intelli-
genence.

The relationship between emotional intelligence and moral character is,
however, not as clear-cut as might first appear. The same emotional skills
that make some individuals good, caring people can also be used to achieve
more nefarious goals. Criminals who are masters at deception or con artists
who are trained to manipulate others may in some ways be among those
highest in at least some of these emotional skills (Salovey & Mayer, 1990).
Any discussion of how emotions and emotional skills relate to moral develop-
ment and behavior must take this into account.

A (VERY) BRIEF HISTORY OF MORAL PSYCHOLOGY
AND EMOTION

Although research on moral development has grown enormously within the last
50 or so years, most of the interest has come from researchers within the
tradition known as cognitive-developmental. Building on the work of Piaget (1932),
Kohlberg (1969), and others, researchers from this tradition have had the
strongest influence in the field of moral psychology. Unfortunately for those
of us interested in emotions, this tradition has largely ignored the role of feelings
in the way children grow to become moral individuals. Rather, it has focused on
the development of the child’s cognitive abilities and the way these develop-
mental changes affect the child’s moral world view. Kohlberg, for instance,
viewed the child as progressing from an early morality based on parental author-
ity to a fully autonomous morality, based on an understanding of universal
moral principles. Although Kohlberg sometimes touched on the topic of emotions, his theory never adequately sought to describe the role of emotions in the development of a mature morality.

Within the last 20 years, however, social and developmental psychologists have turned their attention to emotional processes in the social development of children and in the judgments and behaviors of adults. Developmental researchers specifically have sought a description of how emotions work in fostering a child's moral sensibilities. There are at least two reasons why theorists consider emotions important for the study of moral development and behavior. First, emotions are powerful sources of motivation. In other words, most emotions are associated with what has been labeled an action tendency, or a propensity to engage in certain actions when experiencing a specific emotion. For instance, anger is associated with the tendency to attack and fright with the tendency to escape (Lazarus, 1991). Emotions such as empathy and guilt motivate prosocial behaviors [constructive behaviors that are also generally understood as moral (Eisenberg, 1986)]. Helping a person in need and apologizing for hurting someone are examples of these kinds of behaviors. Knowing in what circumstances emotions motivate us to do good is therefore an important component of understanding moral behavior in general. Even cognitive theories recognize this role of emotions as an energy source for moral functioning.

Because emotions are powerful motivators of action, they are also important mechanisms that aid in the process of socialization (the process by which children come to internalize the values, norms, and morals of their parents and society at large). Emotions, as naturally occurring events in children, are resources that can help in the transmission of norms and values. By inducing emotions such as guilt, empathy, shame, and even disgust (see Rozin, Haidt, & McCauley, 1993), parents can mold children's responses to behaviors, events, and people. In time, these emotional reactions come to occur naturally in the child in appropriate situations, and act as internal sources of motivation and constraint. It is these two features of emotion, their motivational arousal and their role in socialization, that have made the study of emotion an important area of inquiry to researchers interested in moral development and prosocial behavior.

When discussing the emotional intelligence of morality, we focus on those emotions that seem to have a distinctly moral nature, such as empathy and guilt. This is not to say that emotions such as happiness and sadness do not affect our moral lives. Certainly, we become happy when we do good things for others and sad when we ponder the misfortune of others. However, for the purposes of our discussion, we focus on the emotions investigators have generally lumped together as morally relevant. In our discussion, we organize the functions of these various emotions using the four branches of the emotional intelligence framework (Mayer & Salovey, 1997; Salovey, Woolery, & Mayer, 2000).
PERCEIVING AND APPRAISING EMOTIONS

When discussing moral rights and wrongs, there seems to be room for a lot of disagreement. Issues such as abortion, the death penalty, and same-sex unions, for example, seem to draw a moral dividing line across our nation. Fortunately, however, there exists much more agreement about issues concerning right and wrong than it might seem. For instance, causing innocent individuals to suffer is rarely seen as anything but a morally reprehensible action. Because moral events usually center around the presence of victimization, encountering the suffering of innocent others in our daily lives is a strong indication that a moral event is taking place. It is generally not the case, however, that people wear signs around their neck that announce their pain, such as “I just got dumped by my girlfriend” and “My favorite aunt just passed away.” Rather, there are subtle signals sent by those individuals that clue us in to their distress. These signals act as efficient forms of communication. However, as may seem obvious, a signal must be perceived and understood for it to be effective. The ability to perceive emotions accurately in others is thus a very important emotional skill, arguably the most fundamental skill of all when it comes to human relationships. This ability to know how others are feeling has been labeled empathy by many researchers (Eisenberg & Miller, 1991; Feshbach & Roe, 1968; Hoffman, 1987), and has been the most well-researched of all the so-called moral emotions.

What is empathy? Some researchers have defined empathy strictly in terms of the ability to take the perspective of others, a distinctly cognitive ability. However, empathy can be seen as having both a cognitive component and an emotional component, that of actually feeling an emotion that is more appropriate to the other person’s situation (this is the definition offered by Hoffman, 1998). In fact, the word “empathy” literally means, “to feel oneself into” (Wispé, 1987). For our purposes, we restrict our definition of empathy to the emotional arousal one feels when presented with the emotional experience of another, particularly the distress of another. It is this empathic arousal that allows us to feel suffering when others are suffering and, thus, motivates us to help the individual in distress.

Most people are able to experience empathy, but some are better than others. For instance, there is evidence that some antisocial youth suffer from an inability to feel empathy, an “empathic dysfunction.” As Gibbs (1987) states, “Empathy is available in most [juvenile] offenders but is not readily elicited and tends to be either an isolated impulse or a mawkish sentiment. In either case, the empathy is superficial and erratic; when it lingers, it is readily suppressed by self-centered motives or aggressive impulses. (p. 303)” It has also been argued that psychopathic individuals suffer from a lack of the capacity for empathic affect (Blair, 1995). This serves as further reason to consider empathy a truly moral emotion: if you cannot feel empathy, chances are you are not a very moral person.
What influences the ability to experience empathy? It is clear that a capacity for empathy is not all-or-nothing; individuals vary as to their degree of empathic responsiveness. Various factors have been pointed to as important for the development of empathy (for a review see Barnett, 1987; Davis, 1996, pp. 62–81). These include genetics (e.g., Matthews, Batson, Horn, & Rosenman, 1981), childhood temperament (e.g., Mehrabin, 1980), a stable and positive relationship with a caregiver (e.g., Mussen & Eisenberg-Berg, 1977), and disciplining techniques that focus on inducing empathy in children (e.g., Hoffman & Saltzstein, 1967). Summarizing the research on the development of empathy, Barnett (1987, p. 156) concluded:

The development of empathy and related responses would appear to thrive in an environment that (1) satisfies the child’s own emotional needs, (2) encourages the child to identify, experience, and express a broad range of emotions, and (3) provides numerous opportunities for the child to observe and interact with others who, through their words and actions, encourage emotional sensitivity and responsiveness to others.

Parents and educators should therefore strive to create an environment in which children are encouraged to take the perspective of others, to imagine what the other person is feeling, and to be active in speaking to their children about emotions.

Before we conclude that the capacity for empathy is sufficient to be a moral individual, we must discuss its limitations. As was mentioned above, empathic arousal motivates us to alleviate the suffering of others. It seems as if the distress we feel when in the presence of distressed others can be alleviated only by helping the individual in need. In fact, individuals tend to help even if there is an easier escape from the empathic distress, for instance, by leaving the situation (e.g., Batson, Dyck, Brandt, Batson, Powell, McMaster, & Griffitt, 1991). People high in dispositional empathy (people with an “empathic personality”) are also more likely to engage in helping behavior (Davis, Mitchell, Hall, Lothert, Snapp, & Meyer, 1999). However, being “high” in empathy is not a surefire qualification for being a moral individual, nor is it a guarantee that a person will always do the right thing. One of the interesting features of empathy is that it is more easily elicited for people that we perceive as similar to us (e.g., Feshbach & Roe, 1968) and that we view as innocent (Betancourt, 1990). Conversely, the more different we perceive others to be, and the more at fault we think they are, the less likely we are to experience empathy for them and, thus, the less likely we are to help them if they are in need. This “empathic bias,” as Hoffman (1987) has labeled it, is one reason we cannot always rely on our emotional reactions as a reliable guide to moral truth. Sometimes, we have to try very hard to feel empathy for others, by imagining ourselves in their position and by focusing on similarities rather than differences. Indeed, one of the primary tasks of parents and educators should be to make the empathic response available in children regardless of perceived differences between themselves and the victim.
Another problem with empathy is that sometimes we feel empathy for individuals who we know do not deserve it. For instance, we may feel sorry for a criminal who had a rough childhood, only to find out that he committed numerous brutal murders. In this situation, felt empathy must be “squashed” so that the motivational consequences (helping the murderer) dissipate.

When speaking of empathy as a moral emotion, then, one must be careful not to assume that the capability to feel what others are feeling is the same as making mature moral decisions. Indeed, the ability to perceive and appraise emotions in others is an ability that may even be used to manipulate others.

EMOTIONS THAT HELP US THINK

The idea that emotions are forces that act contrary to reason has plagued Western thinking since the days of the earliest Greek philosophers. Plato (1988) characterized emotions as being akin to wild horses that need to be controlled by the “rational” rider. Freud (1977) also viewed most emotions as strong instinctual forces that must be conquered by the Superego, that portion of the mind that was in charge of matters of conscience. The notion that emotions disrupt cognitive activities persists even today in conceptions of emotional processes (Mandler, 1975; Simon, 1981). For example, labeling someone as being “too emotional” is synonymous with calling him or her irrational. Similarly, crimes of passion are punished less severely than cold, calculated acts because emotions are seen as temporarily seizing the will of the individual, rendering him or her unable to make informed decisions in the planning of actions.

Although there are some investigators who continue to maintain a strong position concerning the divide between reason and passion (e.g., Metcalfe & Mischel, 1999), most researchers agree that emotions often serve to facilitate reasoning, rather than hinder it (e.g., Damasio, 1994; Salovey & Mayer, 1990). Emotions prioritize events, pointing the individual toward problems in the environment that are of immediate importance (Easterbrook, 1959; Leeper, 1948). In this sense emotions serve to aid judgment, by steering thoughts in the right direction. For instance, negative moods encourage careful, deliberate ways of thinking, causing people to elaborate more on problems than they would in a more positive mood. The presence of happy moods, on the other hand, encourages a more creative style of thinking, leading some to listen to happy, upbeat music to facilitate creative thoughts (Isen, 1993; Palfai & Salovey, 1993; Schwarz, 1990).

Stated simply, emotional reactions focus our cognitive resources on the problem at hand. It is no different with moral emotions. Moral emotions prioritize thinking about our moral principles and beliefs, motivate appropriate moral judgments, and prepare us to take moral action. When we become distressed at the sight of another individual suffering, the negative arousal
mobilizes our mental resources and facilitates thinking concerning moral questions such as why the individual is suffering, whose fault is it that she is suffering, and what course of action should be taken to help her. For example, when, on a winter day, we come across a man who is obviously cold and hungry, and who appears to be homeless, the empathy we feel turns our thoughts toward the plight of the homeless and the inequalities of society. Or, it may cause us to pronounce harsh moral judgments on the individual, attributing his or her position to some flaw of character. In either case, the immediate felt empathy is what served to stimulate thinking about the moral implications of the situation.

If empathy generally motivates us to help, guilt is what motivates us to make amends, either by seeking to repair the damage to a valued relationship, as when we ask forgiveness for offending a friend, or by correcting our behavior to be consistent with our principles concerning how one should act. Guilt is a negative evaluation of a specific behavior, and usually occurs when we feel as if we have violated one of our moral principles, for example, by hurting someone else or by otherwise acting in a manner unbecoming of how we think we should act. In contrast to shame, which usually causes us to focus on ourselves, guilt shifts the focus to the transgression and is associated with a desire to undo what has been done (Tangney, 1999). For instance, a young child who feels guilty for hitting his best friend will most likely find it hard to spend too much time organizing his baseball cards. The guilt he is experiencing will turn his thoughts toward how he hurt his friend and to what he should do to make things better. Similarly, if we have hurt the feelings of a good friend, we are easily distracted if we try to work, because our thoughts are constantly turning to the damage we have done. Although one can have maladaptive levels of guilt, in normal individuals guilt is an incredibly adaptive emotion, because it maintains relationship health by motivating individuals to repair any damage done to the relationship.

Once an emotion such as empathy is aroused in an individual, and thoughts turn to matters of a moral nature, one will naturally draw conclusions regarding the situation (Hoffman, 1998). Moral judgments, the conclusions drawn by individuals concerning the moral rightness or wrongness of actions or events, often influence the presence of subsequent emotions. If we feel empathy in the presence of a distressed other and realize that her or his distress is due to the unjust actions of some third party, our empathy is likely to turn into "empathic anger." For example, when viewing footage of police brutality directed toward an innocent African American man, the empathic distress we feel may turn into anger at such a violation of basic rights. If, on the other hand, we feel empathy for the distress of another, but realize that we are the cause of the others' distress, empathy transforms into guilt. For example, the distress aroused when seeing our younger siblings crying uncontrollably quickly turns into guilt when we realize that they are crying because of something we said. Empathy combines with attributions of blame and other moral judgments, and it is the
motivational power of the emotion in combination with our judgments that informs our subsequent actions.

The knowledge that moral emotions will mobilize our thinking concerning moral issues (such as the plight of the homeless or the importance of not hurting those we love) is knowledge that can be used to serve our individual moral goals. By taking the perspective of other people, for instance, we can make ourselves feel empathy for someone with whom we may not have otherwise concerned ourselves. A pragmatic use of these emotional skills is therefore an advantage, in that the emotions encourage the critical thinking necessary to work through moral situations and moral dilemmas, and they harness the full motivational force of the emotion.

**EMPLOYING EMOTIONAL KNOWLEDGE**

Human interactions are full of complex emotional information. The ability to understand and discern this emotional information adds quality and depth to our own lives, and allows us to understand better the lives of others. Knowledge such as what emotion an artist is trying to convey through her work or of the complex combination of emotions that are making us feel a certain way is considered a sign of a healthy emotional life. Knowledge concerning how emotions work and are communicated and the way that people employ this knowledge is organized under this third branch of emotional intelligence. Among the skills are the ability to define emotions, the ability to understand complex blends of emotions, and an accurate understanding of the likely transitions between emotions (Mayer & Salovey, 1997).

How is this emotional knowledge used in moral life? Thus far we have discussed how emotions work as motivation through their immediate action, as in the empathy we feel when we see someone in distress or the guilt we feel immediately after we hurt someone. But emotions also motivate us from a distance. In other words, merely anticipating that we might feel an emotion is sometimes enough to affect our present behavior. A child who is thinking about cheating on an exam might be motivated not to do so because she knows that she would feel guilty immediately following the act. In this case, knowledge of the emotional consequences of an act becomes an important determinant for whether or not a person will be motivated to avoid performing an "immoral" action.

This type of emotional knowledge, although crucial when it comes to behaving morally, takes time to develop. One of the most interesting findings concerning children's knowledge of moral emotions is the so-called "happy victimizer" effect (Arsenio & Kramer, 1992). Very young children expect that a wrongdoer will feel good after having committed a moral transgression. There is a clear age trend in this phenomenon; as children develop (usually between the ages of 6 and 10) they come to believe that a wrongdoer will feel badly after
having committed a transgression. The development of this ability is critical; if a child is unaware of the emotional consequences of his or her act, there will be little motivation to avoid it (or to perform it). Pointing to the emotional consequences of an act can serve to strengthen the connections between transgressions and the feelings of guilt. In fact, there is evidence that disciplining children by pointing out how they feel after an act (what is called inductive discipline) is the most efficient form of discipline, because it pairs emotional consequences with certain acts.

A second type of emotional knowledge, which takes time to develop as well, is the knowledge of complex combinations of emotional states. This knowledge is one of the most important feats of mature emotional and cognitive development. When, for instance, we see an Olympic athlete in a track race fall, we are aware not only of the physical pain he is experiencing, but also of the disappointment he must feel at achieving so much and failing at such a critical moment, and also of the possible wound to his pride caused by falling in front of an audience of millions. Such an understanding of the complex emotions experienced by the individual is important in informing our subsequent actions. Should we help ease his physical pain? What types of things should we say to him to ease his emotional pain? Should we remain quiet rather than speak to him? An inability to answer these complex questions concerning the individual involved renders our helping abilities rather useless. If we were unable to figure out some answers to these questions, our helping behaviors would be similar to those of young children, who often offer a safety blanket or a favorite toy (decidedly not the kind of help that most adults would want). Adequately helping others means knowing how they may be feeling in the larger context of their life experiences.

**EFFECTIVELY REGULATING EMOTIONS IN OURSELVES AND IN OTHERS**

*Regulating Emotions in Ourselves*

Emotional regulation is perhaps one of the most important features of emotional intelligence when it comes to moral judgments and behaviors. Emotional reactions sometimes need to be guided in the right direction, lest they steer us into the wrong one. This is obvious for negative emotions such as anger; if anger is not regulated, it can motivate us to act inappropriately. It is less obvious why we would need to regulate emotions such as empathy. After all, empathy is a good thing, is it not?

This discussion should be prefaced with a point concerning emotions that is especially useful when discussing moral emotions. Sometimes emotions are elicited almost automatically (see Hodges & Wegner, 1997). When survival is threatened, we react immediately with fear. In the same manner, when the desire for social approval is threatened (e.g., by someone who made us look foolish in
public), we immediately feel angry. We also have immediate and automatic reactions of empathy, disgust, jealousy, and nearly every other emotion. The bright side is that human beings are not mindless animals condemned to act on our every impulse, so we are constantly able to choose the emotions that are appropriate and those that are not by stepping outside the emotion and deciding whether or not it is appropriate, then regulating it accordingly (see Gross, 1999). If we have an emotion that we believe we should not be having, or at least that we think would be wrong to act on, we can enlist a higher-order desire to regulate that emotion. If we have an immediate emotional reaction, such as anger, and with it comes the desire to act on that emotion (attack our offender), we can step outside the emotion and act as judges of it. We can have desires about desires or emotions about emotions (Gottman, Katz, & Hooven, 1997). In the case of the anger, it is the greater desire to do the right thing that motivates us to regulate our emotional reaction. Sometimes, it is the case that the immediate emotional reaction and the greater desires match up with each other nicely. For instance, the motivation brought on by empathy (the desire to help the person in need) goes along very well with our greater desire to “do good,” and the end result is that we perform the action. In the cases where they do not match up, however, our skills in regulating our emotions are called into play, and we take on the role of emotional managers. When we become angry with a boss, for instance, we know that we cannot slap him in the face. Thinking about our anger and turning our thoughts toward constructive ways of dealing with the problem are strategies that are often effective in the regulation of the emotion.

Not all people have mastered this skill, as one might guess. Oftentimes, individuals allow inappropriate emotions to exert their full motivational force, with the end result sometimes being disastrous. The recently coined “road rage” phenomenon, where drivers become so angry that they stop at nothing until they satisfy their revenge on other drivers, certainly attests to the unfortunate consequences of poor emotional regulation. This discussion of emotional regulation should not be taken as evidence that emotions are bad and that by regulating them we necessarily mean eliminating their effects. On the contrary, emotional reactions that are channeled constructively can act as excellent sources of motivation. Anger at the presence of societal injustices, when effectively regulated (which may mean letting ourselves experience the anger fully rather than suppressing it), can motivate individuals to great moral achievements, for instance. In fact, there are some instances in which regulating an emotion, by not allowing ourselves to fully experience it, may have drastic consequences for ourselves and others. For instance, suppressing anger is thought to affect various physiological mechanisms that are vital to our health (Petrie, Booth, Pennebaker, & Davison, 1995). Similarly, suppressing an emotion such as empathy might have disastrous moral consequences, allowing people to do things they would never otherwise do (such as harm innocent people).
Regulating Emotions in Others

So far we have talked about the importance of regulating emotions in ourselves, but what about regulating emotions in other people? At first thought, this might seem rather manipulative. However, in everyday life we know individuals who are skilled at manipulating emotions in other people in ways that are considered constructive. For instance, the friend that everyone turns to when they are feeling down is often sought out because of his or her ability to "raise spirits" and make people feel better. Motivational speakers and preachers are also good regulators of emotion in others, and are applauded for these skills. So, while one can certainly see the manipulation that might occur by regulating the emotions of others, by and large people use these skills for the achievement of noble goals.

The ability to regulate the emotions of others is a critical skill when it comes to the socialization of children. As we have mentioned, effective disciplining is often achieved by using children's natural emotional reactions as sources of motivation. Parents can capitalize on these emotional reactions by generating them in children when appropriate. The induction of emotions or moods is something that psychologists interested in emotions often do in an experimental setting. For instance, in our emotions laboratory we often induce moods by asking people to watch sad movie clips or listen to happy music (e.g., Palfai & Salovey, 1993; Salovey, 1992; Salovey & Birnbaum, 1989). Similarly, when disciplining a child, caretakers can take advantage of the ease with which children are likely to experience emotions such as empathy and guilt, and use it to motivate appropriate moral behaviors.

The children of parents that tend to induce emotions such as empathy and guilt when a moral situation arises are more likely to internalize moral norms efficiently (Hoffman & Saltzein, 1967). For instance, pointing out the consequences of stealing, thus inducing empathy for the victim of the theft, is an effective way of teaching children not to steal. By repeatedly inducing empathy in similar situations, children come to associate the act of stealing with empathy for the victim, and this emotional energy provides an internal source of motivation in the children. This type of discipline stands in sharp contrast to disciplinary tactics in which caretakers merely exert their authority over children, threatening them with punishment if they do not act in a moral manner. In any future moral situations, children who were disciplined through the use of inductive methods will continue to act morally even in the absence of external authority or threat, as compared with children who were disciplined merely through an exertion of parental authority. Recent research on children's development of "conscience" has supported these ideas (Kochanska, 1995, 1997).

Empathy and guilt are not the only emotions recruited in the transmission of moral norms. Emotions such as shame and disgust are also implicated. Some authors have pointed to the power of feelings of disgust when it comes to
certain moral practices. For instance, vegetarians (who are vegetarian for moral reasons) are more likely to find meat disgusting than vegetarians who become vegetarian for health reasons (Rozin, Markwith, & Stoes, 1997). Inducing disgust over certain practices may be one of the most powerful ways to get children (and adults, as some religious leaders can attest) to stop performing certain behaviors.

Inductive discipline works not merely as simple conditioning, i.e., the pairing of emotions with situations. Through time, caretakers elaborate on the moral principles involved in situations that arouse emotions, focusing on the similarities across situations such as hitting others, stealing, or lying, and teaching the child the appropriate principles involved. By linking moral principles to emotions like this, thinking about moral principles becomes an emotion-laden task, lending the principles greater motivational power. Every time there is a co-occurrence of moral principles with empathic affect, the association causes a bond between the two. Moral principles thus acquire a motivating power that they would not have acquired without the effective pairing of the empathic response. Moral principles come to elicit empathy and guilt, and conversely, empathy and guilt elicit thinking about moral principles, leading Hoffman (1987) to refer to them as “hot cognitions.” This may help to explain why emotions become so intense when individuals disagree about their moral beliefs.

A WORD ABOUT MORAL PRINCIPLES

In our discussion of emotions, we have briefly mentioned the importance of moral principles in guiding the regulation of emotions and in elaborating on them when disciplining children. As mentioned before, many psychologists studying morality have largely ignored moral emotions, choosing to focus on the development of cognitive abilities instead. They have focused on how maturing cognitive abilities affect children’s thinking about moral principles, and how understanding these principles affects their judgments concerning right and wrong. However, moral theorists who do focus on emotions have been criticized for ignoring the role that an understanding of moral principles plays in the moral development of children, choosing rather to focus on how emotions act as rewards for doing good or punishments for doing wrong (e.g., Blasi, 1999).

It is our belief that any discussion of morality should ignore neither the role of moral principles nor the role of emotions. In the moral lives of individuals, it makes little sense to separate the two. We feel guilt when we violate what we believe to be a moral principle. Guilt does not exist without previous judgments that certain acts are wrong. In the same manner, were it not for the emotions of guilt and empathy we would have little motivation to act on our moral principles. Because the two cannot be separated in real life, we do not think they should be separated in our theoretical frameworks either.
MORAL EDUCATION

Having covered a few key points concerning moral emotions and emotional intelligence, we are now in the position to take a closer look at the implications for moral and emotional education. There is a large push for the implementation of programs in schools across the nation that focus on the education of character, values, and morals. Although this is not intended to be a review of socio-moral-emotional education programs, there are a few points to be made concerning the broad approaches that are currently in favor. In his article "How Not to Teach Values," Kohn (1997) takes a critical look at many character education programs, guiding his criticism by asking five questions he considers vital. Among these are "What is the view of human nature [espoused by the program]?" and "What is the theory of learning [espoused by the program]?"

Many character education programs adhere to an underlying assumption that children are intrinsically evil and that their natural impulses must be curbed. This bleak view of human nature, according to Kohn, leads to efforts at controlling behavior by "breaking the will" of the child, and by offering the child rewards for their good behavior. As Kohn correctly points out, this approach is directly contrary to psychological research on motivation; one way to extinguish behavior is to encourage it with extrinsic rewards (Lepper, Green, & Nisbett, 1973). The rewarding of behavior (e.g., by giving tokens to children when they are "caught" performing a good behavior) may undermine intrinsic motivation.

Attempts to stop misbehavior by external punishments are just as ineffective. If character education is to work, it must foster internal motivation to do good, and not depend on the presence of external rewards and punishment. As discussed above, moral emotions are, by their very nature, internal sources of motivation and constraint. The easy solution seems to be just to "teach" emotional skills, focusing especially on moral emotions. In fact, it is strange that more moral education programs do not pay special attention to emotional education. But the goal sounds easier than it may actually be to accomplish it. Berkowitz (1995) lists some reasons why this may be the case. First, developmental evidence points to an early emergence (within the first 2 years of life) of empathy, making its presence dependent on factors that occur before children even reach school. Second, there is a general lack of research on how to educate moral emotions. As Berkowitz states, "[T]he role of the school is to direct the child to care for the good and abhor the bad; e.g., empathize with victims and despise injustice. Unfortunately it is quite unclear how this is done. The literature on moral education pays little attention to this issue" (p.25, emphasis added).

A more general approach to moral learning has also been popular in schools across the nation—programs that focus specifically on issues such as conflict resolution, emotional learning, and social development in children. Although in most cases more broadly focused than character education programs, these
programs were also initiated because of the desire to minimize behaviors such as interpersonal violence, drug abuse, suicide, and lack of civility among students. There is only limited evidence at this point regarding the effectiveness of many of these programs (see Lopes & Salovey, in press, for a review). However, this is most likely due to a lack of controlled research (i.e., adequate comparisons between programs) rather than an inability of these programs to foster change in students.

Lest the state of affairs seem beyond remedy, it must be made clear that there are strategies that can promote moral emotions in children. We have already mentioned some strategies for effectively inducing emotions in others. For instance, pointing to the consequences of a child’s actions is an effective method of promoting an empathic response in the child, and capitalizes on the child’s natural tendency to feel for others. Below we present further strategies that may promote the education of moral character through the use of emotions:

1. Build an environment that encourages the expression and discussion of emotions. There is no substitute for having good models of emotional skills. The way in which parents and educators treat and talk about emotions has been shown to be an important part of the child’s ability to adjust (Gottman et al., 1997).

2. Be an effective regulator of emotions in children, especially when confronted with moral situations. For instance, induce empathy for innocent victims of crime, or guilt when the child has hurt someone. The built-in motivation provided by these emotions will continue to exert an influence even in the absence of caretakers.

3. One strategy for inducing empathy in children is to point to the similarities between them and the victim, framing victims in ways that allow children to fully experience empathy. In contrast, framing victims as different preempts feelings of empathy. By fostering a universal respect for humanity, as opposed to drawing boundary lines across races, religions, and nationalities, parents and educators can ensure that children will not fail to experience emotions when presented with the victimization of others.

4. Although there may be a heritable component to the tendency to experience empathy, it is most certainly the case that we can improve this ability in ourselves and in children. Encourage children to be constant “perspective takers,” to learn to see the world through the eyes of others. Encourage conversation about how others must be thinking or feeling. This is especially important in situations where there is a conflict between two parties. Encouraging both sides to take the perspective of others will help children not only to feel what the others may be feeling, but is also an important exercise in respecting the opinions of others. Make it a habit to verbalize your empathic feelings when presented with the suffering or victimization of others.
5. Discuss important moral principles, and link them to moral emotions. Discussions about justice and fairness will come naturally to the developing child (e.g., when having to share toys with other children, or when having to take the blame for mishaps). Seize these opportunities to engage children in a discussion of justice and fairness. Say, for instance, why feeling anger at the sight of unfair practices is okay (i.e., because the principle of justice has been violated). If a child is effective at reasoning about moral issues, it is usually the case that appropriate moral emotions will follow.

There is little reason to think that we are helpless when it comes to the emotional and moral education of children. The truth of the matter is that we can be systematic and effective in fostering the moral and emotional development of children.

CONCLUSION

Emotions play an enormous role in the moral development, moral judgment, and moral behavior of individuals, and have often been ignored by researchers in moral psychology. For a full psychological understanding of morality, one must take emotional processes into account. The emotional intelligence framework provides a useful background by which to organize the various ways emotions work in moral processes. The ability to be effective in dealing with emotions—accurately perceiving them, using them to guide thinking, being knowledgeable about complex emotional states, and being effective regulators of emotions—comprises skills that come into play in being a moral individual. In fact, these skills can be used to teach children right from wrong more effectively. There is no doubt that people who are poor at dealing with emotions and emotional events would find it hard to maintain their moral character over time. As it is, moral judgments are nearly always affected by our emotions, and being bad at dealing with emotions would seem to imply being bad at dealing with moral situations.

In discussing emotions and emotional skills, however, we must be wary not to transform emotional intelligence into something it is not. Emotional skills are merely one subset of all human skills. Cognitive abilities, emotional abilities, and various other skills and talents are important in making us complete individuals. And, as we know, any human skill can be used to achieve destructive goals. Just as an individual who has the IQ of a genius could use her or his intelligence to hurt others (the notorious Hannibal Lecter of The Silence of the Lambs comes to mind), so can a person who is high in emotional intelligence use his or her skills to manipulate and hurt others. Being good at knowing how others feel, regulating the emotions of others, and controlling one’s display of emotions are all skills that are prerequisites for any great leader, whether she or he chooses to lead people to do good things or evil things. Emotional intelligence is therefore not a cure-all for the ills of society. If tomorrow everyone in
the world became emotionally intelligent, the world still might not be a paradise. However, by understanding the role of various emotional processes in the development of morality and in our everyday moral behavior, we are that much closer to being effective moral agents and effective moral educators.

**Teachers' Questions and Answers**

**Q:** In the wake of the Columbine tragedy, what kinds of interventions can schools implement to help violent or withdrawn students deal more effectively with their emotions? How early should these interventions take place? Is there a point where it is simply too late to effect change?

**A:** Recent violent incidents reported in the news media have made the mental health of our youth very salient. Partly in response to these incidents, schools across the nation have implemented programs in an attempt to preempt any future tragedies [according to one count, more than 300 such programs are in place in the United States alone (Cohen, 1999)]. Although they often go by different names (character education, positive youth development, emotional intelligence, emotional literacy, social-emotional learning), they usually have as their main goal the teaching of skills surrounding the effective management of emotions, the building of healthy social relationships, and the achievement of positive social and personal goals.

It is too early to offer a critical evaluation of the success of these programs. However, there have been some optimistic reports. For instance, one of the first of such programs (instituted in the public schools of New Haven, CT), has contributed to the reduction of school violence and feelings of hopelessness among students (Shriver, Schwab-Stone, & DeFalco, 1999). A conflict-resolution program in New York City (Resolving Conflict Creatively) has also contributed to a reduction in aggressive behavior; children who received more conflict-resolution lessons were less aggressive overall (Aber, Brown, & Henrich, 1999). These early findings provide some assurance that we are headed in the right direction.

As far as the ideal age of implementation, the easiest answer is the earlier the better. This is not to say that older children and adults cannot benefit from such training. It seems as if old dogs can learn new tricks when it comes to emotional skills. It is never too late to teach a child to take the perspective of others, for instance, or to teach children to reappraise situations so as not to feel overwhelmed with violent emotions.

If there is a take-home message, however, it is that there is still much to learn about the motives of children such as those involved in the Columbine and Jonesboro incidents. It would be a mistake to say that emotional intelligence training could have prevented such a tragedy—we just do not know at this point. However, the hope remains that by paying closer attention to the social and emotional well-being of children at high risk for such behaviors, we may be able to prevent such tragedies in the future.


The “Mozart effect,” a term coined by the Los Angeles Times, refers to the finding that college students who listened to the first 10 minutes of a Mozart sonata (K.448) scored higher on a spatial-temporal reasoning task immediately afterward—an effect that lasted approximately 10 minutes. The original research report, first published by my colleagues and me in the journal Nature (Rauscher, Shaw, & Ky, 1993), received a disproportionate amount of attention from the popular press. To our horror, the finding has spawned a Mozart effect industry which includes books, CDs, web sites, and all manner of hyperbole. Articles with titles such as “Mozart Makes You Smarter” and “Mozart Makes the Brain Hum” have led readers to believe that classical music in general, and Mozart in particular, can improve babies’ math scores later in life, improve scores on the Scholastic Aptitude Test (SAT), and turn average healthy children into Einsteins. Unfortunately, press reports of scientific findings are powerfully seductive to parents, educators, and policymakers. In fact, Georgia Governor Zell Miller, based on his understanding of these results, asked legislators to purchase classical music CDs for every newborn baby in the state. “No one doubts that listening to music, especially at an early age, affects spatial-
temporal reasoning that underlies math, engineering, and chess." Far from no
one doubting it, there is no evidence at all for the claim that listening to
classical music CDs improves children's spatial-temporal reasoning or any
other aspect of intelligence, for that matter. The scientific reports made no
claims about general intelligence, SAT scores, or babies.

Although the term Mozart effect initially referred to the transitory increase in
certain visuospatial task scores following listening to a particular Mozart
sonata, the phrase has generalized to include, for example, the effects of
music instruction on spatial-temporal task performance. In numerous studies
preschoolers, kindergartners, and second graders who received piano instruc-
tion scored higher on spatial-temporal tasks than control groups who received
other instruction or no training (see, for example, Rauscher, 1999). My goal in
this chapter is to share with you the most recent research in this area. Because
this is an area where there is considerable temptation to overstate the scien-
tific findings in the interest of a particular advocacy position, I caution the
reader to employ a conservative interpretation of the data presented here.
Although the research has strong implications for policy and practice, it is
important to keep in mind that these studies were designed with an eye toward
determining the parameters of a scientific effect rather than with an eye toward
application. Questions to be addressed include: (1) What have researchers
discovered about instrumental instruction and spatial-temporal reasoning?
(2) What is the best age to begin instrumental instruction for spatial-temporal
enhancement? (3) How long do the effects of instrumental instruction on
spatial-temporal reasoning persist? (4) How might musical experiences affect
cognitive development? (5) Does enhancing spatial-temporal reasoning im-
prove mathematics scores? (6) What are the implications of this research for
educators and public policy?

To understand the effects of instrumental instruction on children's spatial-
temporal reasoning, it is necessary to understand what is meant by "spatial-
temporal." Virtually every healthy human has some degree of spatial-temporal
intelligence. To maneuver an armchair through a doorway and around a corner,
for example, one needs to picture its shape and which way to turn it before one
lifts it. Even animals can reason spatially. One researcher in the field of spatial
cognition, for example, reports an event he noticed while watching a German
shepherd play fetch with its owner (Cooper & Shepard, 1990). The owner threw
a long stick over the backyard fence, and the dog pranced over and immedi-
ately placed his head through an opening where a board in the fence had fallen
off. The dog grabbed the stick horizontally, jerked backward and, one moment
before the stick would have rammed the fence, rotated his head 90° to pull the
stick neatly through the hole in the vertical direction. One can never know
whether the dog's foresight was conscious but, writes the researcher, "Might
[there] not have been a preparatory mental rotation of the stick," a rotation, I
might add, similar to the one that lets you picture this whole episode in your
head as you read? Children show this form of intelligence as soon as they start
building block towers or putting together puzzles, and later as they reason about ratios and fractions. Individuals with highly developed spatial skills often become architects, sculptors, engineers, graphic designers, painters, mathematicians, physicists—and musicians.

Lois Hetland, a researcher from Harvard University, recently published a statistical review (i.e., meta-analysis) of all the causal studies she could find that explored the effects of instrumental instruction on spatial abilities (Hetland, 2000). Although not all studies showed positive effects, overall the data were convincing. Hetland concluded, "Active instruction in music does appear to enhance spatial-temporal performance for preschool and elementary-aged children, at least while instruction is occurring and at least up through two years of instruction. The effect is...remarkably consistent across this population of studies. ...It is a solid finding."

The typical study included in Hetland’s analysis compared spatial-temporal scores of two to four groups of children. One group received music instruction and the other(s) received either no instruction or instruction in an alternative activity to control for the Hawthorne effect. Instruction was provided either individually or in groups of approximately 10 children, and lasted 10 to 60 minutes for periods ranging from 6 weeks to 2 years. In most studies children were taught the piano or xylophone, generally in conjunction with Orff or Kodály techniques that included listening, singing, movement, and learning to read music. Spatial-temporal reasoning was typically tested before and after instruction began.

The primary outcome of Hetland’s analysis was that active music instruction led to dramatic improvement of children’s spatial-temporal task scores. In addition to this finding, Hetland made several other interesting discoveries. To determine if the effect was stronger for younger than older children, Hetland compared the posttest scores of children aged 3 to 5 years with those of children aged 6 to 12. Her results suggest that the spatial abilities of younger children are more enhanced by active music instruction than are those of older children. This finding is consistent with the notion that the age at which music instruction begins is related to structural changes in the brain. The 4-year study reported below illustrates the importance of Hetland’s finding.

**SCHOOL DISTRICT OF KETTLE-MORAINE STUDY**

**Kindergarten**

Children from four kindergarten classrooms at two Wisconsin public elementary schools in the school district of Kettle-Moraine participated. Some children received piano keyboard instruction (keyboard group) and others received

---

1The Hawthorne effect is the phenomenon that whenever one introduces something new into a curriculum or program, it has an enhancing effect on a variety of behaviors.
Frances H. Rauscher

no special training (no music group). We began by pretesting all the children using two spatial-temporal tasks, a puzzle-solving task and a block-building task, and one pictorial memory task. Based on previous research, we predicted improvement for the spatial-temporal tasks only.

Immediately following the pretesting, a music specialist visited each classroom to provide the keyboard group with 20-minute piano lessons two times per week for the remainder of the school year (8 months). Children were taught in groups of 8 to 10. The instruction involved singing and moving to the compositions of the current and subsequent weeks, rhythmic clapping and solfège, ear training, music notation, improvisation, interval and dynamic exercises, and keyboard performance. The children in the no music group engaged in journaling activities with their kindergarten teacher during music lessons. These children were not permitted access to the keyboards.

Children were posttested twice, once following 4 months of lessons and a second time following 8 months. For both spatial-temporal tasks the children who had received the keyboard lessons scored significantly better than the children who had not. Although no differences in pretest scores were found between the two groups of children, after only 4 months of instruction the keyboard group’s puzzle-solving scores were 38% higher than those of the no music group. The keyboard group’s scores had improved by 52%. These enhancements were similar in magnitude to those found in similar studies using preschoolers as participants, despite the chaotic setting of the kindergarten classroom and the participation of older (5- to 6-year-old) children. Furthermore, after 8 months of lessons the difference between the two groups’ scores had increased in magnitude. The keyboard group scored 46% higher than the no music group, representing a 65% improvement. Similar results were found for the other spatial-temporal task, block building. As predicted, scores on the memory task did not differ significantly for the two groups following lessons. Thus, in contrast to what the Mozart zealots would claim, music training effects were limited to spatial-temporal skills; they did not generalize to other skills.

First Grade

We returned to the schools the following year, at the end of the first grade, to retest the children. The school district had partially expanded its kindergarten keyboard program into the first grade. Therefore, some first grade children received keyboard lessons and others did not, depending on the logistics of classroom assignment. We thus had three groups of children to retest. Some children received keyboard instruction for 1 year (in kindergarten) and did not receive instruction the second year (in first grade). These children therefore had a 1-year gap in their instruction, after which they were retested. A second group of children received music instruction for 2 years (in kindergarten and first
grade) and were retested after each year of instruction. Finally, a third group received no music instruction at all. All children were tested using the same three tasks used earlier.

Results indicated that the children who received keyboard instruction only in kindergarten scored 15% lower on the puzzle-solving task 1 year after their lessons had ended. In fact, these children’s scores were not significantly different from the scores of the children who had never received lessons. However, the scores of the children who continued lessons through the first grade had increased by approximately 17% since kindergarten. Finally, the children who received no lessons showed only the improvement one would expect from age. The block-building task followed a similar trend. Again, no effects were found for the memory task. These data suggest that 1 year only of keyboard music instruction will not induce long-term effects on spatial-temporal task performance. Either the instruction must continue indefinitely for the effects to persist (use it or lose it), or some critical amount of training is required to produce lasting effects on spatial cognition. Unfortunately, it is too early in the research to determine which of these two explanations is correct.

Second Grade

The following year we returned to the schools to retest the children yet again. After viewing the data, the district superintendent had decided to provide keyboard lessons to all her elementary school children. All children were to receive instruction every year. This decision provided us with three groups of children to retest, all of whom had participated in our study in previous years. One group had received keyboard instruction in kindergarten and second grade only (not in first grade), a second group had received the instruction in all three grades (kindergarten, first grade, and second grade), and a third group had received instruction in the second grade only. We administered the same three tasks as before, after the children had completed the second grade.

The data show that the children who received lessons in kindergarten and second grade, but not in first grade, improved by approximately 37% after their lessons were reinitiated in the second grade. The children who received lessons for all 3 years continued to improve, although the improvement from first to second grade was not significant (14%). This may be due to the presence of a ceiling effect.2 Finally, children who received the lessons in the second grade only did not improve significantly. Consistent with Hetland’s (2000) analysis, these data suggest that the effects of keyboard instruction on spatial-temporal task performance are found primarily for those children who begin training at the earliest ages.

2“Ceiling effect”: refers to the failure to observe any improvement in performance owing to the fact that the participant is already performing at maximum capacity.
Third Grade

We collected additional data from these children the following year, after they had completed the third grade. This time we used a more difficult version of the puzzle-solving task. The block-building and memory tasks were not administered.

As before, three groups of children were retested, some of whom received lessons in kindergarten, second grade, and third grade, some of whom received lessons from kindergarten through third grade, and some of whom received lessons in second and third grades only. Because of the difference in task difficulty between the test items we administered in third grade and those administered earlier, we did not compare the data collected following the third grade with those collected in previous years. However, we were able to compare the scores of the three groups of third grade children.

The data are compelling. The children who received keyboard instruction for 4 consecutive years (through the third grade) scored 30% higher on the task than children who received instruction in kindergarten, second grade, and third grade, and 52% higher than the children who began instruction in second grade. This lends further support to the importance of beginning the instruction early.

Summary

Consistent with previous studies this longitudinal study found that young children who were provided with music instruction scored higher on spatial-temporal tasks compared with children who did not receive the instruction. The effect was significant after 4 months of instruction. No enhancement was found for a nonspatial task: pictorial memory. However, when the music instruction was terminated the children’s scores began to decrease. The children who received instruction over the entire 4 years of the study continued to score higher on the spatial-temporal tasks. Finally, scores of the children who began instruction in the second grade did not improve significantly, and these children continued to score lower than all other groups in the third grade.

Lois Hetland's meta-analysis provides further information regarding several variables of interest to researchers and educators. In addition to age-of-onset differences, she found that one-on-one instruction may lead to stronger spatial skills than group lessons, although group lessons, as demonstrated above, do appear to be effective. Furthermore, Hetland’s analysis revealed that instruction on the keyboard, rather than another musical instrument, may not be necessary for spatial enhancement, although she recommends caution in interpreting this finding: Only five of the studies included in her analysis did not include keyboard instruction. Also, the inclusion of move-
ment in the music instruction did not affect spatial skills. Programs that included movement produced similar effect sizes as those that did not include movement. Finally, learning to read music may play a role. Although learning standard musical notation does not appear to be necessary for spatial enhancement, programs of music instruction that included literacy resulted in greater spatial-temporal enhancements than programs of instruction that did not.

THEORETICAL INTERPRETATIONS

The effects of music instruction on spatial-temporal abilities have been explained by two types of theories. Neuroscientific theories assert that music instruction induces physiological changes in brain structure that consequently affect spatial-temporal processing (Leng & Shaw, 1991). Indeed, recent research suggests that the brains of musicians are different from those of nonmusicians. For example, two structural magnetic resonance imaging (MRI) studies have found that musicians who began piano instruction prior to age 6 or 7 had larger corpus callosi and greater asymmetry of the planum temporale (the brain’s sound signal processor) relative to nonmusicians (Schlaug, Jancke, Huang, & Steinmetz, 1995; Schlaug, Jancke, Huang, Staiger, & Steinmetz, 1995). Furthermore, violinists who began training prior to age 12 displayed greater cortical representation of the digits of the left hand than nonmusicians (Elbert, Pantev, Wienbruch, Rockstroh, & Taub, 1995). Finally, one study found that musicians who started playing before age 9 showed greater auditory cortical representation than those who began instruction after age 9 or nonmusicians (Pantev, Oostenveld, Engelien, Ross, Roberts, & Mannfried, 1998). Again, there was a significant positive correlation between effect size and the age at which subjects initiated instruction: musicians who began instruction before age 9 displayed the largest effects. These differences in the brains of musicians and nonmusicians may be related to findings of improved spatial-temporal abilities in children who began music instruction at an early age.

Transfer theories, on the other hand, suggest that playing a musical instrument and performing a spatial-temporal task require similar cognitive skills, and thus the skills involved in making music may transfer to spatial-temporal task performance (Rauscher, 1999). One approach to examining the nature of the relationship between music and spatial-temporal reasoning is to analyze the cognitive requirements shared by these two domains. For example, several of the musical elements described by Serafine (1988), including temporal succession, nontemporal closure, transformation, and abstraction, may have parallel elements in the visuospatial domain. Perhaps the cognitive skills required to process this type of information are used in performing both musical and spatial-temporal tasks.
THE LINK BETWEEN MUSIC AND MATH

An important practical question remains: Will children who score higher on spatial-temporal tasks as a function of music instruction also score higher on mathematical tasks? Although significant correlations have been found between spatial-temporal task performance and mathematical ability, only two studies have addressed the hypothesis that music instruction affects mathematical reasoning. The first study (Gardiner, Fox, Knowles, & Jeffrey, 1996) found that first and second grade children who received 7 months of supplementary music and visual arts classes achieved higher standardized mathematics scores than children who received the schools’ typical music and arts training. However, because the two treatments were initiated together it is difficult to determine which intervention, music or art training, may have been responsible for the improvement.

The second study (Graziano, Peterson, & Shaw, 1999) compared the mathematical reasoning (in particular reasoning about ratios and fractions) of second grade children assigned to four groups: (1) keyboard instruction coupled with exposure to a computer game designed to develop spatial-temporal reasoning; (2) English instruction coupled with the same spatial-temporal training; (3) spatial-temporal training only; (4) no treatment. Results indicated that the mathematical reasoning scores of the children whose treatment included the music instruction were significantly higher than those of the children in the other groups. It is unfortunate that the researchers did not include a fifth group of students who received keyboard instruction only. However, this study does suggest that music instruction may enhance reasoning related to certain mathematical abilities, and confirms the role of spatial-temporal reasoning in some mathematical operations.

IMPLICATIONS FOR PUBLIC POLICY

The research reported in this paper has public policy implications. It seems clear that children derive measurable educational benefits from music training beyond those directly related to music. I believe that the results of these studies must be included in music education advocacy efforts. Arguments that emphasize the extra-musical benefits of music instruction are effective and have saved school music programs. Disadvantaged children, whose caregivers can afford neither the time nor the money to provide music lessons, stand to lose the most if school music programs are cut back or eliminated. I suggest that music advocates use all available evidence to convince policymakers of the importance of a music education for all our children.

Nevertheless, I feel it is important to acknowledge the possible dangers associated with an argument of music for math’s sake. Care must be taken to ensure that scientific goals do not displace developmentally appropriate in-
Decisions regarding music education curricula should be based on musical goals only. Consistent with recent recommendations of the National Association for the Education of Young Children (Bredekamp & Copple, 1997), a position statement containing guidelines for the establishment of age-appropriate music curriculum has been published by the Music Educator's National Conference (The School Music Program, 1994). MENC recommends a focus on singing, listening, movement, instrumental instruction, creativity, and music literacy as well as the development of musical knowledge of melody, rhythm, timbre, and form. Musical play is also highly recommended, as is the encouragement of individual creativity. Kenney (1997) outlines specific teaching strategies relevant to these instructional goals for newborns to children aged 8. I encourage scientists and educators to attend carefully to these guidelines when considering the application of these research findings.

John Bruer, president of the James S. McDonnell Foundation and a leader in the funding of educational research, cautions us that "neither neuroscientists nor behavioral scientists have the vaguest notion of how differences in brains translate into differences in IQ or how a brain that can pass third grade differs from one that cannot" (Bruer, 1994). He further comments that "I don't want to discount [brain research] because eventually we will know much more. In twenty years, it's conceivable we will understand the brain circuitry involved in reading, for example, and how learning to read changes neural circuitry as the skills mature." However, today's students and teachers cannot wait 20 years for neuroscience to unequivocally demonstrate the nature of the link between brain function and cognition. The current research suggests that music instruction improves children's spatial abilities, whether due to neurophysiological mechanisms or not. I believe that to exclude this research from discussions arguing for music in the schools is to do a disservice to the children whose lives will be affected when music programs are eliminated. Yes, much more research is needed to provide converging evidence, and no, music is not a panacea for poor academic achievement. However, it seems clear that music has benefits to intellectual development that transcend music itself.

**Teachers' Questions and Answers**

**Q:** You say that the original effect of listening to Mozart on test performance lasted only 10 minutes. What does this mean, exactly? Does it mean that 10 minutes into the test, there was no difference between a group that listened to Mozart and a group that did something else? What if there was music playing constantly say before, during, and after a test, or piped into classrooms constantly, could this limited effect be stretched out? If not, why would such an effect be so ephemeral?

**A:** Our claim that the cognitive effects of listening to Mozart are short-term came from the fact that a 10-minute delay between music exposure and spatial-temporal testing eradicated the enhancement. In delay circumstances,
participants’ scores were essentially the same as when they had been exposed to relaxation instructions or silence. The answer to your question regarding why the effect is so ephemeral ultimately rests in determining the cause of the Mozart effect. There are some data suggesting that the effect is due to arousal, which would suggest that when the music-induced arousal ends, so does the cognitive enhancement. I find this argument plausible, but it does not account for all of the data. For example, my own research finds that other arousing music, such as Mendelssohn, does not improve performance on spatial-temporal tasks. Why would a Mozart sonata improve task performance while a Mendelssohn symphony, which subjects reported as equally arousing, not affect performance? What we need is an experiment in which actual physiological measurements (e.g., heart rate and galvanic skin response) are made of participants before, during, and after exposure to Mozart and other music and also during a subsequent spatial-temporal test. Only then can we determine if arousal is a viable explanation.

Q: You argue very passionately for the importance of music programs. Is your assumption that because music can improve spatial-temporal reasoning, we should use it? Is there actually an advantage to developing these skills indirectly through music, as opposed to teaching children spatial-temporal skills directly, for example, by giving them lots of puzzles to solve?

A: I strongly believe that music should be included in the core curriculum for the beauty and joy it brings into our lives. The fact that music instruction has also been shown to enhance children’s spatial abilities is an added benefit. I am often asked by my own music specialists if there is anything “special” they should be doing to enhance the children’s spatial abilities. I tell them that they should teach the children using their best musical judgment, and the effects will follow.

A study by Gordon Shaw and his colleagues at the University of California, Irvine, directly pertains to the second portion of your question. Shaw compared the spatial-temporal reasoning scores of several groups of children, including one group who received spatial-temporal training alone and another group who received the same spatial-temporal training coupled with piano keyboard instruction. The spatial-temporal training consisted of several months of playing a computer game designed to train spatial skills. The children were then tested using items similar to those used in the computer training. Although both groups scored higher than a group of children who received language or no special training, results indicated that the group who studied the piano along with the spatial-temporal training scored significantly higher than the group who received the spatial-temporal training alone. This is particularly interesting because the children who received the spatial-temporal training alone had twice as much direct spatial-temporal training (via the computer) than the children in the keyboard group. (For example, if the spatial-temporal alone group was given 40 minutes of spatial-temporal computer training, then
the spatial-temporal/piano group would be given 20 minutes of computer training and 20 minutes of piano training.) It seems that adding the music instruction to the training provided the children with an advantage that the computer training did not. Perhaps it is the multisensory nature of the piano instruction, which requires kinesthetic, auditory, and visual skills, that contributes to its effects on spatial learning. Only further research will tell.

Q: Does the Mozart effect work both ways? That is, is there any evidence to suggest that practicing with puzzles or other spatial-temporal activities improves one’s ability to learn music?

A: No one has explored the possibility that spatial-temporal training can improve music learning, although I think it is a feasible hypothesis. I have thought about conducting such an experiment for quite some time, but have encountered major difficulties in the design of the study. For example, what would be a suitable measure of “music learning”? Those of us who study music cognition recognize that learning to play a musical instrument requires an integration of several types of knowledge, physical coordination, listening skills (including aural discrimination for pitch, duration, and intensity), planning skills, and so forth.

I am currently conducting a study with Head Start children to try to separate some of the musical skills that may be affecting cognitive performance. We are providing the children with different types of music instruction (e.g., rhythmic training, singing instruction, and piano instruction) and are then testing a broad range of spatial abilities. I am hoping that the information gained from this study will lead to a better understanding of the components of musical learning that may be contributing to the enhancement. If we can eventually determine precisely which aspect(s) of music learning is affecting spatial-temporal skills, perhaps then we can determine if the effect works both ways.

References


Suggested Reading

