

CHAPTER

1

TRANSITIVITY AT WORK

Five Effective Lessons

Neither the reporting teachers nor the boys found it difficult to identify what they felt worked for them in the lessons they selected as especially effective. Across academic disciplines, teachers and students reported elements of instruction that carried the intended points and resulted in understanding and mastery on the boys' part. These conductive elements are what we call the *transitive* factor in a lesson's effectiveness.

To illustrate this transitivity at work, we have selected five lessons from different academic subjects to highlight in this chapter. The students in these classes range from middle schoolers to older high school boys. Although not all of these classes are tracked by ability level, the boys in them range from modest to high aptitude. The reporting teachers represent schools in both the Northern and Southern Hemispheres, and their years of teaching range from three to thirty-eight.

We selected these lessons on the basis of their variety and because they seemed representative of the tone and substance of the larger sample, many examples of which follow in the succeeding chapters. These five lessons were emphatically not selected because we thought they were exceptional or dazzling. In fact, one of our conclusions from this study is that effective teaching—even

best teaching—is rarely dazzling. Moreover, “dazzling” may be something of an impediment to effective teaching, in that it calls attention to the manner and methods of the teacher rather than to the engagement in subject matter and ultimate mastery on the part of the students. So what follows here is a series of ordinary lessons, notable only for the fact that the teachers who conducted them found them to be especially effective with boys.

We believe teachers everywhere will recognize elements of their own practice—including quite ordinary ones—in the “best lessons” that follow. What makes these lessons effective and best for the teachers and boys reporting them is not that they are anomalous or, in most cases, surprising, but simply that they engaged boys’ attention and energy. In short, they worked.

LESSON 1: “TWICE THE SPEED”: A LESSON ON THE PRINCIPLES OF MOMENTUM

Many of the effective lessons reported in this study required building something, that is, creating a product. A variety of these lessons are included in the next chapter. A New Zealand teacher of technology reported gratifying results in conducting the following lesson with his middle school boys:

This unit of work was based on the F1 in Schools CO₂ dragster project, an international competition for school children (aged eleven to eighteen), in which groups of three to six children (in this case, individual students) have to design and manufacture a miniature car out of balsa wood. The cars are powered by carbon dioxide cartridges and are attached to a track by a thin wire. They are timed by a computer from the moment they are launched to when they pass the finish line. The cars have to follow specific guidelines (for example, the wheels of the car must be in contact with the track at all times). The cars are raced on a 20 meter long track (in the international competition, it is roughly 25 meters) with two lanes, to allow two cars to be raced simultaneously.

The lesson started with an introduction in the classroom to the project and an explanation of the processes involved. This included showing the students the balsa wood billets, carbon dioxide canister, and wheels they were going to use and an example of a completed dragster. They were then asked what main features or key factors they needed to research in

order to start designing and manufacturing their own car. These included aerodynamics, friction, momentum and inertia, surface finish, and some others, and they were written on the board and copied by the boys. Then the boys were asked how fast the car would travel down the track, and a general consensus was met of about 30 to 40 kilometers per hour, again written on the board.

Next, they went into the workshop and formed two lines down each side of the track. Waiting until they had settled down and were paying attention, I explained the mechanics of the start gate, finish gate, and timing system. We use a simple set of microswitches to start and stop two timers with red LED electronic displays. I then converted a predicted speed of 36 kilometers per hour to a time of 2 seconds. Then the example dragster was placed on the track and attached to the wire. The carbon dioxide canister was placed in the back of the car, which was loaded into the start gate.

Then the students were instructed to start a countdown from 3. At the end of the countdown, the spring-loaded firing pin was released with a loud snap and a puff of carbon dioxide. In a second, the car had disappeared down the track and into the finish gate.

When the boys calmed down, the time was checked and converted into kilometers per hour. At less than 1 second, the speed was an average of about 70 kilometers per hour and the maximum was obviously higher, taking into account friction and wind resistance versus momentum.

When the boys returned to the classroom, they analyzed the dragster's performance with regard to identifying the most important factor to achieving a good race time and what they needed to research.

This introduction led into a series of theory-based research lessons that had a practical example to put them into context. The initial demonstration provided motivation to the students to produce self-motivated work and was referred to as much as possible.

In this lesson, the instructor challenges his students to design a model vehicle that will compete with other models to see which can go fastest. The learning objectives are student mastery of a number of physics principles—momentum, aerodynamics, friction—and an understanding of the competition's specifications and the applied construction skills necessary to make and modify the vehicle.

The boys are challenged to predict the speed of their vehicles given their understanding of the principles set out in the exercise. Because teams of boys will construct the dragsters, they will exercise interpersonal skills as well.

A number of factors are transitive to achieving these learning outcomes:

- The stimulus of competition
- The stimulation of interactive exchanges with team members
- Opportunities for physical movement and manipulation of materials
- The drama of the demonstration—perhaps the most transitive component of the lesson. The kind of dragster that the teacher demonstrated not only sped down the miniature raceway; it did so at twice the speed the boys had predicted. The teacher heightened the drama of the demonstration by a simulated countdown to the launch of the car. The demonstration model raced down to the finish line at 70 kilometers per hour—twice the predicted speed. The boys were stirred to the extent they had to be “calmed down” before proceeding to subsequent analysis and tasks.

The demonstration was thus clearly transitive to a variety of learning outcomes. In the narrating teacher’s words, the demonstration was “referred to as much as possible” as the boys undertook their subsequent tasks, which, the teacher reported, had become “self-motivated.”

LESSON 2: RISING TO POWER, RULING THE WORLD: “GAMING” THE TEACHING OF LATIN AND CLASSICAL CULTURE

The teachers participating in this study reported a variety of successes in converting all kinds of scholastic work—from mastering rudiments of foreign language to reviewing extensive sweeps of material before exams—to a game. (The various ways teachers employed games to enrich classroom business considered in Chapter Three.) In this instance, an experienced U.S. teacher of Latin recounts how he and his colleagues converted the school’s eighth-grade Latin curriculum to an extended game:

Our eighth-grade Latin curriculum has been transformed over the past three years. We have attempted to help our eighth graders improve

their transition into our high school Latin program. We created a new textbook that emphasized a grammatical approach while also including longer stories to translate, an introduction to questions similar to the ones the boys would see on the national Latin exam, work with derivatives to improve the students' English vocabulary, and a threefold increase in the number of vocabulary words. We have incorporated daily use of a Smart Board to emphasize the work introduced in our text and enable the students to interact with manipulative exercises. We incorporate work at the board, in partners, in every class. We use PowerPoint productions to show the relationship between what we are reading and studying as it appears in later art and literature.

Each activity has an element of competition to it on a number of levels. First, students strive to move up the *Cursus Honorum* [to honors course level] throughout the year. This is based on the student's average. His picture begins at the rank of "citizen," and he strives to improve his status until he reaches the position of "consul," or leader of his team. Lone perfect scores within a team enable that student to claim dictatorial power until his quiz scores are no longer the highest.

The teams are designated by color, similar to the teams that raced in the *Circus Maximus*. A class is divided into two teams of eight students each. There are six classes and thus twelve teams. These teams compete in a game called *Bellum*. Each quarter, the twelve teams (rotating each quarter) compete in a game of world domination loosely based on the game of *Risk*. With each new quarter comes a new map that represents roughly the time period being studied in their ancient history class.

Each day the teams strive to earn a maximum of forty *denarii* (points), accomplished in a number of ways. Each team's homework is placed on the board after the partners deliberate, questions are asked of individual students, and sight work is completed with the help of a partner. At the conclusion of each class, teams may then use accumulated *denarii* to purchase armies at a rate of ten *denarii* per army. These are placed on the map in an area currently controlled, and movement can then take place—often initiating a battle. Battles are resolved through a comparison of quiz scores. There are approximately two quizzes each week.

At the conclusion of the quarter, the team controlling the greatest number of territories is declared the winner, and prizes are awarded.

In this account, the scholastic aim of building a strong foundation in Latin language and Roman culture is subsumed into a continuing game in which students advance—rise in power—as they master scholastic tasks.

Several transitive factors are at work. The instructor begins with an account of information technology applications—Smart Boards and PowerPoints—that engage boys actively in the material presented.

Transitive competition, both individually and in teams, is built into the entire instructional program. Through the *Cursus Honorum*, gradual student achievements enable students to rise out of the ranks of humble citizenry into positions of power in the Roman hierarchy. The challenges and pleasures of negotiating this passage are transitive to learning not only the structure of Roman society but also its Latin vocabulary.

The Risk-like game *Bellum*, which engages all students in all sections, is similarly transitive to students' learning the geography of the classical world. The many competitive elements in these exercises are complemented by collaborative team interactions as contending teams vie to advance strategically.

LESSON 3: TACKLING—LITERALLY—AN ABSTRACT CONCEPT IN PHYSICS: THE TRANSITIVITY OF EMBODYING

This lesson, from a teacher of beginning chemistry in New Zealand, is an example of the dozens of lessons other teachers submitted to illustrate the effectiveness of active movement in helping students to grasp and retain a wide variety of highly conceptual material:

This is a lesson on reaction rate—in particular, looking at the role of activation energy on the rate of reaction. Normally this topic, although interesting, can be rather theoretical and is difficult for students who are not particularly self-motivated. Although it is possible to show increases in reaction rate using chemical reactions, it is never possible for the boys to see what the reacting particles are doing. Students often do not grasp the behavior of molecules, a concept that is absolutely essential to understanding chemistry.

This activity is best done on soft ground outside with lots of boys and space. The lesson begins by looking at the simple idea that molecules must collide to react. A reaction is modeled by a rugby tackle where the outcome

could be a failed tackle (unsuccessful collision), students (reactants) still standing after collision, or a successful tackle (successful collision, that is, a reaction), where the students end up on the floor. They can play no further part because they are now products.

The students begin by walking around, and therefore most meetings do not involve a successful tackle, so the reaction rate is slow. We next introduce increasing temperature, and the students now run around. The tackles become much more frequent and more likely to be successful because more students have the required energy to tackle (react). This is generally a successful way to introduce activation energy—the minimum collision energy that results in reaction.

It is now possible to introduce the idea of a catalyst, which lowers the activation energy. Half the students are asked to hop around on one leg and are now very easily tackled by the others. We have now decreased the minimum collision energy that results in a reaction. The students will find that everyone gets successfully tackled (reacts) quickly even when the others are walking (low temp). It is even possible to get some students (catalysts) to hold the others in place so they are tackled easily, thus explaining why surface conditions are useful in “heterogeneous catalysis,” the process of holding molecules in place in order to facilitate reactions.

It is now possible to go back to the classroom with motivated students who have a good visual feel for the topic.

This chemistry teacher was concerned about the theoretical and potentially unengaging nature of an important concept in molecular chemistry: the role of activation energy in chemical reaction rates. He was especially concerned that students who were not “particularly self-motivated” would fail to engage and master the concept.

Sensing perhaps an openness to sports play among his students, he devised a workable analogy between a human collision—a rugby tackle—and a completed chemical reaction. The key concept to convey was the necessary energy among chemical reactants to

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complete a successful reaction. The novelty and motor stimulation of simply tackling one another may have been transitive enough to deepen students' understanding of the role of energy in reactions, but the elaborations of the analogy—how increased speed of the tacklers (running versus walking) allowed more successful tackles, how the relative ease of tackling boys who were hopping on one leg was analogous to chemical reactions aided by a catalyst—deepened, and literally embodied, the boys' understanding.

LESSON 4: THE TRIUMPH OF THE NERDS: THE TRANSITIVITY OF ENGAGING BOYS IN A CONSIDERATION OF THEIR DEEP NATURE

A number of effective—and affecting—lessons we gathered were those in which boys were engaged by their teachers in a consideration of their own nature and character. (Many of these are reviewed in Chapter Eight.) In the following lesson, a seasoned American teacher of high school English challenges his boys by advocating for outwardly unattractive underdogs in two canonical school novels:

Nothing gives me greater pleasure than playing advocate for two of contemporary literature's oddballs: Leper in John Knowles's *A Separate Peace* and Simon in William Golding's *Lord of the Flies*. To healthy-minded, optimistic, teenage boys, each of these characters, if not a candidate for the loony bin, is certainly the kind of odd-man-out adolescents dismiss as a "nerd" or "geek." For one thing, both are loners. Neither is varsity material. Leper spends his time collecting snails, drawing pictures of birds, and cross-country skiing in search of beaver dams when he should be working with his classmates shoveling snow to clear the tracks to help the war effort. Simon, another "nature freak," who also has epilepsy, has the odd habit of wandering off into the jungle, which frightens everyone else. He goes to a little hideout where he sits and—of all things—thinks! Neither of these characters is the sort of boy other boys admire. They are tolerated but consistently viewed with barely concealed irritation and suspicion. They are what Thomas Mann called wallflowers: creatures of the margin who fall down in the dance of life. What vigorous, sports-playing, outgoing, college-aspiring boys' boy would want anything to do with them?

I love playing defense lawyer for Simon and Leper, citing on their behalf evidence from the text that their creators, John Knowles and William Golding, respectively, are their secret admirers. Attracted by risk

taking and daredevil acrobats, and just as compelled by an allegiance to fairness, to rendering a just verdict, boys are curious, then, to observe the intellectual gymnastics they think must be required to justify my claim that in the most important sense imaginable, Simon and Leper are the sharpest boys in their books.

The transitivity of a teaching element lies in its capacity to connect an object under study to a student's abiding concerns. Certain books, ideas, and discussion topics—in an emotional climate that is both stimulating and safe—can be inherently transitive to student engagement. Histories, biographies, and fiction that explore universal human concerns—one's true nature, worth, social place—have that transitive potential.

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In this lesson, the teacher draws on distinctive types in two classic novels: John Knowles's *A Separate Peace* and William Golding's *Lord of the Flies*. He is teaching adolescent boys texts about adolescent boys. The transitive potential of identifying with central characters, especially admirable ones, is thus considerable (and why such books become canonical in schools). But in this case, the teacher strikes an additional transitive note. He surprises and challenges his students by celebrating—"playing advocate for"—two characters, Leper and Simon, who, in their respective texts, are marginalized painfully. The teaching objective here is to invite boys to reconsider their standard, reflexive assessments of these characters and begin to appreciate them in a fresh, objective way: to see the quite real merits of these two characters once their "loser" appearance has been dissolved by the teacher's reappraisal.

It is easy to sense the transitivity the boys experience in the pleasure of seeing through earlier, easier perceptions, of the empowering feelings of recognizing and valuing an underdog, and the possible realization that one might be an underdog oneself—and therefore acceptable and valuable.

It no doubt helps to experience this gain in self-understanding in the presence of a teacher for whom "nothing gives me greater pleasure than playing advocate for two of contemporary literature's oddballs."

LESSON 5: SUFFERING SLAVES: THE TRANSITIVITY OF DRAMA, NOVELTY, AND SURPRISE

In Chapter Nine we consider a variety of ways teachers make effective use of engaging students by expanding their expectations of a typical classroom experience. In the following lesson, an experienced teacher of “extremely low-ability” New Zealand seventh-grade social studies students succeeds in engaging them in a consideration of the American slave trade through a thoughtful—and uncomfortable—variation in routine:

I had an extremely low-ability year 9 [thirteen-year-old students] social studies class a few years ago. We were studying the slave trade, and specifically the voyage from Africa to America. I sensed that the boys had gained no real understanding of the horrific nature of the voyage. The text we were using was dry, and the language was perhaps pitched a little too high, so I decided to take a different approach.

Without any real preparation or lead-in, I instructed the boys to group their desks together in a solid block. Then they had to climb under their desks. They had to make sure that their entire body fit within the boundaries of their desk. I joined them, under my desk. Once they were in place and settled, I told them to close their eyes. I told them to imagine that they were slaves, chained and stuck in this tiny space for six weeks or more. They were on the middle of the fourth deck, with hundreds of other slaves packed above, below, and beside them like human sardines. I described rough seas, forcing the sailors to keep the hatches closed; slaves vomiting, urinating, defecating as they sat chained in the dark. I talked about fellow slaves dying next to them and starting to decompose in the hot and humid conditions. The language I used was graphic, at times profane. I conjured up images of the most horrific sights, sounds, and smells. Within two to three minutes, we were all extremely uncomfortable, and the boys simply had to cope. They didn’t make a sound apart from some rustling and jostling of desks even as the discomfort levels rose. All up, we were under the desks for something like only ten minutes, but everyone was greatly relieved when we finally came out.

The follow-up activity was a piece of empathy writing. The students were asked to imagine that they were sixty years old, having lived in the

United States as slaves all their adult lives, and they had to describe their slave ship experiences on the voyage to America to their grandchildren who had been born into slavery in the United States. This was arguably the best piece of empathy writing that the class produced all year.

The teacher notes at the outset the “extreme low ability” of this class, although few early adolescents are likely to appreciate the excruciating awfulness of the oceanic crossing of African slaves, especially if conveyed in dry textual print.

The teacher senses the need to close the gap between the events narrated and the boys’ own experience. A number of factors were transitive to the boys’ producing what their teacher thought was their most expressive, empathic writing of the year. As in several of the previous examples, this lesson involved motor activity. The boys got up and moved their desks and then confined themselves beneath. Moreover, the instruction to do so was a novelty, a surprise, dissolving the boundary between typical class work and inventive play. In addition to leading the boys to a physically new and surprising condition in the classroom, the teacher guided their imaginations with a vivid, even “profane,” account of the horrors below decks on a slave ship. This was not only dramatic; the drama was embodied to the point of discomfort. The drama, novelty, and surprise of this lesson, including the element of embodiment, were transitive to the boys’ engagement in the historic experience of the slaves—to the extent that these boys of extremely low ability were able to produce especially successful written accounts.

The rest of the chapters feature many more lessons, most of them transcribed in their entirety, to illustrate the range of methods and the transitive elements at work in them. Practicing teachers will undoubtedly see aspects of their own approaches at work and may perhaps view them with a heightened sense of why such approaches are especially effective with boys. Teachers may also sense the promise in approaches that they have not previously considered. Whatever the case, teachers of boys are likely to recognize the voices and intentions of these colleagues who have reported their best lessons.

