Teaching Meaning

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What Works When Telling Isn't Enough

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Dedicated to my wife Blanca, and my sons Leo and Noah

Contents

A different game

During my teacher training, I came across an unfamiliar book that I had found through a passing citation in a paper. I was convinced by what I read. The book described how a humanities department in an English school had transformed its geography education. Their results on standardised tests had vastly improved, and their students acted with greater independence and motivation. The parents also saw a positive change in their children's behaviour.

The book was a case study of their classroom method, one that many might classify as problem-based learning. It drew me into one side of a debate. You couldn't just tell students, I had thought. They needed a reason to be actively engaged with what they were learning and to think critically about ideas. I was convinced; learning should be student-led.

Yet, I started my first teaching role in a school where the staff and students didn't necessarily share that vision. My attempts to fit it into our lessons mainly failed. Around the same time, however, something new emerged. Teachers in England began to gather on social media, and the networking of ideas grew without preced-

ent. I was soon awash in a tide of blog posts that challenged the status quo. Teachers defended their views by appealing to scientific studies, and this felt convincing. When the tide receded, a set of ideas emerged arguing that discovery, problem and project-based learning were ineffective pedagogy. Many terms, such as inquiry and critical thinking, fell into disgrace. I swung hard the other way; learning should be teacher-led.

It wasn't long, though, before I was again disenchanted. What was missing? My breakthrough came when I realised the debate wasn't about absolute truths, but *what works* according to some selected *rules*.

Teaching is complex, and we adopt rules to help us organise ourselves. We're responsible for the learning and behaviour of more than twenty students (who are somewhat coerced into attending school). These students bring varying personalities, moods, emotions, values, understandings and difficulties. Drowning in the chaos of this complexity makes it impossible to act with any guarantee of success. So, we simplify to a set of rules that work for navigating our context.

Rules, then, are *tools* for predicting the likelihood of events and help us make sense of what we see and experience[1]. And there are a couple of rules that offer a way out of the teacher-led or student-led debate.

Seen this way, teaching resembles a game.[2] Consider chess, for example. There are a limited number of rules that constrain what you can do, but this limitation makes the game workable. I'm not referring to any *fun* aspect of games, but rather the framework they provide for *action*. In the teaching community, the rules of the game are not as clearly defined as in chess, and they indicate probabilities rather than absolute certainties. They help us *act* by

implying what's possible and warning what's likely to fail. The difference between teacher-led pedagogy and student-led pedagogy is just different rulebooks.

One game prioritises the rule of cognitive load, limiting what students explore to prevent them from becoming overwhelmed. The other prioritises the rule of active construction, limiting direct instruction to foster critical thinking. Both games work according to their own logic, but both are incomplete.

The major transition for me was grasping a law of learning that had been hidden from my view. It's rarely mentioned in the communities I engaged with, yet it's a fundamental law with the power to create a distinct teaching game with its own set of *moves*. I've explored this game's moveset over many years in the classroom and refined my understanding of the steps. In this book, I'll share my knowledge with you.

The law, as I'll explain, says that meaning can't simply be transmitted into our students' minds. Meaning can be used in different ways. Sometimes, for example, if something is meaningful, people consider it a synonym of worthwhile. I'm not using it in this sense. I'm referring to the answer to the question, "What does that *mean*?". This is what I'll explore in the following chapters, drawing on insights from enactive cognitive science.[3]

My teaching repertoire begins with the most basic and intuitive of all moves: communicating. This move shows and tells. Yet there's a predicament: if meanings can't be transmitted, what works when telling isn't enough? If we want our students to think *with* what they learn, we'll need classroom moves that provoke them to *make meaning* of what any fact means for their world. To address this, the following chapters add crucial moves to the teaching playbook.

While this book does share practical insights, it *isn't* a book of teaching tips and tricks. It shares a distinct perspective on learning and its effect on how we teach. The argument unfolds gradually and continually folds back on itself. So you'll get the most value by reading from beginning to end instead of skimming. Here's what I want to share with you:

In ***Chapter 1***, I'll explain *why* meaning can't be transmitted and must necessarily be enacted by the learner. By the end of it, you'll understand the rule and be able to explain it to any doubting teachers. Then we'll explore the implications for teaching. The natural starting point, in ***Chapter 2***, is an explanation of how we can trigger the process of making meaning in our lessons. The fact that *meaning must be enacted by students* presents a tension between arriving at the *correct* answer and exploring the new meanings. ***Chapter 3*** deals with how this tension can be resolved.

Chapter 4 presents the second rule whose implications overlap with those of the other chapters: A student's capacity to engage MUST AT LEAST MATCH the complexity they face. By following its implications, new teaching moves will be revealed, and others will be vetoed. ***Chapter 5*** takes our exploration of meaning to the level of the curriculum and what students actually learn. While the curriculum has content, students learn about it via their teacher, who holds their own meanings of the content. Rather than just content, students would benefit from a curriculum that explicitly models the content in a way that makes sense to the teacher. I'll explore what this means for teaching and designing curricula. ***Chapter 6*** concludes the exploration of the law of meaning by contending the idea of optimisation in education. ***Closure*** offers a few thoughts on the concept of rules, moves, and teaching games.

CHAPTER 1

Rule One: Meaning is enacted; it can't be transmitted

As a young teacher, I experienced a mid-lesson crisis. A predicament, I would come to realise, that had always been there, hidden from view. I was about to teach my 11-year-olds about living cells, invisible entities so small and strange that we can hardly conceive them. I was excited. Picture the honour of exposing children to a world beyond their imagination. But something went wrong. I went through the usual teaching moves; I drew diagrams, showed images and many examples. I was clear about any new vocabulary. Yet, the anticipated amazement never arose. Instead, sitting slumped with glazed eyes, I witnessed my students stare into the abyss of meaninglessness.

In a flash of sudden insight, I realised that all my students heard were peculiar sounds (nucleus, mitochondria, membrane), and all

they saw were curved shapes in a diagram. That was the moment I perceived the distinction between communication and meaning. I felt stupid. I realised it was impossible for all the meanings I had made about cells to somehow travel through the air on the back of a spoken word or description. Think about this definition: Mitochondria are the sites of cell respiration that provide energy to the cell. A student may be able to recall and repeat this definition, but do they know what it *means*?

In that lesson, I immediately downed tools, scrapped the plan and embarked on something new. It was obvious; my repertoire of teaching moves was no longer satisfactory. A new fundamental rule began to form in my mind, and I had to act accordingly. This law of learning, when adopted, transforms every classroom interaction and decision.[1] Its effects show up everywhere in our profession: from lesson explanations and classroom relationships to curricular design and the organisation of our schools.

As I mentioned in the introduction, think of it as the first rule in a game I'm about to unfold. By the end of this chapter, you'll grasp the rule and begin seeing which actions it permits and which it forbids. In the chapters that follow, we'll explore its consequences in practice, deriving both a ruleset to guide meaningful teaching and the moveset it makes possible. Neither will make sense, though, without first understanding the rule itself. Though not widely recognised, it's deceptively simple; an anecdote brings it to light.

In the 19th century, the telegram was the latest technology for long-distance communication. A telegraph involved transmitting electrical signals down a wire using a code of some sort. Morse code is the prime example. It encodes characters into distinct patterns of dots and dashes. A telegraph was charged by the number of characters, and many people were keen on keeping their messages as short as possible. In the (maybe apocryphal) anecdote, a person

sent a message consisting of a single character: "?". They then received a reply: "!". But what did the messages mean? Aside from their celebrated brevity, the communications reveal a key distinction: the signal sent is separate from its meaning. In other words, within a shared culture, we can all agree on the signal (a question mark is a question mark) but not necessarily agree on what the sender had in mind. In this anecdote, the question was sent by Victor Hugo. Having recently written *Les Misérables*, he inquired about its sales by sending the character: "?". *Assuming* he had understood, their publisher replied with the "!", which we can guess communicated "great success in sales". Yet, if anyone else were to read the signal out of context, the "!" would be meaningless. We could speculate a list of possible meanings, but the intended meaning remains obscure. Teaching, I began to see, was full of signals exchanged with uncertain interpretations.

By the mid-20th century, information theory would formalise the distinction.[2] Only signals could be transmitted in a communication; the meaning of that signal couldn't travel with it. Instead, the meaning had to be *made* by someone on the other side of the transmission. In the context of the telegraph, this feels intuitive, especially if you were to receive a collection of dots and dashes. Yet, the idea of signals was generalised beyond electrical signals in a wire. All forms of communication involve signals, including the principal tool of teaching: spoken words. A telegraph uses an electrical signal travelling down a wire, words amount to sound waves that propagate through the air, or symbols on a page that we sense as light waves.

How can students make meaning of new vocabulary if meaning doesn't come with the signal? According to many images found in teaching guides, information simply flows into a student's eyes and into their brain's memory storage.[3] This removes the distinction between the information and its meaning. Both

appear to enter the brain as one entity. With these diagrams, we can often find metaphors for a *flow* of information, and learning difficulties are described as obstacles to it; there are bottlenecks, chokepoints, and pitfalls.[4]

This perspective has a history. In the 17th century, the Nuremberg funnel depicted a child having knowledge poured through a gigantic funnel into a hole in their head.[5] It's now a common idiomatic expression in German-speaking countries. In a similar vein, in English, people speak of spoon-feeding information or even drumming an idea into the head. Teachers may complain that "nothing's going in". At the beginning of the 20th century, Jean-Marc Côté's vision of futuristic schools involved students connected to electrical wires.[6] The teacher, in his image, fed books into a machine which then transmitted them directly into students' brains.

By the mid-20th century, the idea of *faultless communication* arose in teaching theory.[7] This suggests that teachers should design their explanations to be logically faultless, and if this is the case, they will be faultless for all students. Faultless communication supposedly confers teachers the power to dissolve the distinction by perfectly designing a communication in which meaning is transmitted.

If this perspective is taken to heart, priority can be given to the teacher's explanation, and we can simplify our world to just our teaching actions. We can script our explanations word for word, curate diagrams perfectly, and arrange activities in a flawless order. And be satisfied with our efforts, for we have created an impeccable explanation without needing to worry about anything else. Amid the complexities of classroom teaching, the idea is very seductive. For a time, as a novice teacher under pressure to improve my students' achievements in standardised exams, the idea tempted me also. When things feel out of control, it offers a feeling of order and engineerability.

But think about it this way, if the communication was believed to be *faultless* but the student didn't grasp the meaning, what is the reason? Following the premise, all we can do is blame the student. Either they weren't paying attention, or they must have been thinking about it incorrectly. In other words, this paradigm attributes misunderstandings to faulty reasoning and flawed intellect. But is it right? To understand why my students' eyes glazed over, I had to go all the way down to the very limits of what nervous systems can do.

The biology of cognition does just that; it offers a perspective on learning that considers the possibilities and limitations of nervous systems.[8] The nervous system is composed of cells within a living organism. This limits what can be done because cells can only do certain things. In particular, the cells of the nervous system show limits that also imply a distinction between signals and meaning.

Think about a time you've been splashed by water on the back of your leg. What did you notice? Whenever I ask this question, the first reply is that it felt wet. If this were true, it would mean the neurons could somehow sense water and send a message to the brain, signalling water's presence. When I ask what wetness feels like, they eventually realise that they detect a sudden temperature change and maybe a slight pressure change. The sense of wetness was the meaning they had ascribed to the sensation. This mirrors how words in an explanation are only signals we detect in vibrations. The meaning of those words is something assigned by the whole system.

Think of single neurons as decision makers that send a clear "yes" or "no" signal.[9] They detect simple signals like pressure, temperature, pain, stretch, sound vibrations, or light. If a change is too small, they don't send any signal; a "no". But if a stimulus passes a certain threshold of importance, the neuron fires a signal, sending a "yes" to the rest of the nervous system. Stronger stimuli lead to more frequent signals, like the neuron "shouting". Yet all a neuron

can do is detect and signal "yes". It's the nervous system as a whole that must then make sense of what that "yes" means.

When water hits your leg, there is nothing *about* the environment in the signal the neurons produce. The neurons can only signal, "temperature change, here" or "pressure change, here", depending on their type. If, for example, we located those neurons and zapped them with electricity, they wouldn't say "electricity, here". One would say "temperature change, here", the other would say "pressure change, here".[10] Think about how chilli peppers trigger sensory neurons that signal hotness even when the food is cold. Or how peppermint oil triggers sensory neurons that signal coldness, despite being in a hot chocolate.

There's a deep truth behind these examples: no messages enter the nervous system. Signals (like classroom communication) can only trigger the nervous system to act in its own way. From there on, the nervous system, as a whole, must make meaning of the signals. Unlike what some popular images imply, signals don't flow into a passive brain like parcels entering a sorting station.[11] Instead, the brain is continually active in making sense of its senses.

It's like the biological version of the English proverb, "You can lead a horse to water, but you can't make it drink." We can't control the horse's nervous system.[12] We can only create the conditions in which it's more likely for the horse to drink. Likewise, our communications can't govern our students' meanings. But we *can* create the conditions for fruitful learning to emerge.

Information theory and the biology of cognition highlight a fundamental distinction between signals and the meaning a person creates. This means we can't "just tell" students something and expect them to share the same meaning we live by. Yet, you may be imagining times when students have read a textbook or watched

an explanation and have appeared to have "learnt". How can we explain these experiences?

Paul Watzlawick offers a helpful distinction.[13] As humans with similar senses, we typically agree on the trivial details we perceive. For example, statements like "the light is turned on," "there is a pine tree in their garden," or "the diagram says [these words]" are rarely worth disputing. These form the basic details of what we sense. Learning in schools involves these details, but frequently, assessments only test the ability to recall them.

The deeper, more interesting part comes from the meanings we associate with those details. When students hear words in an explanation (their first-order reality), they must create their own meaning from them (their second-order reality). If the intended meaning can't accompany the words, students have no choice but to interpret them based on what they already know. In this book, I'll continue to refer to this distinction as "the details" and the "meanings". This is the first rule of my game, the law of meaning:

> ***Meaning is enacted and can't be transmitted.***

Yet sometimes students *do* bring forth a similar meaning when just reading a textbook or watching an explanation. Does this break the law? No. Any new meanings depend on a person's knowledge and the meanings they already hold. When Victor Hugo sent a single "?" to his publisher, he understood because they already shared pertinent meanings.

The more people think alike and understand one another, the more likely they are to grasp the intended meaning. Which is good news for teachers. Yet, the publisher still had to make sense of the message himself. And Victor Hugo was still left with the doubt whether he'd perceive the intended meaning.

Misunderstanding isn't faulty thinking

You can see the law's value immediately when asking why misunderstandings happen. The paradigm of faultless communication would say they're due to faulty reasoning; the students aren't thinking correctly enough. It suggests that correct signals (and their meaning) can enter students' brains and then, somehow, be processed incorrectly. The bizarreness of this explanation becomes obvious when applied to children. When a child replies to an explanation with something unexpected, everyone may giggle. But no one assumes they have faulty thinking, just that young children perceive differently from adults.

The biology of cognition agrees. Misunderstandings result from a difference in perception. Students will think perfectly rationally with the meanings they've made; there's no faulty processing. But, because people have different knowledge, values, feelings, and ways of seeing, the meanings they make of communications aren't guaranteed to be the same.

> *A misunderstanding isn't due to faulty reasoning, but a difference in meaning making.*

There's an upside to this fact; teachers *can* infer the meanings their students have made by how they respond and act. It also sheds light on an old argument.

Is there discovery learning in explicit teaching?

When lured by the promises of teacher-led methods, I was regularly pulled into debates on the idea of discovery learning. I hadn't yet considered the idea of meaning, let alone developed a teaching game based upon it. Back then, it was content that mattered; to understand more, students just had to know more. I can see now how, by building a game from this rule, it was easy to slip into disputes. It used to be obvious: if the path to understanding is paved with knowledge, then just supply the knowledge in the right order.

A very different perspective emerged once I adopted the law of meaning. Explicit teaching and discovery learning share a deep similarity. In neither can meaning be transmitted into students' minds. Whether it's a textbook, webpage, chatbot, or a teacher's explicit explanation, the idea of "just telling" students only shares details. Students will still need to make meaning of those facts for themselves. All teaching styles, therefore, share the same fundamental problem. Rather than a dichotomy between "telling" and "discovering," teaching in any form can be seen as a process that must trigger meaning making.[14]

Meanings themselves aren't things that exist "out there" in the world. They're profoundly individual, formed throughout a unique life. Yet no matter the rich meanings I associate with certain words, when I use them in speech, only the word can be sent in

communication. There's no wonder we're frequently misinterpreted during lessons.

If we "just tell" students our understanding, they have no choice but to interpret it through the lens of their own knowledge, values, and ways of seeing. Think about it this way: how could a teacher "just tell" students what it felt like to experience the bombing of Dresden, or live on an ancestral Pacific island about to be lost to rising seas?[15]

There's a famous study showing this.[16] Its participants read a Native American story and were asked to recall it several times. Each recollection, however, tended to alter the story ever more to fit their cultural background and understanding. This occurs whenever I teach students about nutrition, a topic that is common in every household. Their new understandings emerge through ongoing interactions with their preexisting world of meaning. When I ask them about their ideas months later, I notice how they've changed form compared to the answers they gave in my original lesson.

Students hold meanings based on their experiences

I vividly recall a lesson I gave a long time ago. It was on how plants transport sugars from leaves to other areas of their bodies. Plants are often alien to students, and we delved deep into their molecular-level world, a place of little meaning. Yet, I was still charmed by the rule that understanding is just knowing the facts. I delivered my explanation with an immaculate order of images and descriptions. Then, I had my students answer a set of short-answer closed questions. The type of question that just asked for the facts.

My students performed poorly, so I explained again and had them try the questions for a second time. Better but not quite good enough, we went for a third round in which they could finally reproduce most of the answers accurately. I'm sure I remember this lesson due to its deeply unsatisfactory flavour. How would my students' experience have been different had I played by different rules?

Ezequiel Di Paolo describes acts of sense-making as producing f/acts: a deliberate fusion of "fact" and "act".[17] These are moments when we act in the world to bring forth the facts and meanings we live by. They help us navigate familiar situations and feel right in our everyday lives. They're not necessarily *true*; we hold them because they work and explain the world we know. Only when there's a mismatch between what we expect and what we experience do our meanings break down. Then, we're compelled to

interact with the world to make sense of what's going on and get a fresh grip, a new meaning.

I once saw this with a student helper at a science fair, who disagreed with my chosen winner. They insisted the winner was wrong because evaporation couldn't be caused by wind. For them, it didn't make sense. Wind cools, and to evaporate water, you need heat. By their age, they had experienced the cooling feel of windblown wet skin. But they didn't realise that the wind caused evaporation, and the evaporation caused the cooling. They hadn't made meaning of the scorching summer winds of a heat wave. As they hadn't experienced a breakdown in their understanding, they held it tightly.

I experienced it myself one winter while living in Andalusia. My friend insisted her shaded street remained cold even at midday, but that didn't make sense to me. Surely, I thought, warm air from an adjacent sunlit road would blow in. When I finally visited one midday, the chilliness surprised me, and my explanation broke down. I had overlooked the sunlit bricks and stone, which emitted the warmth missing from my friend's street. In that encounter with reality, a new meaning emerged.

In other words, we're provoked into generating new meanings when the world resists our existing grip.[18] Throughout this book, you'll find anecdotes narrating other breakdowns in my teaching and the new meanings I made as a result. But, if this were all there were to making meaning, how could we ever teach successfully?

We make meaning through conversing

The distinction between communications and meanings poses challenges for teaching. A teacher's explanation of a concept could, in principle, prompt each student to draw unique meanings. Some teachers might worry that this makes learning sound like it's happening only "inside the head", disconnected from the real world.

But here's the key: the world pushes back. We all know if there's a tree in our garden. It blocks our view of what's behind it, and opposes our attempts to walk through it. As it resists our acts, it becomes a fact.[19] The same is true for the meanings we make. Our meanings also meet resistance when we converse with others, as they may not understand or agree with us.

Imagine two people meet who believe that only their meanings are real. An argument might develop about who's right. Eventually, they may accept a different perspective; they're both real.[20] At this moment, they can begin conversing about their world. They can communicate ideas and agree on what to call them. From this, a common vocabulary emerges to describe the world they build together in conversation.

We do the same in our lessons. Our role is to help students perceive new things; we show and tell them about the world we perceive. As we do so, we share the words we've used to name things. The difference between everyday conversation and

classroom teaching is that our task is to ensure students perceive the meanings we hold.

In addressing this problem, Gordon Pask developed his conversation theory.[21] Figure 1 shows an overview. It depicts a lesson as a continuous dance of teachers and students. They exchange ideas through actions and utterances, each adjusting their understanding in response to the other. As meaning can't be transmitted, communication can have two possible consequences. Either the participants reorganise their understandings in some way, or they mostly talk past each other. Pask only considered the former a type of conversation.

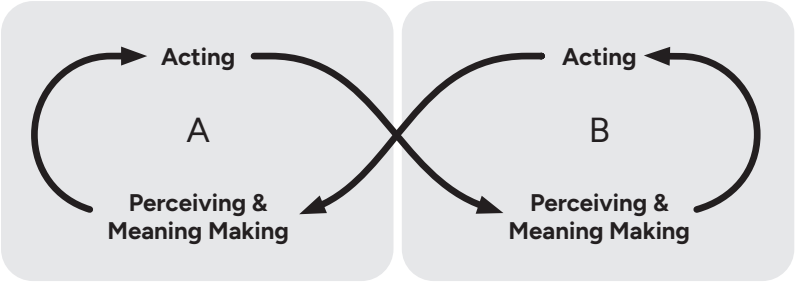

Figure 1: An illustration of how a conversation occurs in which two interactants become entangled in communication.

Conversations are built on communication, but the two are distinct.[22] In the introduction, I presented communication (which includes telling, exemplifying and demonstrating) as the most basic and intuitive of teaching moves. The value of communication is in its *clarity*.

Conversations arise when two participants become entangled in communication. Their value lies in sharing, generating and coordinating meanings. Conversations don't just check under-

standing; they're where teachers and students literally bring a shared world of facts into being. Conversing, then, is a basic move in teaching meaning.

The distinction is often observed in classrooms:

- A poor explanation by a teacher (the communication) may prompt a talkative class to ask lots of questions (the conversation).
- A carefully designed explanation (the communication) may be given to a keen and attentive class. But little discussion (the conversation) takes place between students and the teacher to check their understanding.

Pask thought that the information age, networked computers and the internet had endangered conversation.[23] I fear that classroom technology has pushed lessons in a similar direction. The ability to project slide decks and virtually any video has actively hindered conversation.

The distinction follows my own trajectory. At first, I focused too much on communication; only later did I prioritise communication and conversation in equal measure. In my early experiments with student-led learning, I would emphasise the importance of students reading and thinking for themselves. If they asked questions, I would ask them to think harder rather than converse. Later, with teacher-led lessons, I focused on delivering an explanation via a slide deck. Then, I projected questions and expected students to mark their own answers. The ability to meticulously predesign the communication impeded any conversation.

Whether it was a student-led or teacher-led activity, I had created a separation between myself and my students. How would I ever know the meaning that my students were making? And how could

I ever work towards a *shared* meaning? Pask advocated asking students to explain their understanding back to the teacher. He called it "teachback". The reason Pask spelt it as a single word (without a space) was to relate it to "feedback". In its original meaning, feedback refers to loops of activity. In classrooms, teachers act, which causes the students to respond, whether that's answering a question or simply changing their facial expressions. The students' responses feed back to the teacher, who then decides how to act, and so on, in a continual spiral.

Conversation theory depicts a classroom of looping interactions that generate meanings; conversing until there's agreement (or disagreement) on a meaning. This doesn't have to be entirely spoken; it could involve diagrams, photos, videos, physical demonstrations, or written text. It also includes hands-up voting, a frequent move in my classroom that encourages wide participation, something I'll return to in Chapter 3. It paints a picture of a lesson in which a teacher must prioritise *both* basic moves: communicating (a good explanation) and conversing.

When I designed slide decks or student-led activities, the lesson trajectory was premeditated. I knew how I wanted the lesson to unfold, and I'd make sure it did so. When I began to embrace conversation, I had to abandon this ideal. As I taught, I couldn't foresee the meanings that my students would make, and as we conversed, the lesson trajectory became more organic. By allowing my actions to be determined by my students' responses, the separation between us was blurred. This isn't to say that I no longer prioritise the design of my explanations. It means that I expect to be surprised by my students and embrace the idea of adapting to their meaning making.

From that pivotal moment with my Year 7 students and glazed eyes, I sought a new game with distinct rules and moves. It's

been a long journey of reading, researching, trialling, failing and succeeding. Only now is it easy for me to see that the first rule of my game is that meaning can't be transmitted. It says: *Don't bother thinking that you can just tell students what it means.* By following the rule's consequences, I established conversation as a basic move in my playbook.

Yet, we only become proficient in a game when we've explored what moves are feasible and effective, and their appropriate timing and importance. There's much left to discuss, and it's time to tackle a pressing implication: How can we prompt students to make meaning during our lessons?

Ready to read the rest?

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