

# **MAKING THINKING VISIBLE: USING THINKING ROUTINES TO FOSTER STUDENTS' UNDERSTANDING**

## **Chapter 1: Unpacking Thinking**

According to the Oxford English Dictionary, there are somewhere in the neighborhood of a quarter of a million distinct words in the English language—if one uses a somewhat strict definition of distinct words, that is ("Facts about language," 2009). Of course, of this vast number of linguistic options we use only a small percentage on a regular basis. It is estimated that a mere 7000 words account for 90% of our day-to-day usage. With these numbers in mind, where do you imagine the word "think" resides in terms of frequency of use? That is, with what relative incidence do you believe you use, hear, or read the word "think" each day? What rank does it hold in our average use? Does it make the top 1000 or is it much further down the list?

Drawing on information from several lists, "think" as a word ranks somewhere around the top 125 to 136 in terms of frequency in print (Fry, Kress, & Fountoukidis, 2000; Most frequently used English words, "). If one considers just verbs, Oxford English Dictionary rates the word "think" as the twelfth most used verb in the English language! Clearly the word "think" plays an astonishingly prominent roll in our speech and writing, but for all this usage how well do we understand what it actually means to think? When we use the word "think," what meaning do those listening to us infer? When we tell someone we are thinking, what is it we are actually doing? Although no data is available, one might expect the word think occurs even more frequently in classrooms. When teachers use it, what do they intend?

When students hear it, how do they interpret it? Does it lead to any actions on their part?

If we want to support students in learning, AND we believe that learning is a product of thinking, then we need to be clear about what it is we are trying to support. What kinds of mental activity are we actually trying to encourage in our students, colleagues, and friends? When I ask teachers in workshops, “What kinds of thinking do you value and want to promote in your classroom?” Or, “What kinds of thinking does that lesson force students to do?” Most teachers are stumped. They simply haven’t been asked to look at their teaching through the lens of thinking before. They ask their students to think all the time, but they have never stepped back to consider just what it is they actually want their students to do mentally. However, if we are going to make thinking visible in our classrooms, then the first step will be for us as teachers to make the various forms, dimensions, and processes of thinking visible to ourselves.

### **Beyond Bloom**

When I ask teachers to identify the thinking required in their lessons, I frequently get the response: “Do you mean Bloom’s taxonomy? Is that what you’re after?” Most teachers have learned about Benjamin Bloom in their teaching training course. Although his taxonomy focused on three domains: affective, psychomotor, and cognitive; it is the cognitive domain that most teachers remember. Bloom identified a sequence of six learning objectives that he felt moved from lower order to higher order thinking: knowledge, comprehension, application, analysis, synthesis, and evaluation. However, these ideas were just a theory and not based on research on learning. Nonetheless, they have become codified into how many teachers are taught to think about thinking. Teachers are often admonished to make sure some of their questions or lessons require the “higher levels” of thinking, though generally this is taken to mean anything above comprehension.

Although Bloom's categories capture types of mental activity, and thus are useful as a starting point for thinking about thinking, the idea that thinking is sequential or hierarchical is problematic. Bloom suggests that knowledge precedes, comprehension, which precedes application and so on. However, we can all find examples from our own lives where this is not the case. A young child painting is working largely in application mode. Suddenly a surprise color appears on the paper and she analyzes what just happens. What if she does it again but in a different place? She tries and evaluates the results as unpleasing. Continuing this back and forth of experimentation and reflection, she finally finishes her work of art. When her dad picks her up from school, she tells him about the new knowledge of painting she gained that day. In this way, there is a constant back and forth between ways of thinking that interact in a very dynamic way to produce learning.

In the 1990's, two of Bloom's former students revised his taxonomy and a new list was published using verbs rather than nouns. However, the idea of a sequence was kept. Moving from lower to higher order skills, Anderson and Krathwohl identified: remembering, understanding, applying, analyzing, evaluating, and creating. Once again a potentially useful list, but it remains problematic if one takes it as a set sequence to guide instruction for learning. Looking at the thinking actions Anderson and Krathwohl associated with these six, one might question whether the "testing" they say is involved in evaluating is really more difficult or higher order than the "describing" they list under remembering. For instance, looking carefully to notice and fully describe what one sees can be an extremely complex and engaging task. Such close observation is at the heart of both science and art. Analysis and speculation depend on careful noticing {Lee, 1998 #430}. Our colleague Steve Siedel, has written about both the importance and challenge of description when looking at student work. Because the mind is designed to detect patterns and make interpretations, slowing it down to fully notice and just describe can be extremely challenging.

On the other hand, one can test the ability of a paper airplane to fly, the accuracy of a proposed mathematical algorithm, or the strength of a toothpick bridge pretty quickly and easily.

What these examples illustrate is that it makes little sense to talk about thinking divorced from context and purpose. Furthermore, the idea of levels might best be considered with regard to the thinking itself. Rather than concerning ourselves with levels among different types of thinking, we would do better to focus our attention on the levels or quality within a single type of thinking. For instance, one can describe at a very high and detailed level or at a superficial level. Likewise, one can simply test something out to determine if it will fail or one can fully test the limits and conditions of that failure. Analysis can be deep and penetrating or deal with only a few readily apparent features. Watch any major television news show and contrast it to the more in depth stories one might here on radio and see in print, and you will see different levels of analysis at play.

One can argue that there is a bit of category confusion in both of the Bloom's lists as well since not all seem to operate at the same level. This can most readily be seen in the way "understanding" is framed. Over the last 25 years many researchers have focused on the complexities of teaching and learning for understanding, as opposed to just knowledge retention (Bruner, 1973; Gardner, 1983, 1991; Skemp, 1976; Wiske, 1997). Some researchers have made the distinction between deep and surface learning (Biggs, 1987; Craik & Lockhart, 1972; Marton & Saljo, 1976). Surface learning focuses on memorization of knowledge and facts, often through rote practices, whereas deep learning has a focus on developing understanding through more active and constructive processes. Today, most educators would argue that understanding is indeed a very deep, or at least complex, endeavor and not in any way a lower-order skill as the revised taxonomy suggests (Blythe & Associates, 1998; Keene, 2008; Wiggins & McTighe, 1998). Indeed, understanding is often put forward as a primary goal of teaching.

Research into understanding, much of it conducted with our colleagues at Project Zero, indicates that understanding is not a precursor to application, analysis, evaluating, and creating but a result of it (Wiske, 1997). Recall the brief illustration of the young girl painting mentioned earlier. The understanding or insight she develops into painting are the direct result of much and varied activities and the associated thinking that went along with that activity. Thus, we might consider understanding to not be a type of thinking at all but an outcome of thinking. After all, one cannot simply tell oneself to understand something or direct one's attention to understanding versus some other activity. Ellin Keene (2008) writes about the complexity of the process of understanding in the process of reading and the need to develop explicit thinking strategies to support those efforts. Likewise, James Hiebert et al (1997) write about how learning mathematics for understanding is fundamentally a different task than memorizing procedures.

The same argument put forth about understanding, that it is a goal of thinking rather than a type of thinking, applies equally well to the process of creating as well. How does one go about the process of creating anything? It is not necessarily a single direct act but a compilation of activities and associated thinking. Decisions are made and problems are solved as part of this process. Ideas are tested, results analyzed, prior learning brought to bear, and ideas synthesized into something that is novel, at least for the creator. This creation can be simplistic in nature, the child creating a new color; useful, the invention of a new iPhone app; or profound, new methods of producing energy from never before used materials.

As these brief critiques point out, the idea of levels is problematic when it comes to parsing thinking and ultimately less useful than one might hope. Thinking doesn't happen in a lockstep, sequential manner, systematically progressing from one level to the next. It is much messier, complex, dynamic, and interconnected than that. Thinking is intricately connected to content; and for every type or act of thinking, we

can discern levels or performance. Perhaps a better place to start is with the purposes of thinking. Why is it that we want students to think? When is thinking useful? What purposes does it serve? We pick up on these issues in the following section

### **Beyond Memorization, Work, and Activity**

In the preceding discussion of Bloom's taxonomy, I made the argument that understanding isn't a type of thinking one does but is in fact a chief goal of thinking. As most teachers are aware, understanding is one of the major thrusts of current educational practices. The Teaching for Understanding (TfU) framework (Blythe & Associates, 1998) and Understanding by Design (UBD) (Wiggins & McTighe, 1998) are two current curricular planning tools that help teachers focus on understanding. It would be nice if we could merely take for granted that all teachers adopt this goal and strive to teach for understanding, but we all know that the reality of most schools and classrooms is quite different. Within the current high-stakes testing environments educators today operate, there is often pressure to cover the curriculum and to prepare for the test. Although lip service may be paid to the idea of teaching for understanding, there are pressures that work against it. These pressures aren't necessarily anything new. Schools, being built on an industrial model, have long focused on imparting skills and knowledge as their chief goal.

In most school settings, educators have focused more on the completion of work and assignments than a true development of understanding. Although this work can, if designed well, help to foster understanding, more often than not its focus is on the replication of skills and knowledge, some new and some old. Classrooms are too often places of "tell and practice." The teacher tells the kids what is important to know or do and then has them practice that skill or knowledge. In such classrooms little thinking is happening. Teachers in such classrooms are rightly stumped when asked to identify the kinds of thinking they want students to do

because there isn't any to be found in much of the work they give students. Retention of information through rote practice isn't learning, it is training.

The opposite side of this same coin is a classroom that is all about activity. In the misunderstood notion of experiential or inquiry-based learning, students are sometimes provided with lots of activities. Again, if designed well some of these activities can lead to understanding, but too often the thinking that is required to turn activity into learning is left to chance. Other times, the activity itself is little more than a more palatable form of practice. Playing a version of Jeopardy to review for a test may be more fun than doing a worksheet, but it is still unlikely to develop understanding.

At the heart of this view of teaching is the notion that curriculum is something that teachers deliver to students and good teachers are those most effective at that delivery. Reflecting on his own evolution as a teacher, Mark Church recounts how prevalent this view was in his own teaching: "In my early years of teaching I was "the fun teacher" bursting with confidence and more than a bit of hubris. I kept my students entertained. They liked me. They liked my class. Whatever was to be covered became an object of knowledge that I, as the expert, would deliver by way of gimmicks and glamour to my students. Consequently, I judged my teaching by the ease with which I was able to transmit information along a linear, one-way path of knowing. My idea of good teaching was to focus on the creation and delivery of palatable, hands-on, though not necessarily minds-on, activities. Becoming a good teacher meant mastering a set of delivery techniques and knowing all the answers to my students' questions. In those years it had not yet occurred to me that good teaching hinged upon what I knew and understood about the learners themselves and about how learning happens. However, it was not until I really examined the issue of what is understanding and how does it develop, that I actually began the process of becoming a teacher. Only then did I recognize that work and activity are not synonymous with learning."

Let's return to the key questions with which I began this chapter, "What kinds of thinking do you value and want to promote in your classroom?" And, the associated question, "What kinds of thinking does this lesson force students to do?" When classrooms are about activity or work, teachers tend to focus on what they want their students to do in order to complete the assignments. These physical steps and actions can be identified, but the thinking component is missing. When this happens, the learning is likely to be missing as well.

Here's a quick exercise to help you identify the possible discrepancy between students' classroom activity and teaching that is likely to lead to understanding. Begin by making a list of all the actions and activities with which your students are engaged in the subject you teach (if you are an elementary school teacher pick a single subject to focus on such as math, reading, or writing). You might want to brainstorm this list with a couple of colleagues or teammates. Now working from this list, create three new lists: 1) The actions students in your class spend most of their time doing, 2) The actions most authentic to the discipline, that is, those things that real scientists, writers, artists, and so on actually do, and 3) The actions you remember doing yourself from a time when you were actively engaged in developing some new understanding of something within the discipline/subject area.

To the extent your first list, what students spend the bulk of their time doing, matches the other two lists, your class activity is aligned with understanding. If the three lists seem to be disconnected from one another, students may be more focused on work and activity than understanding. To develop understanding of a subject area, one has to engage in authentic intellectual activity. That means solving problems, making decisions, and developing new understanding using the methods and tools of the discipline. We need to be aware of the kinds of thinking that are important for scientists (making and testing hypotheses, observing closely, building explanations...), mathematicians (looking for patterns, making conjectures, forming generalizations, constructing

arguments...), readers (making interpretations, connections, predictions...), historians (considering different perspectives, reasoning with evidence, building explanations...), and so on; and make these kinds of thinking the center of the opportunities we create for students. Furthermore, these kinds of thinking need to be among the primary expectations we hold for students: that they can and that they will engage in the kinds of thinking necessary to build disciplinary understanding.

### **A Map of Thinking Involved in Understanding**

In the preceding section I listed a few types of thinking that were central to different subject areas, such as making and testing hypotheses in science or considering different perspectives in history, but are there particular kinds of thinking that serve understanding across all the disciplines? Types of thinking that are particularly useful when we are trying to understand new concepts, ideas, or events? When you thought about the kinds of thinking you did to develop your own disciplinary understanding, you probably identified some of these. With my colleagues David Perkins, Shari Tishman, and Patricia Palmer we set ourselves the task of trying to identify a short list of high-leverage thinking moves that serve understanding well. Our goal was not to come up with all the different kinds of thinking that were involved in understanding but to identify those kinds of thinking particularly essential in aiding our understanding. We wanted to identify those thinking moves that are integral to understanding and that without which it would be difficult to say we had developed understanding. We came up with the following six:

- Observing Closely and Describing What's There
- Building Explanations and Interpretations
- Reasoning with Evidence
- Making Connections
- Considering Different Viewpoints and Perspectives

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- Capturing the Heart and Forming Conclusions

We felt that these six all played an important, if not essential, role in fostering understanding of new ideas. If we are trying to understand something we have to notice its parts and features, being able to describe it fully and in detail. Identifying and breaking something down into its parts and features is also a key aspect of analysis. The process of understanding is integrally linked to our building explanations and interpretations. In science we label these as theories and hypotheses. In mathematics, we sometimes call them conjectures or generalizations. In building these explanations, we draw on and reason with evidence to support our positions and try to arrive at fair and accurate positions that can be supported. When we encounter anything new we make connections between the new and known, drawing on our past experience. These connections help us to link ideas and find where the new ideas fit within the subject area and out. Our connections might also be about application and where the new ideas or skills are used. All of these connections aid our retrieval of information and help to ensure that new information is not static or inert (Whitehead, 1929). If one were only to look at new ideas or situations from a single perspective, we would say that one's understanding was limited and sometimes even biased. Awareness of the different perspectives or takes on an idea gives us a more robust understanding. Capturing the heart or core of a concept, procedure, event, or work ensures that we understand its essence, what it is really all about. We want to make sure we haven't lost the forest for the trees and that we notice the big ideas in play.

These types of thinking are by no-means exhaustive of all the kinds of thinking we want to make visible in classrooms. However, they do provide a good and useful list with which to begin. Many teachers working to make thinking valued and visible in their classrooms have found that posting these thinking moves in their classrooms can be extremely useful. The list helps draw students' attention to what they will be

doing to learn. To help ensure that work and activity don't swamp students' learning, teachers often pause class either before or after an assignment to discuss the types of thinking that will be or were involved in the assignment. As students become more aware of their own thinking and the strategies and processes they use to think, they become more metacognitive (Ritchhart, Turner, & Hadar, 2009).

Since all of these thinking moves directly support the development of understanding, this list can be useful to teachers in planning units. Over the course of a unit of study, students should be engaged in all of these types of thinking on more than one occasion to help them develop their understanding. If students haven't been actively engaged in building explanations, reasoning with evidence, making connections or having the opportunity to look at things from more than one perspective, then there would likely be significant holes or gaps in their developing understanding. Just as the six thinking moves can help to develop understanding, they can also be useful in assessing understanding. Fredrick, a middle school history teacher in Sweden, found that the six thinking moves were exactly the qualities he was looking for in an historical essay and decided to use them as an assessment rubric, which he gave to his students. The sixth grade team at the International School of Amsterdam decided that if they were really trying to making thinking visible in their classrooms, then students should focus on their thinking and not only their performance on tests and quizzes. All sixth graders were charged with creating a visible thinking portfolio in which they collected samples that demonstrated where and when they had engaged in each of the six thinking moves. These portfolios were then presented to parents as part of a student lead conference at the end of the year.

Since our identification of the six thinking moves that support understanding, what we sometimes call the "understanding map," we have added two additional thinking moves:

- Wondering and Asking Questions

- Uncovering Complexity and Going Below the Surface of Things

The importance of curiosity and questioning in propelling learning is easily seen in our experience as learners. We know that when our curiosity is sparked and we have a desire to know and learn something, our engagement is heightened. Many teachers are familiar with the use of essential questions as vehicles to propel students' learning. However, questions are also an ongoing part of developing understanding. The questions we ask at the outset of a learning journey change, morph, and develop as that journey moves forward. Even after extensive efforts to develop understanding, we find that we may be left with more questions than when we started. These new questions reflect our depth of understanding. This depth and our ability to go below the surface of things is a vital part of our ongoing development of understanding. Rather than look for or accept the easy answers, we push to identify the complexity in the events, stories, and ideas before us. In this complexity lies the richness, intrigue, and mystery that engage us as learners.

While these eight represent high-leverage moves, it is important to once again stress that they are by no means exhaustive. We offer up this list as a useful starting place, and no more. You can probably think of other kinds of thinking that are useful, such as visualization, taking stock of what you understand, looking for cause and effect relationship, and others. Furthermore, you can probably identify many thinking moves that further flesh out the key eight in ways that are useful. For instance, comparing and contrasting ideas is a specific type of connection making as is thinking metaphorically. Classifying extends our description and noticing. We've chosen the broad terms of explanation and interpretation, but these are certainly related to inferring, explaining, and predicting. You might well ask, where is reflection? Structured reflection has been shown to be a way to enhance understanding and problem solving (Eyleer & Giles, 1999). The answer is that a structured reflection, that is,

reflection that goes beyond voicing one's opinion or feelings, involves describing the object of reflection and noticing its key features, connecting what is new to what one already knows, and examination of the event or object of reflection through various lenses or frames, which is perspective taking (Colby, Beaumont, Ehrlich, & Corngold, 2009).

### **Other Kinds of Thinking**

Of course understanding is not the sole goal of thinking. We also think to solve problems, make decisions, and form judgments. Many of the eight key thinking moves come in handy when we are doing those activities as well. Looking at things from new perspectives, identifying the parts, and reasoning with evidence certainly play a role. Making connections to our prior knowledge so that we can draw on it and use it effectively is useful as well. Forming conclusions and identifying the essence are also important moves. Some additional types of thinking we haven't mentioned that seem particularly useful in the areas of problem-solving, decision making, and forming judgments are:

- Identifying Patterns and Making Generalizations
- Generating Possibilities and Alternatives
- Evaluating Evidence, Arguments, and Actions
- Formulating Plans and Monitoring Actions
- Identifying Claims, Assumptions and Bias
- Clarifying Priorities, Conditions, and What is Known

Again, these six are not meant to be exhaustive, merely useful moves in terms directing our mental activity and planning our instruction. Each of the six could be further elaborated with associated kinds of thinking. For instance, brainstorming is a useful strategy to help one generate possibilities and alternatives and taking stock would be a part of clarifying priorities, conditions, and what is known. Formulating plans and actions connects with the idea of being strategic just as evaluating evidence is a part of being

skeptical. Reviewing the above list, one might get the impression of a very thoughtful mathematics or science classroom where problem solving plays a central role. In learning mathematics and science actively, it is important that one gets used to looking closely, noticing patterns, and generalizing from those patterns to create procedures, algorithms, and theories. Of course, these theories and conjectures must be carefully evaluated and tested.

The list above might also give one the impression of a civics class where students are exploring current political, social, or ethical issues. In these situations, getting clear about priorities, conditions, and what is known and unknown is an important starting place. Being sensitive to assumptions and bias that might be clouding our perception is also crucial. Of course in such situations one must also look at things from a variety of perspectives, drawing on one of the kinds of thinking discussed in the understanding map. Depending on the situation, one might also find oneself generating possibilities and alternative takes on the situation and/or making plans to carry out and monitor.

The combination of the above list with the thinking moves in the map of understanding go a long way to helping us unpack what we mean by thinking. By being clearer in our own minds as teachers about the kinds of thinking we want our students to do, we can be more effective in our instructional planning. We can create opportunities for the kinds of thinking we value and want to make an expectation in our classrooms. Being clear about the thinking students need to do to develop understanding or to solve problems effectively allows us to target and promote those kinds of thinking in our questioning and interaction with students. Now that we are clearer about what we mean by thinking, we can turn our attention toward looking at how we create a classroom culture that values and supports thinking.

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