

Some operating principles

Introduction

How do we manage to get the five year old, or the seven year old, sufficiently interested in dust or apples to get the project off the ground? What will they do for the first year or so?—especially if they can't read. Mind you, there are other vulnerable points, such as the major transitions that commonly take place in students' interests at around age eight—some time after fantasy worlds have evaporated, tooth-fairies and Santa Clause are long discarded with the dolls of childhood, and reality-based hobbies and collections begin. The other significant transition is at about age fifteen, when the hobbies and collections tend to be left behind in their turn and are replaced by a greater sense of independence, more theoretical concerns, and burgeoning social agency.

Building a portfolio over twelve years is going to involve a fair amount of hard work. What I want to do in this document is show how we can draw on sources of energy in students to engage them with this work and enable them to see it as worthwhile.

I'll suggest some teaching principles we can use, derived in part from another project I have been engaged in. This one has involved a Vygotskian-oriented exploration of some of the socio-culturally derived cognitive/psychological tools that students have available to make their learning most effective at particular phases of their educational development. Well, that's one way of putting it. Another would be to say that it has focused attention on what students find spontaneously engaging at different ages and then try to infer from their engagement more general principles that can be applied when teaching. Perhaps it will become clearer as I give some examples. In giving illustrations of the examples I'll imagine a portfolio based on *apples*. My purpose here is not to give descriptions of the kind of teaching approaches that can be found in many good books and websites. Rather I want to focus on approaches that may seem a little unusual at first, but should be particularly helpful in engaging students' interest in their LiD topics.

Learning tools for the first years

The teacher who is supervising a few portfolios can draw on some of the following learning tools to engage students as they launch into their topic. These tools include the story form, binary opposites and mediations, forming images from words, metaphor-use, puzzles and mystery, rhyme, rhythm, and pattern, and humor.

Take "the story form." I don't mean fictional stories, though they are hardly to be excluded. Rather I mean "story" in the sense that we use the term about the evening news. What's the story on the bridge collapse, or what's the story on the election, on the

movie star's latest behavioral extravagance, on the local team's struggle to win the cup, and soon. That is, we are not asking for fictional accounts of these topics. We want the facts, but we want them in a special form, in which the emotional importance of the facts is vividly brought out, and the facts are organized so that they have the greatest interest and impact. We can invite our young students to begin their topic, and can introduce them to it, by asking what's the story on apples, or dust, or leaves, or trains, or whatever. That is we will be looking first for what is emotionally engaging about it, what can vividly capture their imaginations in their topic.

Portfolio supervisors need to develop a skill all good teachers are expert in: looking at topics in such a way as to engage students' imaginations in their content. They share this skill with the good reporter. "What's the story here?" If our topic is *apples*, the story has to do with the development from a restricted source of the remarkable variety currently available of this wonderfully healthy and delicious food, and has to do with how apples affect and have affected human lives. If that's central to our story, how do we get the young child into it? Well, let's see how we can draw on the help of some of the other learning tools.

We can use "binary opposites" to give the students a first and clear hold on the topic. Bruno Bettelheim noted the "manner in which [children] can bring some order into [their] world by dividing everything into opposites" (1976, p. 74). Once we have such oppositions in place, then we can mediate between them and gradually build a more adequate conception, but first we need to establish our binary grappling hooks. Imagine a world in which those wild apple trees in Kazakhstan were blighted seven thousand years ago and simply died out. Had that happened, we would now not have any apples; we would not be able to imagine the apple. So one binary opposite can be simply the *presence/absence* of apples, and how lucky we have been. We could choose less dramatic binary opposites to build our story on, of course. We might choose *sweet/sour*, or *rare/common*, or *human ingenuity in cultivation/chance development*, as oppositions onto which we can hang the astonishing story of apples.

We can also think about what "images" can get the child engaged in *apples*, or *dust* or *trains*, or whatever. By images I don't mean simply pictures, but rather emotionally charged senses that can be formed in their minds with words. We can have an image of a smell, for example. So I mean something more like an emotionally charged and perhaps diffuse association formed in the mind. The forming of one's own unique images in the mind is one of the great early stimulants of the imagination. So what emotionally charged images come to mind when we think of the wonder of the mighty apple? Because apples are so common today, with supermarkets carrying small mountains of as many as ten varieties, it is easy for students to take them for granted. Also, of course, the abundant availability of sugars, and the chemical industry's contribution to appealing to the taste buds of children, reduces for children today the sense of the deliciousness that apples held in the experience of children in centuries past. So our first images should try to disrupt that taken-for-granted sense of apples as routine, plentiful, and not especially tasty. We could tell students that in olden times visions of paradise very commonly involved a garden in which fruit trees were common (Hebrew,

Chinese, Celtic, Germanic, Japanese, Greek, African, etc.). Fruit was delicious and greatly prized, and paradise was easy access to fruit. And of all the fruits in the world, the apple has been the most highly prized. It is the most abundantly produced fruit, and fruits are the most enjoyed nutritious food, so the apple has been one of the world's most celebrated foods. Later the students can learn that the word "fruit" is derived from the Latin *fruo*, which means "I delight in" or "I enjoy."

An image suggested above is between the apple and paradise. The very word "paradise" comes, via Greek, from the Persian name for the walled gardens wealthy Persians built for themselves long ago. Xenophon describes his amazement that throughout the great Persian Empire the richest people had attached to their homes large walled gardens in which they would grow flowers, cedar, cypress, palm, and apple trees. The gardens were set usually in hot and arid landscapes and engineers directed water into them, providing cool shade and greenery among predominantly brown and tan surrounds. These gardens were called *pairidaeza*, and represented security, calm, and beauty to their owners, and to all who saw them—the walled garden being as close as one could get to paradise on earth. The teacher can tell students about these gardens in such a way as to call up in their minds this association between the apple and the peaceful places in which they were early cultivated. Pictures of such gardens can help build students' images of such places and what they meant to their owners, as can stories that bring out the contrast between the harsh and arid world outside and the safety and green shade within—particularly appropriate stories chosen from the One Thousand and One Nights.

Gradually the teacher can help build up other images, from the astonishing story of their elaboration from those early edible forms of apple in Kazakhstan thousands of years ago to the plump, rich, and juicy varieties available today. The image in the mind is of ingenious cultivation gradually plumping out with delicious fiber into multiple forms, colors, and flavors across the centuries. We might call up the image of some of the famous apple cultivators—perhaps the Etruscan *Api*—to make clear that this proliferation of varieties is an achievement of individual people, not some inhuman process of development. Or the image can be of the apple's interactions with our bodies: What happens when we eat one? If we are what we eat, what does the apple do for us? What amazing fact about apples suggests an image we can make important to the story we are to tell? The adventures of the wonderful apple can include William Tell and Johnny Appleseed and all those fairy tales that bring out the magic of the golden apples of the sun in memorable images. Another of the great learning tools that comes along with an oral language is the ability to interpret and generate "metaphors." This is a capacity of great importance to the elaboration of language. It's a somewhat magical and mysterious ability to see one thing in terms of another. Indeed, sometimes it seems as though we can see almost anything in terms of almost anything

else: the tree of life, my heart is a stone, music is the food of love, the foot of the hill. You are probably familiar with those exercises that give two random lists of words and invite you to combine any two and explore the new meaning created.

The ability to recognize and generate metaphors seems to be very potent in young children (Gardner & Winner, 1979), tied perhaps to the periods of most rapid language development. We get a hint of this power when we see a four year old playing with an empty box as a house, a car, a shoe, an airplane, all within a ten-minute period. So we will want to engage this metaphoric ability with the student's topic early on, so they can see it in numerous ways. An apple is literally a fruit, but metaphorically it can be a boat floating on a river to the sea, or a wholesome sign of friendship, or a computer logo, or a symbol of the theory of gravity, or an expression of appreciation to a good teacher, or anything we care to make it. We can help the students to keep a record of metaphoric uses of their topics and explore what these metaphors add to their understanding of it. The story of apples is truly one of progress—that powerful modern metaphor of development in a direction favorable to us.

The “sense of mystery” is another “tool” that comes along with language use. Language allows us to describe the world in symbols, and also to lie, to create fictions, and to articulate to others what we know. Mystery is an important tool in developing an engagement with knowledge that is beyond the students' everyday environment. It creates a sense of how much that is fascinating that remains to be discovered. All the topics we might select have mysteries attached to them, and part of the teacher's job in making any topic engaging to students is to give them an image of richer and deeper understanding that is there to draw their minds into the adventure of learning. Too often we represent the world to students as known, and we represent their task as to accumulate the knowledge that we already have. This is, of course, a part of education, but when we forget that our small circle of secure knowledge is bounded by a vast ocean of mystery we make the educational task rather dull. When we make clear that we are engaged in a journey of discovery, surrounded by mystery, we better represent what the educational task is really like, and open up possibilities and wonder.

If our topic is apples, we can suggest a sense of mystery by picking up from the binary opposites - presence / absence - on which we can hang our story of apples. We might encourage the student to wonder about other fruits that might have existed in the distant past, but which did not survive. We have apples by chance, and others have certainly been lost by chance. What wonderful experiences, of taste and health, have we been deprived of? It needn't take much to stimulate the sense of mystery. That suggestion alone can be sufficient, if planted at the right time—to use a resonant metaphor. A small blight long ago might easily have deprived us of apples—what fruits, flowers, and trees were less lucky?

In addition we can wonder how many varieties of apple is it possible to develop and what might future varieties include? What colors—those silver and gold apples? Can we expect bigger and bigger apples? How do the sun and earth astonishingly conspire to pack the colorful skin with healthy fiber? How magical is the neat skin, the rich pulp, and the seeded core? What mysterious changes it passes through on the branch, from bee-fumbled flowers to promising buds and then plumping out during the summer months to mellow fruitfulness till it ripely falls to the ground or is picked by grateful hands? How perfectly beautiful the many-hued varieties are, especially when gathered in baskets or barrels or on the table in bowls—rich metaphors of nature's beneficence? Why are apples used in many religious traditions as a mystical or forbidden fruit?—so many ancient stories combine the seductiveness of apples, to which people succumb, with some punishment for giving in to such sweet temptation. We can find ways in which even the young child can be introduced to this mysterious dimension of apples by telling some of these stories, and pointing out that this unexpected connection recurs in different stories.

“Rhyme, rhythm, and pattern” are potent tools for giving meaningful, memorable, and attractive shape to any topic. Their roles in learning are numerous, and their power to engage the imagination in learning the rhythms and patterns of language—and the underlying emotions that they reflect—is enormous. They are important in learning all the forms of knowledge and experience that we code into symbols. So we will want to find the more vivid and dramatic rhymes, rhythms, and patterns connected with any particular topic. We can start with simple nursery rhymes. If *apples* is our topic, we can begin a file with such near-nonsense rhymes as:

Do you like apples, do you like pears?

Do you like tumbling down the stairs?

That one, mysteriously, kept our children in belly hugging laughter for years, as each went through the magical point of language development for which it worked so well.

Teachers can invite physical participation with such rhymes as:

Five red apples

Hanging on a tree [*five fingers held down*]

The juiciest apples you ever did see!

The wind came past

And gave an angry frown [*shakes head and looksangry*]

And one little apple came tumbling down.

Four red apples . . .

And here's an item for those mastering the alphabet:

A Was an Apple Pie

A was an apple pie,

B bit it,

C cut it,

D dealt it,

E eat it,

F fought for it,

G got it,

H had it,

I inspected it,

J jumped for it,

K kept it,

L longed for it,

M mourned for it,

N nodded at it,

O opened it,

P peeped in it,

Q quartered it,

R ran for it,

Sstole it,

Ttook it,

Uupset it,

Vviewed it,

Wwanted it,

X,Y, Z, and ampersand

Allwished for a piece in hand.

[Taken gratefully from: <http://www.mamalisa.com/blog/?p=327>]

“Jokes and humor” can expose some of the basic ways in which language works and, at the same time, allow students to play with elements of their topic, so discovering some of learning’s rewards. This learning tool can also assist the struggle against arteriosclerosis of the imagination as students continue through their schooling—helping to fight against rigid conventional uses of rules and showing students rich dimensions of knowledge and encouraging flexibility of mind. It’s always easy to begin with such simple items as:

Q. When is an apple not an apple?

A. When it’s a pair [pear].

To “get” the joke one has to be able to see that the same sound often does double duty, and so one begins increasingly to see language as an object and not just as an unreflective behavior. That ability to see language as an object we can reflect on is central to developing what scholars call “meta-linguistic awareness,” and that ability in turn is implicated in learning to use language with flexibility and sophistication. So jokes are not just good fun, but they are also what Lévi-Strauss called *bons-à-penser*—good things for thinking; they have the potential to enlarge our understanding and language fluency.

There are, of course, endless more conventional kinds of apple jokes, such as:

The children were lined up in the cafeteria of a Catholic elementary school for lunch. At the head of the table was a large pile of apples. The nun made a note, and posted on the apple tray: “Take only ONE. God is watching.”

Moving further along the lunch line, at the other end of the table was a large pile of chocolate chip cookies. A child had written a note, “Take all you want. God is watching the apples.”

Or an example perhaps not ideal for school:

Physics Teacher: “Isaac Newton was sitting under a tree when an apple fell on his head and he discovered gravity. Isn’t that wonderful?”

Student: “Yes. If he had been sitting in class looking at books like us, he wouldn’t have discovered anything.”

This set of learning tools – the story form, binary opposites and mediations, forming images from words, metaphor–use, puzzles and mystery, rhyme, rhythm, and pattern, and humor – can be used to engage the young students with their topics. They are hardly an exhaustive set, and I have no doubt that experienced teachers will be able to add a number of their own that will be at least as effective as some of these. It’s just that these tools can help us to recognize that beginning to explore a randomly assigned topic needn’t be haphazard, leaving students wallowing and easily bored. We can engage their interest in apples or the circus or dust or whatever by bringing out the story about the topic and thereby show what is emotionally important about it; we can provide them with grappling tools in the form of binary opposites; we can capture their imaginations with vivid, affectively-charged images; we can encourage flexibility and vividness of understanding by play with metaphors; we can surround the topic with an alluring sense of mystery; and we can enliven students’ interest by drawing attention to rhymes, rhythms, patterns, and jokes.

I haven’t dwelt much that commonly used cognitive tool that develops with language use, and that’s the puzzle or problem. This tool is perhaps too familiar to need much elaboration, but setting up problems or puzzles can stimulate students’ explorations in many directions. The teacher can constantly raise questions that may encourage students to develop further pieces of knowledge, even if initially the knowledge is only very general and imprecise: How many different kinds of apple can you find? Where do their names come from? Do apples float—why or why not? What is your favorite apple? Where do the apples you buy come from? How many colors can apples be? How many songs and stories and nursery rhymes mention apples? Why are apples good for us to eat? And so on.

In summary:

Some prominent learning tools students from K to grades 3 / 4 can use in building their portfolios	
Story	One of the most powerful tools students have available for engaging with knowledge. Stories shape our emotional understanding of their content. Stories can shape real-world content as well as fictional material.
Binary opposites	Basic and powerful tools for organizing and categorizing knowledge. We see such opposites in conflict in nearly all stories, and they are crucial in providing an initial ordering to many complex forms of knowledge.
Images	Generating mental images can be immensely engaging in exploring knowledge. They can attract our emotions and imaginations to aspects of any topic. The use of mental images (as distinct from external pictures) should play a large role in stimulating students’ interest in their topics.

Metaphors	Enables to see one thing in terms of another. This peculiar ability lies at the heart of human intellectual inventiveness, creativity, and imagination. It is important to help students keep this ability vividly alive by exercising it in building their portfolios.
Mystery	An important tool in developing engagement with knowledge that is beyond the students' everyday environment. It creates an attractive sense of how much that is fascinating remains to be discovered. All topics have mysteries attached to them, and part of the teacher's job in making exploration of their topics more engaging to students is to give them an image of richer and deeper understanding that is there to draw their minds into the adventure of learning.
Rhyme, rhythm, and pattern	These are potent tools for giving meaningful, memorable, and attractive shape to any content. Their roles in learning are numerous, and their power to engage the imagination in learning the rhythms and patterns of language is enormous.
Jokes and humor	Can expose some of the basic ways in which language works and, at the same time, allow students to play with elements of knowledge, so discovering some of learning's rewards. They can also assist the struggle against arteriosclerosis of the imagination as students continue to build their portfolios.
Puzzles and problems	Pointing out puzzles or problems can stimulate students' explorations in many directions. The teacher can raise questions that encourage students to encounter some attractive difficulty, solving which will enable them to develop further knowledge.

Learning tools for the middle years

Once students become fairly efficiently literate, reading and writing with ease and using many of the tools that require the intricate use of the eye in organizing and classifying knowledge, some new cognitive tools come into play. One way to think about the shift to literacy is to see it in terms of a shift from a dominance of the ear to the eye in gathering information. Literacy is commonly thought of as a more or less complex skill, whereas we might better think of it as a toolkit, invented a few thousand years ago, and accessible now to anyone who learns to use those tools appropriately. Literacy brings with it a whole range of additional learning tools that we commonly don't think of when we focus on simply the coding and decoding aspect of it. Here, I want to focus on the often-neglected toolkit that comes along with literacy.

Certain activities can facilitate this shift from ear to eye and also show students how literacy can give new powers with the accumulation of new learning tools. Usually we see these changes begin to come into prominence at about ages seven, eight, or nine. So the supervisors of students' portfolios at these ages might be alert to signs of students spontaneously using the kinds of tools I will describe below, and might then help students to begin to reorganize the information they already have accumulated in their

portfolios in more efficient, eye-dominant, forms. In particular, this might be the time to develop students' digital on-line portfolios—perhaps even to the point of scanning or taking digital photos of earlier drawings or pictures and having them available in the student's portfolio server space. Attention should be given to helping students reorganize their portfolios, and to prepare categories and file systems that will be more effective in dealing with the increasing knowledge, and the new kinds of knowledge, that students will gain in this period.

During these years, the worlds of fantasy fade away and are replaced in some degree by the light of common day, or with what adults recognize simply as a more realistic view of things. Santa and the Tooth Fairy yield to fantasy creatures of a different kind, whom students' don't believe are true in the same way, and they yield also to real-world heroes. This new sense of reality does seem to be influenced by particular forms of literacy. As Jerome Bruner puts it: “literacy comes into its full powers as a goad to the redefinition of reality” (1988, p. 205).

So we see in the kinds of stories that most readily engage students a new concern with reality. Anne of Green Gables and the rabbits of Watership Down make quite different accommodations with reality than did Cinderella or Peter Rabbit. Even such fantasies as Superman, Spiderman, and the Hulk and their equivalents all come with elaborate explanations for the fantasy elements of the stories, suggesting that they fit into some kind of reality; fairy godmothers are simply asserted, but Superman needs an explanation, however implausible or impossible we might find the account of his escape from exploding Krypton and so on. A oddity of much educational literature at the moment is the suggestion that one can best engage students' interest by starting with what they already know and is a part of their everyday environment. This seems odd in the context of what are found most interesting to typical students at these ages—those spies, pirates, star warriors, superheroes, etc.

The everyday world around students is not apparently what they find most interesting, rather it is “the extremes of experience and the limits of reality” that most powerfully engage students' imaginations as literacy becomes fluent. That is, the reality that we first engage imaginatively during these years tends to focus on the extremes, on its most exotic and bizarre features, on the most terrible and courageous events. We are familiar with this kind of material from sensational newspapers, TV shows, and from publications like The Guinness Book of Records. Supervising teachers might sensibly be alert, then, to how to use this learning tool of engagement with the extremes and limits of reality and experience in expanding students' portfolios in new directions and dimensions. (The attention to the extremes and limits of reality, to the exotic, weird, and bizarre, is not

disconnected with students' everyday reality; rather it is how they establish the context of their everyday reality and, in some deep sense, its meaning.)

If the topic is *apples*, students might be encouraged to begin exploring the largest and smallest kinds of apples, the rarest, those that have been cultivated for the most extreme climates, those that last longest after being picked and those that wither fastest, the sweetest and sourest, and so on. A student might open a file on "apple records" to contain such information. Where are the largest orchards, and to whom do they sell their apples? How are they transported? How many tons of apples were grown worldwide last year and how does this compare with previous years? How many of those original orchards in central Asia continue to produce apples? Are they in danger? The exotic and extreme can be routes to massive amounts of engaging information.

During the years from around eight to around fourteen or fifteen, students feel increasing independence, but are typically hemmed in by rules and regulations that they commonly find irksome. They seem much that they want, much that they want to be, and remain relatively powerless to gain either. A learning tool that becomes quite prominent during this period is "the ability to associate with heroic qualities". We identify as heroes those people who are able to overcome the threats that hem us in, constraining us from gaining those things we dream of. We lack the money or power or skill to achieve what we would like, so we associate with those who most clearly have the heroic qualities that enable them to achieve precisely what we want. It is a tool that helps us overcome our insecurities; it enables us to overcome some of the threat of alienation involved in the new sense of reality. By associating with those things or people that have heroic qualities we can gain confidence that we too can face and deal with the real world, taking on those qualities with which we associate.

The story of William Tell gains a new resonance for students at this age. They want to know now about the real person behind the story. Johnny Appleseed is a mythic figure who reflects the heroic activity of real people who spread apple trees and cultivated new varieties; it is now time to introduce the true stories of the real people who carried apples across the Americas, bringing to the fore the real heroes in this epic tale. Who made the greatest contributions to the development of the apple from ancient times to the present? Are the most widely cultivated apples recently developed? What is happening to those older varieties of apple that are not suitable for modern forms of transportation and supermarket sales—are there heroic people working to preserve varieties? Who and where? The apple itself can be seen as heroic: a vulnerable plant like many that have disappeared over evolutionary time, which overcomes its vulnerability in one small and remote area of the world to spread and proliferate across the planet.

“Grasping knowledge through human emotions” is another tool that enables us to get beyond the surface of any knowledge to its source in human emotion. All knowledge is human knowledge, discovered or invented as a result of some human emotion. This tool allows us to seek knowledge through the emotions that were involved with its past creation or current use, and so grasp its deeper human meaning. We often forget that during the ages from about eight to fifteen, students make sense of the world very largely in personal terms; not personal simply in the sense of their own local interests, but rather in the sense that it is through seeing knowledge in terms of universal human feelings that it gains much of its meaning.

This learning tool also encourages us to direct students’ attention to the people involved in the story of apples, or whatever the topic is. Who were the cultivators? What were their motives? Who developed orchards and against what opposition or threats? Who discovered the health benefits of apples, and how did they feel about their discoveries? In all such cases we are asking, again, what’s the story here, or what narrative can we discover that shows the emotional meaning of the knowledge being learned.

The “sense of wonder” is another key learning tool in our initial explorations of reality. It enables us to focus on any aspect of the world around us, or the world within us, and see its particular uniqueness. It serves like a spotlight, bringing something into bright focus while somewhat suppressing everything else. We can turn this sense of wonder onto anything, recognizing the wonderful in each feature of the world: “everything is wonderful.” This tool can provide the gift that allows us to recognize something wonderful behind even the most routine and taken-for-granted things. The starting point of all science and all inquiries is “I wonder why . . .” It gives us the ability to imbue any aspect of reality with heightened importance.

The story of the apple is replete with wonders – historical, medicinal, technical, “orchardic”, etc. Students can begin to explore the apple in greater detail, focusing on just what are its healthful properties, how it grows, its roles in history and art, its development around human settlements, its fruity competitors for our palette and their various pros and cons, and so on.

Around age seven or eight one of the more curious activities of nearly all children begins. They commonly start to collect something or start a hobby. What is going on? Well, one explanation is that they are seeking some security in this new world of reality in which they find themselves; that world might be infinitely extensive and by getting control of some small part of it, through their collection or hobby, they gain some security that it isn’t, at least, infinite. These hobbies commonly continue till around age fourteen or fifteen.

The learning tool that is tied in with “collections and hobbies” can find energetic work to do in expanding students’ portfolios during this period. If the topic is *apples* then one might look for features of apples that open them up to the collecting instinct. This might be the time for the development of relational tables of all the variety of apples the student can discover, or elaborate “family trees”. The on-line portfolio can have pictures of as many varieties as can be found. (I’m not sure what real artifacts connected with apples

might be collected for the physical portfolio: perhaps photographs of all the apples and apple tree varieties the student has located, pressed leaves from various trees? I was going to add as a kind of joke “pips,” assuming they would all look much the same but maybe some of our apple experts might indeed be able to distinguish features of pips.)

The kind of intellectual energy one sees being spent on students’ hobbies and collections can also be harnessed to expand and alter somewhat the work they do on their portfolios. Ideally, their portfolios will become a kind of hobby or collection during these years from around seven or eight to fourteen or fifteen.

“Changing the context” is a tool that enables the imagination to grasp a richer meaning of any topic. The classroom is often an emotionally sterile place; so routine that one topic after a while begins to look like another. By shifting the context in which knowledge is learned—often by use of simple devices – students’ imaginations can be brought vividly to life, engaging the material much more richly.

As students begin to develop this intermediate toolkit, the portfolio supervisor can deliberately encourage them to take different perspectives on their topics from those that dominate the portfolio to this point. The aim is to see the topic in many contexts, through many perspectives. If they haven’t done so already, they might be encouraged to start looking at the biology of apples, or their medicinal properties, or discover uses of apples in myth stories or other fictions, to explore the history of the apple, to study apples in art and perhaps to try to copy paintings and then do their own life studies, to attend to the ideal climatic conditions for different varieties, to monitor and note the decay of different varieties of apple, and so on.

At around age seven or eight, many students’ spontaneous interests change quite significantly, and the kinds of stories they enjoy also change. These changes are clues to some of the new learning tools we can use to refresh their interest in their topics and draw them to expand it into new dimensions. We need to recognize that improved literacy brings with it a somewhat distinctive conception of the reality the students find themselves among. Their interest in their topics can be enlarged by a focus on extremes and limits, on the strange and exotic, on “records” associated with it. Knowledge tends to become more engaging if seen in the context of human lives and the human emotions that students share, and especially if they can see new aspects of their topic through the heroic qualities of people involved with it. We will want to draw their attention to the wonderful features of their topics—to those things that are attractive because of their unusualness or because they transcend the everyday. We will also seek to show them that their topic has features that can engage the collecting instinct or can be like a hobby. These learning tools remain prominent in students’ “tool kits” till around fourteen or fifteen.

In summary:

<p>The sense of reality</p>	<p>The development of rational and logically structured forms of thinking is greatly eased by literacy, and these can be deployed to restructure students' portfolios.</p>
<p>The extremes of experience and the limits of reality</p>	<p>Students' imaginations grasp reality readily in terms of its limits and extremes; they focus on the extremes, on the most exotic and bizarre features of reality, on the most terrible and courageous events. These features can add a new dimension to students' portfolios.</p>
<p>Associating with heroes</p>	<p>Enables students to overcome some of the threat of alienation involved in the newsense of reality. By associating with those things or people that have heroic qualities we can gain confidence that we too can face and deal with the real world, taking on those qualities with which we associate. It gives us a further tools to explore human dimensions of portfolio topics.</p>
<p>The sense of wonder</p>	<p>We can turn this sense of wonder onto anything, recognizing the wonderful in every feature of the world. This tool can provide the gift that allows us to recognize something wonderful behind even the most routine and taken-for-granted things. The starting point of all science and all inquiries into all topics can be "I wonder why . . ."</p>
<p>Grasping knowledge through human emotions</p>	<p>Enables us to see beyond the surface of any knowledge to its source in human emotion. All knowledge is human knowledge, discovered or invented as a result of some human emotion. This tool allows us to see knowledge through the emotions that were involved with its past creation or current use, and so grasp its deeper human meaning.</p>
<p>Narrative understanding</p>	<p>A narrative context for knowledge can establish its emotional importance while also conveying the knowledge—about any topic. It keeps alive the sense of the "story" the student is investigating.</p>
<p>Collections and hobbies</p>	<p>The drive to exhaustively discover something to give us security in a complex world. This tool can be harnessed to allow students to explore aspects of their topics in great detail.</p>
<p>Changing the context</p>	<p>By shifting the context in which knowledge is learned—by use of often simple devices—students' imaginations can be brought vividly to life, engaging the material in new dimensions.</p>
<p>Early tools of literacy: the list, etc. "The imaginative eye."</p>	<p>The shift to literacy reflects also a shift from a dominance of the ear to the eye in gathering information. Certain activities can facilitate this shift and also show students how literacy can give new powers. One of the most basic of these activities can be demonstrated through the making and manipulation of lists, and of flowcharts, diagrams, etc.</p>

Learning tools for the final school years

By around fifteen years of age students who have continued to elaborate the set of learning tools described above commonly experience another quite fundamental shift in their understanding, which can be described in terms of some new learning tools they prominently deploy. The most evident index of this further tool-kit is the use of a new vocabulary in which theoretic abstractions become common. Earlier in their lives, for example, students would have known the meaning of a word like “nature.” They would have thought of it in terms of animals and woodlands, the sea and birds, and so on. What begins to happen at the transition to this new kind of understanding is development of such general ideas as “nature” so that it is seen increasingly less in terms of particular features and more as a complex system; it is as though the connections between the features of the natural world become more prominent than the individual features themselves. Similarly a whole range of facts and ideas and knowledge take on a new sense and significance by being seen as elements of general processes rather than as simply more or less interesting elements.

I hope this isn't too abstract a way of putting it, and that it is clear how this new theoretic way of thinking is distinct from the forms of thinking that were shaped by the previous set of learning tools. The shift becomes clear in the way students begin to form theories of history and society, ideologies, metaphysical schemes, and so on. They begin to build a new theoretic world, which they populate with these abstractions.

An example might help introduce what I mean. I remember driving our sons to soccer when one was about thirteen and the other sixteen. We were coming up to a federal election and many of the lawns and windows we passed had sprouted posters in bright red, blue, yellow, and green encouraging us to vote for one or another candidate and party. In the election four years earlier, my children had been interested in how many signs were up for “our” candidate, in who had the most signs and the biggest signs, in which party was likely to win, and in how anyone could vote for the villains who opposed our good guys. Putting his soccer boots on in the car, on this later occasion, one son asked whether we had to pay to have a sign on our lawn, and whether people with the really big signs had to pay more, or did the candidates pay us to put signs on our lawns. I told him that the candidates and their parties paid to have the signs made, or made them themselves, and people put them on their lawns freely to show their support. “But why would people vote for some party because of a sign on a lawn?” one of them reasonably asked, adding, “Wouldn't people vote based on their principles, rather than be swayed by lawn signs?” We discussed this for a while, and their questions spread to the ways in which lawn signs were a part of the process of democratic elections.

My point is to indicate an example of a shift in thinking and in the set of cognitive tools being brought into play. And my purpose here isn't to try to explain *why* this change occurs, typically in the mid-teens among students who have continued to develop the sets of learning tools discussed above, but rather to describe some of its features in a way that illustrates how teachers might engage the *theoretic* imagination in learning.

“The sense of abstract reality” is a tool that develops as a part of the development of rational, logically structured forms of thinking. It has historically been the source of our understanding of the processes by which nature works, and our increasing control over these processes, but can come at the cost of our alienation from the natural world—so that we might see nature, for example, only as a set of “resources.” The students’ portfolio supervisors can use, and encourage in students the use of, the abstract language of the theoretical world. A dictionary of word origins can be invaluable for elaborating on the etymology of theoretic language, and thereby supporting the development of theoretic learning tools.

So the student might be encouraged to explore pomology, perhaps by going to the websites of universities where there are departments devoted to the study of fruits, and perhaps later by visiting such institutions. What are the current interests of scientists dealing with pomology? What are “replant diseases” and how are they being treated? What are the conflicting theories involved in treating them? And what is the best way to deal with codling moth infestations? What are the underlying theories that lead to different approaches? There are hundreds of similar topics and issues, and theoretical disputes that the student will by now be ready and probably eager to join. They might alternatively become fascinated with the representation of apples in art and literature, discovering how apples serve as symbols of famous, aesthetic, or religious meanings from historical changes in the ways in which they appear and play roles in courtship, domestic life, and art.

The “sense of agency” is a cognitive tool that enables us to recognize ourselves as related to the world via complex causal chains and networks. So we can become more realistic in understanding how we may play roles in the real world, and understand ourselves as products of historical and social processes. This realization that our very sense of self is a product of the social and historical conditions that have shaped the world around us is often quite disturbing to students even while increasing a sense of intellectual potency. Portfolio supervisors can increasingly look for ways to encourage students to take part in activities that will help stimulate their sense of agency. The aim would be to help students to look “outward” from their portfolios and see how the knowledge they have been accumulating can be brought to bear in the real world.

The student can begin to engage in a range of social or even political activities connected with apples (or with whatever the student’s topic is). Perhaps the student may have concluded that the reduction in the available apple varieties in supermarkets is potentially dangerous, should some disease devastate one or more of the commonest varieties. The student could be encouraged to write to owners of orchards, first seeking their views on the greatly reduced varieties currently grown, and see whether they think it is a problem, and to consider the orchardists’ reasons carefully. If the student still thinks there are real dangers in the reliance on so few varieties, she can be encouraged to write letters to her

political representative to express her concern. She can join groups who are taking action to preserve a greater variety of apples. She might conclude that the quantity of pesticides currently used in apple cultivation is in excess of what is needed and is posing both an environmental threat and possibly may be leading to some damage to apple stocks and to many of the non-damaging lifeforms that would normally exist along with apples. After hearing the case of the orchardists, if she still concludes there is a potential danger, she could join political action groups that lobby for reductions and controls over pesticide use and other chemicals that lead to more profit from apples but at a risk the student reasons is excessive and indeed risks future profits. She might explore sources of public information about chemical and insecticide use in orchards, and engage in what she concludes are appropriate public actions to inform others and to lobby political representatives. Alternatively, of course, her public actions might be engaged in on the side of the orchardists and growers. What matters is the movement from knowledge to related public action. What also matters is that the action be recorded in one or another form or medium and be added to the student's portfolio.

British gardeners, in particular, keep a wide variety of apples in cultivation, but most of the apple varieties that existed in the US a hundred years ago are now gone, in favor of the few commercially profitable varieties in which "shelf-life" has been considered more important than taste. Taste is often sacrificed by picking apples too early, allowing them to ripen under artificial conditions on the way to market, rather than on the tree. The student can become active, by writing letters, seeking interviews and learning the problems the farmers experience, and perhaps making the case to the farmers for adding some varieties to their orchards, using data they have available in their portfolios.

The student might look for the opportunity to grow apple trees and to learn how to propagate them. Often allotments are available near cities for those who lack space around their homes. The student might make contact with pomology departments of universities, locally or on-line. She can request information about current research projects, and ask whether there might be a role for a knowledgeable volunteer. Perhaps she might, in their dream job, even be able to travel with a research group to Kazakhstan to study the health of the original apple trees, perhaps counting grubs on leaves, or doing some grunt work that can add importantly to knowledge. She might be able to do such work more locally, of course.

"General theories and their anomalies" is a tool that enables us to generate abstract ideas about nature, society, history, human psychology, and then recognize their inadequacy, and rebuild them into more complex ideas. How does this work? I have described very briefly above that a distinctive feature of this new toolkit involves forming theories, and some of these are very general and often simplistic. So one finds students quite suddenly sometimes beginning to think about whether the world is getting better or worse within a huge historical timeframe. If, for example, the student begins to shape a theory of history that is optimistic, seeing, almost in a Victorian sense, progress in action in all spheres of life, then there are some facts that will be anomalous to this view; some facts will clearly run counter to it. So the fact of Third World poverty, despite excessive affluence in some parts of the world, is an anomaly to the optimistic

general theory. The student's theory need not be disproved by such a fact, though. The student can make the theory more sophisticated or nuanced, claiming that the general progress of the world is not regular, and so incorporate the anomalous fact. But it might then be pointed out that those deprived areas become a threat to the "developed world" because of their resentment and armed hostility, and also poverty breeds diseases that are then transmitted around the globe and threaten massive destruction to all societies. The theory then needs to be made more sophisticated again to accommodate these further anomalies. And so the process of general schemes being threatened by anomalies and the anomalies forcing the general schemes to become more sophisticated to accommodate them, and so, dialectically, on, is one of the tools we can see at energetic work as students build their theoretic worlds.

The project supervisor at this stage needs to be alert for students beginning to develop the most general theories concerned with apples and their place in the human and natural worlds. One realm for rich theory development, to continue examples from above, is the battle between modern intensive orchard cultivation and the dangers, under market pressures, of reducing the varieties and taste of cultivated apples, and also the threats created by massive use of chemical insecticides and fertilizers. Perhaps the student might form a theory about organic methods of apple production. Anomalies to that theory will include the problems of producing enough apples to meet market demands and also adequately controlling apple pests. Learning more about these anomalies will compel the student to develop an increasingly sophisticated theory of organic production of apples. The aim in raising anomalies, which may become a significant task for the supervisor—but we can also rely on the students' own accumulating knowledge to throw up these anomalies as well—is not to overthrow the student's theories, but rather to make them more and more sophisticated. While the student might begin with idealistic views, the gradual accumulation of anomalies might lead her to conclude that current industrial apple production ensures good tasting fruit made accessible to everyone at a low cost.

"The search for authority and truth" is a further tool that takes on a particular shape and importance with the development of abstract theoretic thinking. Because meaning is seen to be derived from general ideas, it becomes vital to determine which ideas are true. An objective, certain, privileged view of reality is sought. Among the historical products of this cognitive tool at work have been dictionaries, encyclopedias, and textbooks—repositories of secured knowledge.

The sense that truth and meaning are to be located first in the general and abstract, drives the theoretic thinker constantly, even if subconsciously sometimes, to look for the abstract source in which authority and truth can be located. If the abstract thinker loves singing, it will no longer be sufficient to simply prefer one singer to another. He will draw up criteria for goodness in singers, and compare singers in terms of these criteria. As theoretic thinking becomes more sophisticated, this becomes a tricky business. Callas or Britney Spears may seem best according to some criteria, but Bartoli or Ani DiFranco better according to others. Perhaps one should have different criteria and categories for contraltos and sopranos or for different genres of music? Or if the student begins to think theoretically about something as mundane as shopping, he might wonder whether shopping has

replaced religion for some people; or whether the economic benefits derived from consumption of certain goods that do little for the lives of many consumers are off-set by spiritual desiccation and environmental degradation, or not? They will reflect on how we could reliably compare such things? What are the benefits to our patterns of shopping compared to the way people in oral cultures gathered what they needed and wanted? How can one find the “True” answers to such questions?

Our student who is building a portfolio about apples may use this tool to drive inquiries into the truth about variety reduction, or the adequacy of the criteria for establishing what counts as a new variety of apple, or whether Newton was really stimulated in his thinking about gravity from watching an apple fall, or any of an indeterminate array of issues that may seem to have discoverable and certain conclusions. The student’s portfolio supervisor might be alert to such questions in case the student maybe hesitant in taking on this more theoretic approach to her or his topic.

“Meta-narrative understanding” is a tool that allows us to order particular facts or events into general ideas and form emotional associations with them. That is, we don’t just organize facts into theories, but our tendency to shape even our theories into more general meta-narratives also shapes our emotional commitments to them. For example, think of the different meanings and emotional associations that emerge when we try to make sense of the destruction of the World Trade Center’s twin towers on September 11, 2001 from mainstream American and Mid-Eastern Islamic perspectives. In the West, this event fits commonly into a meta-narrative in which it can be made sense of only as an evil act of terrorists, in response to which a “war on terrorism” is justified. In a militant Islamic meta-narrative, the oppressive Western “devils” were being struck by heroic soldiers of God who sacrificed their lives rather than accept continual oppression and the suppression of their values and way of life. This example illustrates how a meta-narrative is not just a logical structuring device but is primarily responsible for orienting emotions to the topic. No one is disputing the central facts or events. It is their meaning that is shaped by the meta-narrative an individual is using.

The student’s supervisor might be alert to the main meta-narratives commonly used in making sense of the topic. Even apples will be subject to some meta-narratives. The student might be encouraged to question whether the current abundance of apple varieties and the vast orchards in China, the U.S.A., and Russia represent a perversion of an organic development of plants in general. Woodlands and varied grasslands have been obliterated to grow an over-abundance of a fruit that has helped degrade the biodiversity of the planet. Alternatively the student can shape the knowledge so far gathered in the portfolio into a meta-narrative of the increasing accessibility of the miraculously healthy apple that has contributed so much to human health through the centuries.

At around fifteen years many students will find that the growing amount of knowledge they have accumulated begins to require more complex modes of organizing and also, relatedly, more complex modes of sense making. The new toolkit that students develop in response

to the array of knowledge contains prominently such learning tools as we have glanced at above, including the sense of abstract reality, the sense of agency, general theories and their anomalies, the search for authority and truth, and meta-narratives. These tools are related aspects of the abstract and theoretical world that often begins to be built in mid and later teen years. We may currently see clear evidence of this theoretic form of thinking in only a minority of students, but I suspect that is due to the fact that so many students learn too little knowledge to kick this process into action. I hope it will prove much more common if this project becomes widely implemented. I recognize that this section is more complex and abstract than the earlier sections. The kinds of thinking I have been describing, and the learning tools associated with those forms of thinking, are much less common in current forms of education.

In summary:

Sense of abstract reality	The development of a theoretic world and organizing tools can be useful in further restructuring portfolios and adding new dimensions of interests and materials.
Sense of agency	Enables the students to extend the materials of their portfolios in the direction of social action and engagement. Their growing expertise can be seen as a source of influence in the everyday world around them.
General theories and their anomalies	This provides a mechanism for continued growth and development of portfolios through elaboration of their undergirding ideas and frameworks of organization.
The search for authority and Truth	Provides a goad to making their portfolios more reliable and re-examining and extending many dimensions that may have been relatively neglected for some years.
Meta-narratives	Drives the engagement of portfolio contents with powerful and emotional themes that shape the most general understanding of the topic.

Conclusion

What I have focused on in this booklet are some principles that might help teachers engage students' imaginations in their topics at different ages. I have chosen a set of strategies that are a little unusual, but no less effective for that. There are, of course, many other strategies that teachers can draw on to help students build their portfolios. Many excellent books and websites can give support to the somewhat new teaching task of encouraging this kind of learning in depth.