GETTING THE RIGHT ATTITUDE AND STRATEGY FOR COLLEGE LEARNING

M. Kip Hartvigsen—Chair, Department of English

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Not too long ago, I had my fiftieth birthday, a real shocker. While I had hoped my acquaintances would have been stunned to learn of my advanced age, no one batted an eye. The reality is I am firmly entrenched in middle age and obviously look it. Another milestone occurred in June when Christen and I celebrated our twenty-fifth wedding anniversary accompanied by another shocking reality: I am now the same age as parents (or so it seems). The final blow of reality occurs tomorrow, August 16, which marks the twentieth anniversary of my professional affiliation with Ricks College/BYU-Idaho. Now, I realize some of you here weren't even alive on August 16, 1982, which also means I'm old enough to be your…big brother.

But aging has a few advantages. Another realization occurred while I was reviewing these milestones. I am curiously poised in time between my years as a student and as a teacher—that is, if I add up all the years I've spent in school—K through 12, the bachelor's, the master's, and the doctorate—I've been a student 21 years. If I add up my years as a professional, I've been a teacher 21 years. In spite of my advancing age, I remember well what it feels like to be a college student. And because of my present occupation, I know well what it feels like to be a college teacher.

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For example, I remember those late nights as a student cramming for exams when my mind was as blank as the darkness outside. Or writing papers at 4 A.M., hoping I would hit upon an idea in time for an 8 A.M. class. But now I stand on the other side of the desk and watch students just like me file into my 8 A.M. classes. As a matter of fact, not too long ago, a student dragged in—disheveled and unshaven—propped himself on the last seat of an aisle, slightly off center. In minutes he was out cold.

I appreciated his effort to be in class because I hadn't seen him for a few days. I know enough about classroom management to sense this was my cue to move up the aisle, brush him slightly, bring him back to reality, and draw him into the discussion. But the overhead projector I was using blocked his aisle. What could I do? I watched the crown of his head slowly fade back against the wall as his face seemed more and

more focused on the ceiling. Then it happened. He actually began to snore audibly.

There is a point to my rehearsing these experiences: I would like to assure you that there is a better way to go about getting a college education.

Today, on the eve of my twentieth anniversary as a teacher here, I would like to share some insights I have gained from my professional life, particularly from my experience teaching a course focused on critical thinking. Perhaps more than any other course I have taught, this one has helped me better appreciate the capacities each of us has to develop our minds and has excited me about learning, so much so that—as one writer describes this excitement—my heart often "misses a beat" (Bronowski 14).

My own students look at me with suspicion (until they get to know me) when I'm carried away into one of these "learning-is-exhilarating" frames of mind, but my motives are pure. I think part of my own excitement stems from being in my fifties and realizing I'm not going to be here forever. Time is running out; and I earnestly believe, as we have all been taught in the *Doctrine and Covenants*, "Whatever principle of intelligence we attain unto in this life, it will rise with us in the resurrection. And if a person gains more knowledge and intelligence in this life through his diligence and obedience than another, he will have so much the advantage in the world to come" (130: 18-19).

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The Prophet Brigham Young, whose name our institution now bears, once asked about our mortality, "What are we here for?" His answer? "To learn to enjoy more, and to increase in knowledge and in experience... The object of this existence is to learn" (quoted in Holland 148). From this point, I would like to consider with you one overarching question about learning: How can we best learn in order to fulfill what our Father in Heaven expects us to do with our minds during mortality?

One of my favorite stories about student life addresses this question. William G. Perry, Jr., a former Harvard professor, describes an incident which scandalized Harvard, embarrassed the faculty, and delighted the students. According to Perry, a certain Mr. Metzger, a Harvard junior in mathematics, was one day waiting to meet some classmates for a study group; but no one showed. Other students, meanwhile, were filing into an opposite classroom and taking seats at various testing tables. Spying a friend across the lobby, Metzger dashed to greet him and discovered his friend was about to take an exam in a course entitled "Modern Perspectives on Man and Society." About then, Metzger heard a stern voice, "Take your seats please" as a proctor presented him with a copy of the essay exam. Metzger, "overwhelmed by a surge of curiosity and puckish glee," wrote "George Smith" on his blue book, opened it, and began writing.

A few days later, Metzger's friend found himself in the company of several others who had received a C on the exam. But "George Smith's," a.k.a. Metzger's, exam had received an A. In the margin appeared a note: "Excellent work. [However] could you have pinned these observations down a bit more closely?" (Perry 158-9). Now, I can imagine what you're thinking. Metzger's experience only proves what we always knew: exams, after all, are not accurate measures of what we know. Or at least we reserve opinion about a particular exam until we see what grade we get, right?

Well, what is most interesting to me about Metzger's experience is how he later described his own thought process while writing his essay—a thought process prompting one observer to comment that what Mr. Metzger wrote on his exam "is nonsense, utter nonsense. But ah! Sir! It's the *right* kind of nonsense" (157). Perry explains Metzger's thinking like this:

The essay question invited consideration of either Margaret Mead's *And Keep Your Powder Dry* or Geoffrey Gorer's *The American People*. Because he had read neither, he chose to write about the second because the title gave clues about what the book might be about. He sensed another clue from the exam itself: the test offered one favorable and one unfavorable comment about each book. "Having heard that Margaret Mead was a social anthropologist, he inferred that Gorer was the same," but British rather than American, because Gorer spelled his first name Geoffrey the English way. Well, from this point, Metzger drew from what he remembered about the topic at hand and took off with his exam—always making best-hunch inferences from what little data he had at his disposal.

Each time I think of this story, I chuckle although I hope you won't misinterpret the example. I am not advocating Mr. Metzger's test taking strategy—there is no substitute for diligent preparation. Yet I am interested in why William Perry went on to defend Metzger and why Metzger's response, though *nonsense*, was "Ah! Sir! The *right* kind of nonsense!"

What is the *right* kind of nonsense? And what does Metzger's experience tell us about learning? Hold this example in your mind for a moment while I share an experience of another university teacher who also illuminates the question "How can we best learn?"

Richard P. Feynman, a brilliant American physicist until his death in 1998, was once invited to critique a foreign country's system of higher education. While teaching university students there, Professor Feynman discovered a "strange phenomenon." In his own words, he noted: "I could ask a question which the students would answer immediately. But the next time I would ask the question—the same subject, and the same question, as far as I could tell—they couldn't answer it at all! For instance, one time I was talking about polarized light" (51).

(It's been a long time since I took physics, but apparently "polaroid passes only light whose electric vector is in a certain direction," so Feynman's students could figure out which way the light was polarized depending on whether it was light or dark.)

Feynman goes on to explain: "We took two strips of polaroid and rotated them until they let the most light through. From doing that we could tell that the two strips were admitting light polarized in the same direction—what passed through one piece of polaroid could also pass through the other." Then Feynman asked his students if they could tell the *absolute* direction of polarization from a *single* piece of polaroid. They hadn't a clue.

Feynman continued: "I knew this took a certain amount of ingenuity, so I gave them a hint: 'Look at the light reflected from the bay outside.'" There was silence. He then asked, "Have you ever heard of Brewster's Angle?"

"Yes sir!" his students recited. "Brewster's Angle is the angle at which light reflected from a medium with an index of refraction is completely polarized."

"And which way is the light polarized when it's reflected?"

Again his students fired their response: "The light is polarized perpendicular to the plane of the reflection, sir."

At this point in Feynman's narrative, he stops to admit his own amazement: "They knew it cold!"

"Well?" Feynman continued.

Still nothing. Feynman's students had just told him that "light reflected from a medium with an index, such as the bay outside, was polarized"; they had even told him the direction of the polarized light. Bewildered, Feynman finally said, "Look at the bay outside, through the polaroid. Now turn the polaroid."

"Ooh, it's polarized!" his students admitted in astonishment.

Nonplused, Feynman summed up his experiences: "I finally figured out that the students had memorized everything, but they didn't know what anything meant. When they heard 'light that is reflected from a medium with an index,' they didn't know that it meant a material *such as water*. They didn't know that the 'direction of the light' is the direction in which you *see* something when you're looking at it, and so on. Everything was entirely memorized, yet nothing had been translated unto meaningful words" (51-2).

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Here's what I concluded about Feynman's students and Perry's Mr. Metzger—they are at opposite ends of a spectrum. In short, Feynman's students memorized everything, but didn't understand what anything meant. Metzger, on the other hand, hardly knew anything but pushed himself to apply what little he knew. Put another way, Feynman's students

were buried in heaps of sterile information lacking any significant contexts; Metzger, however, drew inferences from his little bit of data and organized it sensibly. Obviously, neither extreme is an ideal. Yet several Harvard faculty chose to defend Metzger and his nonsense, because his thought process was more sophisticated: he had moved beyond mere memorization to inference.

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This process of inferring, of imposing order on data, is at the very core of learning. Yet I fear many of us will plow through our college experiences and life, believing the more data we have memorized, the better educated we are. My understanding of the learning process certainly does *not* discount the importance of learning factual information. (And I suppose such information will make us great contestants on *Jeopardy*.) But we are often cautioned by great teachers that inference, this process of extracting ideas from information, is what makes learning meaningful—even thrilling.

Listen to a few of these great teachers. Besides physicist Feynman, who bemoans how college-level students "memorize everything," but don't know what anything means (52), mathematician Jacob Bronowski writes, "No scientific theory is a collection of facts…[Rather] science finds order and meaning in our experience" (10-11). Writer Theodore Roszak says, There's "data, data everywhere, but not a thought to think" (quoted in Muscatine and Griffith 55). The famous nineteenth century naturalist Louis Agassiz told his students, "Facts are stupid things until brought into connection with some general law" (quoted in Scudder 197). The poet T. S. Eliot characterized this predicament as an "'endless cycle' in which 'wisdom' is 'lost in knowledge' and 'knowledge' is 'lost in information.'" (quoted in Oaks 82-83).

These great thinkers insist that memorizing information—while a beginning—is not enough. In other words, reading a text to absorb facts is not enough, or entering a laboratory to record data is not enough either. All of this data, all of these facts, all of these statistics (whatever we want to call all of this information), all of it will mean more when we organize it, find meaning, and—when possible—apply it.

Let me illustrate this valuable process of inference with a simple exercise. John Cotton is an English poet who enjoys writing poem riddles. Cotton's objective is to present several images that describe or characterize something; his intent is to have the reader infer from his imagery the thing or idea he is describing and take delight in the power of language to conjure fresh imagery. As you read the following poem, consider each cluster of images, one at a time, and infer or guess what Cotton is describing. As more information comes, you will probably become more certain of the solution you are inferring from the data clusters.

Cluster 1:

Insubstantial I can fill lives,
Cathedrals, worlds.

Cluster 2:

I can haunt islands,
Raise passions
Or calm the madness of kings.

Cluster 3:

I've even fed the affectionate.

Cluster 4:

I can't be touched or seen,
But I can be noted. (quoted in Cooper and Patton 17)

Imagine each of these four image clusters as being analogous to information you might be required to memorize for a course you are taking. And imagine having to memorize data like this without a sense of what the data means, each cluster no more than a seemingly random bit of information without a context to hang onto.

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How would Feynman's students react to the challenge of "learning" this poem? I rather imagine they might recite the entire poem verbatim, but when pressed with the question, "What does it mean?" they might appear confused. On the other hand, how would Metzger respond to Cotton's poem? I rather imagine Metzger would argue for a solution, even if he had access to only one or two of the poem's clusters. His mind would be busily organizing the information. He might say, "Cotton is describing the Holy Ghost, because the Holy Ghost is insubstantial, fills my life and cathedrals. And I suppose because he's referred to as a ghost, he could haunt islands because ghosts are creatures that do that."

Metzger may or may not have inferred the best idea from his limited data. *But he has an idea*. He is theorizing, hypothesizing, synthesizing. He he is in a strong position to learn content rapidly and meaningfully—and to retain it because he is organizing information to make sense of it. He is experiencing "the joy of inductive discovery" (Perry 164). And who knows? If he keeps it up, he may discipline himself for some real learning, search out the information he's missing, modify his hypothesis, have a genuine "aha!" moment, be excited about his idea, and feel his heart miss a beat!

I have to ask, has your heart ever missed a beat while you were learning? If so, what was happening that you could replicate? If not, why? We should all be excited about learning. And perhaps, learning will become more enticing as we make ourselves search for those seemingly hidden ideas buried in that pile of information in those unbelievably expensive books we lug from class to class. I remember when my own study seemed no more than a process of memorizing disparate bits of information. Caught in such "learning" situations, I found myself burning out and losing interest in my studies. William J. Perry (that Harvard professor who defended Metzger) claims that students who merely memorize data believing that collected facts constitute knowledge "rob" themselves of their "education" and of their "soul" (163-4).

Is Perry guilty of exaggeration in such a statement? Or do we lose something valuable within us when we reduce education to the mere acquisition of fact?

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I hope the idea of inference is clear to you by now. However we order information, even if someone argues we are wrong, that information means much more if we at least try to make sense of it. And we can always change or fine-tune our ideas as we acquire more information.

I am not absolutely sure what Cotton, the poet, intended as a solution for his riddle. As I draw inferences from his data, for me, Cotton was describing music. Music is insubstantial, intangible. Music fills our lives; it's everywhere, in elevators, grocery stores, cars, church meetings, cathedrals, movies, homes—indeed the whole world. "Music haunts islands." Well, that's a tough one, but I think Cotton, the poet, may have been alluding to the Sirens described in Homer's *Odyssey*. In one of Odysseus' adventures, he encountered these enchantresses of the sea who sang songs so alluring that men would do anything to get to the source. Inevitably, however, anyone who sought the Sirens was drawn to ruin. To avoid his own death, then, Odysseus ordered his crew to fill their ears with beeswax and then strap him to the mast of his ship. Thus he was able to hear the haunting songs these Sirens sang from their island paradise, while he avoided death.

"Raise passions"? Well, we know music can raise passions of every kind—heightened feelings of patriotism, devotion, and so forth. "Calm the madness of kings"? I thought of David's soothing harp relieving the depression of King Saul. "Feeds the affectionate"? In countless love songs, music feeds the affectionate. The real clincher to Cotton's riddle came in the poet's final pun, "Music can't be touched or seen, but it can be *noted*." At that point, I saw a page of music with all of those black notations.

Each of us in our own disciplines will be asked to solve problems somewhat analogous to this riddle. Will it be bad to memorize information, to memorize the poem, so to speak? Of course not. Thomas G. Plummer,

a professor of Slavic languages at BYU, asks, "What if you are a student of biochemistry or German grammar? Then you have to memorize information and take notes from instructors who know more because the basic material is factual. There is no other way. [But] this is a temporary condition.... Eventually every discipline enters into the unknown, the uncertain, the theoretical, the hypothetical, where teachers can no longer tell students with certainty what they should think" (172). At this point we will each be required to order the facts at hand and to infer for ourselves their sense and applicability.

So let me pose the question again: How can we best learn? We learn best when we penetrate information to see its order, its significance, its meaning, its application.

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As I conclude, I would like to share an episode in the life of a student who is as far away from that sleepy student I described at the beginning of my presentation as a student could possibly be. He represents for me just how far we can all go making learning an exciting adventure. Please note too that he has managed to successfully learn the facts, just like Feynman's students; but he finds joy in applying them in interesting ways. It's almost as if a Mr. Metzger has married a Ms. Feynman.

Alexander Calandra tells the story of a university professor who received a call from a colleague who asked him if he would referee an examination. He was about to give a failing grade on a physics exam, yet the student believed he should receive full credit. The instructor and the student agreed to abide by the decision of an impartial arbiter. The exam question read, "Show how it is possible to determine the height of a tall building with the aid of a barometer." The student had written, "Take the barometer to the top of the building, attach a long rope to it, lower the barometer to the street, and then bring it up, measuring the length of the rope. The length of the rope is the height of the building."

Unhappy with an answer that failed to show an understanding of physics, the student's professor pressed for a second exam. Calandra relates the arbiter's experience as follows:

> I gave the student six minutes to answer the question, with the warning that his answer should show some knowledge of physics. At the end of five minutes, he had not written anything. I asked if he wished to give up, but he said no. He had many answers to this problem; he was just thinking of the best one. I excused myself for interrupting him, and asked him to please go on. In the next minute, he dashed off his answer which read:
>
> "Take the barometer to the top of the building and lean over the edge of the roof. Drop the barometer, timing its fall with a stopwatch. Then, using the formula $S=\frac{1}{2}at^2$, calculate the height of the building."

At this point, I asked my colleague if *he* would give up. He conceded, and I gave the student almost full credit.

In leaving my colleague's office, I recalled that the student had said that he had other answers to the problem, so I asked him what they were. "Oh, yes," said the student. "There are many ways of getting the height of a tall building with the aid of a barometer. For example, you could take the barometer out on a sunny day and measure the height of the barometer, the length of its shadow, and the length of the shadow of the building, and by the use of a simple proportion, determine the height of the building."

"Fine," I said. "And the others?"

"Yes," said the student. "There is a very basic measurement method that you will like. In this method, you take the barometer and begin to walk up the stairs. As you climb the stairs, you mark off the length of the barometer along the wall. You then count the number of marks, and this will give you the height of the building in barometer units. A very direct method.

"Of course, if you want a more sophisticated method, you can tie the barometer to the end of a string, swing it as a pendulum, and determine the value of g at the street level and at the top of the building. From the difference between the two values of g, the height of the building can, in principle, be calculated."

Finally he concluded, there are many other ways of solving the problem. "Probably the best," he said, "is to take the barometer to the basement and knock on the superintendent's door. When the superintendent answers, you speak to him as follows: 'Mr. Superintendent, here I have a fine barometer. If you will tell me the height of this building, I will give you this barometer.'" (31-32)

We learn best and get most excited about learning when we push ourselves to impose order on the multitude of data that surrounds us.

I enjoy this story because it gives us a glimpse of just how creative our thought can be when we're able to synthesize and apply the information we garner.

Well, then, what does our Father in Heaven expect us to do with our minds during mortality? To quote President Hinckley: "I believe that the glory of God is intelligence, and that the Almighty takes delight in our efforts to improve and enrich and enhance our minds" (60). And how can we best learn in order to fulfill those expectations? We learn best and get most excited about learning when we push ourselves to impose order on the multitude of data that surrounds us. Remember: "Facts *are* stupid things, until brought into connection with some general law, principle, or idea." (Agassiz quoted in Scudder 197; emphasis my own).

We need to remember the joy of inductive discovery—difficult though the enterprise can be. In the words of a teacher I admire:

> To be educated will enrich one's life and increase one's joy—and joy is the reason that humans are. To be educated will increase one's humanness and one's respect and love for God's offspring—and such love is the second great commandment. To be educated will enlarge one's capacity to serve one's neighbor—and to serve well is the highest calling for a child of God. My suggestion for you and me is that we get on with the task. (Butler 29)

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