## Tom Karkanis; 2/20

I=Interviewer; T=Tom

- 1. I: ....about this one.
- 2. T: Yeah, but the one about learning, I don't know, it was more vague. I don't know it was more personal. Usually when you write essays, its... you write very, like distance, not personal.
- 3. I: But in this, I wanted you to talk about, personal. I want to ask you a few things about, take for example, the distinction between -- is scientific knowledge artificial, or is it, what do you say -- "scientific knowledge is artificial and does not describe nature as it really is". What exactly is your point -- you say here that .... physics does not propose to explain how it really works, but it just....
- 4. T: It tries to model the universe because scientists understand that they can't really know what nature and science really is, but, so I guess the closest they can get is to make a model of it, a representation of what it is. And I think as long as the math part of it, as long as that is accurate and your predictions that you get from using your mathematical model, as long as those are accurate, it doesn't -- I don't think it matters...
- 5. I: So the question then is -- you say it doesn't really matter and if we have opposing theories, or two theories that give you the same result, or in other things, you have ....
- 6. T: ....out of life, and you don't know which one is right. Maybe there isn't even a right one or a wrong one because for some things, like for some specific experiments the one theory works and for others, the other one will work. And I don't think there is a point in even, like, asking the question if its real or not, as long as... If there is no answer you can possibly give, then what's the point of asking the question.
- 7. I: Because then, in the next one. Okay, here, you say 'the closer to truth .... an accurate model is established. In terms of truth, do we approach truth, or is it, or do you say it doesn't really matter if.... Or what is truth.
- 8. T: Well, first of all, I don't think it matters if we're approaching truth or not, because even if we were we wouldn't know it. Because there is no way in knowing if what you're talking about, or the way you are talking about nature, if that is the real way. Thats what the *Inventing Reality* book taught us. There is no.... you'll never know which is the right way. So I can't really say if its getting closer to the truth or not. Cuz its just like people who say

representational

CLAIM: Constructivism = claimed. What is the discourse in support?

empiricist

rational

perceptual

you are getting closer to the truth, they don't know either. I don't know either so I can't say we're not. I'm just saying the model of what we are doing is getting more accurate. Thats one way of describing this

- 9. I: Okay, more accurate in how far -- like
- 10. T: In terms of what you, what values you can predict by using it.
- 11. I: Oh, so you're saying your model -- as long as it predicts well, its okay. Okay - assumptions. You say that science is not based upon assumptions in the sense that regular commerce is. Why do you think -- some people would say that science is just a belief, just as much a belief as religion is, only the way they go about it is different.
- 12. T: I guess you could argue that science as a whole is one big belief in everything. But because, just because the fact as I said earlier, you'll never know if its true or not, so you can say its one big belief and its all based on one big presupposition or whatever, but its not the same type of thing as I said religion or commerce was, because for religion there's different, like there's assumptions, that have no proof or backing behind them whatsoever. At least science is built up on top of each other, and its...
- 13. I: What do you think ??? science from... because you are just saying ion religion you don't have the backing, but in science, what sort of backing do you have?
- 14. T: Okay. In religion your backing is faith. And faith is empty, so to speak, because.... I guess the definition of faith is there is no proof, its just belief. But for science there is proof in that you're, the answers you get by using science and mathematics and stuff, the answers you get are true in the sense that they fit. Like they satisfy the equation or whatever. So in that sense, I think that science is not based on assumptions in the way that religion is.
- 15. I: How does that then connect to the scientific laws and theorys. On the one hand you're saying that scientists sort of make them and it doesn't really matter, on the other hand you say here that they do exist before man comes around.
- 16. T: Well, I'm not..... it's one thing to say that the theory ... the theory is just nature, I guess, defined into a model, because you don't know what nature is, and you only have your model of what it is, but you can say that it, the basic laws that, I guess, we don't know, or, its hard to discuss....
- 17. I: What does exist?
- 18. T: Okay, if we say that....

- 19. I: When you think about Newton's Apple? And Newton's law. Obviously it was Newton that said, he said there was a force.
- 20. T: Okay fine. The forces of nature exist and they've always existed, even before any defined them, and science I guess, then, doesn't exist and science is just a model that is made when people define it.
- 21. I: What do you say to a person who tells you 'thats a presupposition'? That there are forces exist. A person could say, yeah I admit that the apple has fallen, but ??? no one has ever seen the forces. No one ever saw a force. We see things falling and we see the moon go around the earth and the sun go around the, the earth around the sun. No one has ever seen a force.
- 22. T: Fine. I'm not saying that forces exist. I am saying that something exists and forces is what we, forces is the model that we create in order to explain it. I'm not saying that I know that forces exist, because I don't and no one will ever know if its forces or if its just a different....
- 23. I: I think thats what the question is, sort of is aiming at. Do forces exist? No. No. I'm not saying that you missed. That forces do exist. The question is do forces exist? Before Newton came?
- 24. T: I think that forces have always existed in the nature sense, but in that sense too, the theories have always existed, its just no one has defined them up until then. And then its when people define them that the science is created.
- 25. I: So, you would say that scientists... they just find
- 26. T: They discover them, they don't create them, they discover them.
- 27. I: But then you say.... but then, I wonder if there is a discrepancy with what you said earlier on, that we don't know when scientists make, lets say, a theory, we don't know it -- there could be two different ones. So if they discover ...or what do they discover?
- 28. T: Maybe, maybe a phenomenon in nature, so if there is life, is it, we hadn't created, or we haven't discovered the perfect model for it yet. Because just like maybe the particle on wave theories do.... they are probably not even what truth is since truth is -- you'll never find it. So I guess things that have dual nature or whatever, it's just the correct model has not been discovered yet, and until we do, as long as our particle and wave?? theories satisfy whatever equations we use them for, its alright.

- 29. I: What about the... you said the scientists, that the social environment affects...the knowledge of the science -- does it or doesn't it?
- 30. T: It does. Just -- your social environment I think affects every characteristic of your life, every part of your life.
- 31. I: So how does that affect then -- in the question before you say that the scientists discover scientific knowledge. And now you are saying that scientific knowledge is affected by society.
- 32. T: Well, the scientific knowledge itself isn't . What I am saying is that the knowledge that the scientist has, or finds, in the long run is affected by their environment. Cuz I, someone who is in -- well this isn't very physics -- but someone who has lived on the farm all their life and has become a veterinarian, they're not about to discover a new particle wave light theory, but instead they might find some medicine or cure to something else, whereas someone who is more interested in, like pure sciences, or whatever, they'll go into that field in the university and they'll....
- 33. I: Okay. So this is just one difference, but what about, say two scientists who sort of look at the same phenomena
- 34. T: But in a different way?
- 35. I: Yeah, but come up with a different...
- 36. T: Two different models? Well there is the example of -- I don't know . I can't explain that. I guess its just...maybe its their problem solving techniques. The way one person analyzes a situation and the way another person analyzes it. Maybe, I don't know what it was exactly, electromagnetics, something with Maxwell? He found a different mathematical way of coming up with the same thing that another scientist -- I'm not sure -- we read about it.
- 37. I: Yeah
- 38. T: ...but I guess his problem solving techniques were completely different from the other mans so the way he analyzed the problem was different and therefore he got a different, he approached it a different way. And found a similar thing to the light and particle wave....
- 39. I: Another example could be if you take, like the pharmaceutical industry, they always make these sort of tests. And a chemist for a pharmaceutical company may say or find one thing and someone working for Greenpeace will say the opposite. So how come -- what is true? How come scientists who purportedly, you know, subscribe to the same scientific method, come up with different....
- 40. T: Mmmhmm. About this example here, are we saying that each of those scientists truly believes that his is correct.

And its nothing to do with the line of work that they're in? Like, the pharmaceutical scientist may say 'oh this won't affect the environment at all', but the other one will.

- 41. I: But they truly believe that what they discover is the way it is. I mean, the .... that's where society comes in. You may not know that it affects you...
- 42. T: Subconsciously they don't.... I guess if some scientists discover something. Let's say subconsciously he knows that it does affect the environment he's not going to....maybe.... he won't admit even to himself, because of the environment that he's been in, because he wants it to be his way.
- 43. I: So it does.... I know you've already answered that it affects.... So I ... my sort of -- the question that I have is how does that all relate to learning. If, you know, if our models are always tentative --thats what you said, our models are tentative, and as long as they fit, that's fine, and if they don't fit any more, we go and make new ones. How does that then affect learning. Because I see hear that you put a lot of emphasis on the teacher -- the teacher gives me a problem, the teacher expects me to remember important ideas, the teacher to set the activities, the teacher to show the correct method, and so on. Actually, here, you didn't have???
- 44. T: ....forgot to answer?
- 45. I: Yeah. (a bit unclear)
- 46. T: Learn the teachers method for doing investigations. Yes.
- 47. I: (can't understand)
- 48. T: Probably very often, because I would like to be able to -- if I am in a class like chemistry, and Mr. McFarlane tells me that the best way to go about way doing this lab is to -- I don't know -- use the new filter paper because the whatever won't pass through it, then I'd like to be able to trust the teacher. Well, maybe all the things involving the teacher -maybe I'm a little lazy in the sense that I don't want to have to think everything through myself. Maybe, I don't know, I can't always find the answers myself, so I would like to be able to rely on the teachers.
- 49. I: But what is then, what is the ultimate purpose of learning??? I mean, you rely on the teacher, we can come back to that, but what is the ultimate purpose?
- 50. T: What is the ultimate purpose of learning?
- 51. I: Yeah.
- 52. T: Well, my purpose for learning right now is to get into -- to gain enough knowledge that when I go to university be able to continue my studies so that eventually I will have a job

of my choosing that I hopefully will enjoy for the rest of my life.

- 53. I: But -- you sort of said, that the teacher set all these activities, but once you have a job, then for example, if you were an engineer or researcher or what??
- 54. T: There won't be a teacher to set activities for me....
- 55. I: Thats right. So there is a difference between what they do and what you are doing here and some of that....
- 56. T: Yeah, well there is and I guess to some extent I'm the student here, and by the time I become an engineer or whatever, hopefully I will have the knowledge to be able to set my own....
- 57. I: What you want to have the teacher, even if marks.... imagine yourself in a school anywhere, except for where it was originally intended to be applied.
- 58. I: Oh, here. You write here -- it would be good to explore physics where marks didn't count. Marks weren't responsible -- you get the marks so that you can go into university. How would you like to go and what would you like to learn if the only condition that you have is -- you take the physics course or you want to take the physics course -- how would you want to do it? Would you still want .....
- 59. T: You mean, there is lots of time....
- 60. I: Lots of time...
- 61. T: No worry about marks?
- 62. I: No worry about marks.
- 63. T: Well, I guess then, it would be, to be honest I think it would be more interesting then to have maybe an outline, a vague outline of an experiment and have to go to the library and research it, and maybe plough my way through it one way or another. But not completely on my own, cuz I wouldn't want to be .... cuz, like I wrote in my other essay, if you get stuck, you start to lose interest. It gets too frustrating, you don't want to keep going and have to think too much -- the laziness in me(laughing)
- 64. I: That then when you are an engineer and you get stuck?
- 65. T: Hopefully my colleagues will know what's going on so they can help me.
- 66. I: This is always -- in real life you always have the option. I mean, in real life its not like an exam situation where you...
- 67. T: You're completely isolated...
- 68. I: Isolated. You can start calling around and looking through the literature and so on. See, I wanted to find out more why the teacher, even to insist that they are on time -- do

you think that helps you, or.... What is your ultimate concern? Just the mark -- to get the right marks?

- 69. T: I think everything goes towards marks, to be honest -everything leads towards marks, and therefore, like I said in
  my essay, too, I think to some extent -- it hurts to say this,
  but I think the teacher should collect, maybe homework, or
  like Mr. Thompson does -- he has a quiz every now and
  then so he knows what's going on. And even not for marks
  -- I mean, I feel good about about myself, when I write a
  100 on an algebra or geometry quiz because I did all the
  homework and I understand the concepts well. So I think,
  mainly for the marks, but also to...
- 70. I: Like, we started up and had every -- I guess after two weeks, into the terms we had a test, and then another two weeks we had another test. Well, this time I said I want you to write about the two chapters and what you've learned from them in an essay. So I deviated from -- did that sort of help and put you on track -
- 71. T: The tests...
- 72. I: Yeah, You know, knowing that every two weeks you had a test.
- 73. T: Yeah, to some extent it did. But I don't know, the one thing about the physics course -- its not as cut and past as, like algebra is. Algebra, you know, you come in you learn the lesson, you leave, you do your homework. And you come in.... and its over and over again. I don't know, I like that to some extent. And there you know whats on the test -- chapters 5.2 to 5.8 or whatever, thats going to be on the test. And there you can prepare yourself 100%. Thats one thing about physics -- you never know exactly what you have know and what you don't. So its sort of....
- 74. I: Can you elaborate that? Because I thought that this was very clear. And so you can actually -- you are helping me when you....
- 75. T: Okay. The first test was the one about the ????
- 76. I: Let's say the last one, where we had the ....
- 77. T: The reflection of light and everything...?
- 78. I: That's right.
- 79. T: Okay. The chapters in the book -- I think there was, most of it was all in one chapter and then there was a little bit on refraction and polarization or??? There was a little bit of that in the middle of another chapter. And everything in the first chapter, we didn't have to know. Like there were some very specific formulas involving angles of reflection that got really confusing. We didn't have to know those exactly. So there was a little -- I wasn't sure exactly, so

there was a little -- I wasn't sure exactly which ones I had to know and which ones I didn't.

- 80. I: How do you go then about, like -- I think from your essay I understood -- you sort of -- I think the essay said in the ??? part, you want to have the teacher tell you exactly and then you learn what is expected from you. What about understanding? Like, what do you have to do to understand?
- 81. T: To understand? I think -- algebra isn't a very good example of understanding or not, because its simple. There is no -- I think, like I said in my essay, there is no real application for it, and neither with calculus. The most application that you get in calculus is the growth decay rate -- I mean, those aren't very hard at all. But I think a better example for science is chemistry, because there is a lot of applications with solutions, and concentrations, and I find chemistry a lot harder than I do algebra and calculus.
- 82. I: Why is that?
- 83. T: Because, its -- in algebra or something and calculus you can have your values, you pump them in, and you get your answer. But in chemistry you have to know how to manipulate the equations. You have to know actually what you're going at, what you're looking for. And thats whats not there in ...calculus.
- 84. I: But what do you think that means then. What does it mean -- in terms of ....
- 85. T: Well, its a more demanding subject, first of all.
- 86. I: What are your learning strategies then. I mean, obviously you can't just say algebra and calculus is easy -- you just plug in and....
- 87. T: There's no reading involved in those at all, but in physics and chemistry there is quite a bit of reading. In order to understand it very well -- which I don't always do, I'll have to admit -- I would have to read the text, exactly for all the courses. Like for physics and chemistry. So its a big difference, because one is way more application oriented, and therefore harder, because -- I don't know, I guess, to some extent algebra and calculus, we're being spoonfed, completely. And physics and chemistry isn't like that. Not ?? at all. And that makes it harder. And you have to know the material more -- you have to have a better understanding of it to...
- 88. I: So, where are you on strategies -- are you trying to, you know, understanding, and how are you trying to get..., you know, a better understanding?

- 89. T: The way I go about trying to understand things in physics and chemistry is I have list of problems I'm supposed to do and I go through the list and if there's something. First I like -- I quickly read through the chapter and then I go through the list, and there will always be a bunch of problems I won't be able to do. So I actually go back and reread the chapter and if I still can't do it, maybe if I'm at school, I would ask Chris or someone, cuz he often knows, or I would ask my brother. And when I ask my brother if he can help, he can always explain it to me. And he gives an explanation to you, and he can explain it a different way to the text, so if I don't understand something thats in the text, he can explain it better, or differently.
- 90. I: What then -- what sort of implication does that have then --I mean, it does have -- I would draw some implications from that. Like you said -- a different explanation from the text, and that helps you. (pause) Sort of like myself -- if I start in a subject, and I try to read as many different books as possible.
- 91. T: Well, you get a -- you get different ways of looking at the same thing. Sort of -- like some examples was when my brother was helping me in grade 9 with math, cuz I was sort of lost cuz I had skipped a year and they put me in Mr. Robinson's class and I was lost for a while. The night before the exam, my brother started tutoring me on all the stuff, and it was -- his way of teaching was completely different from Mr. Robinson's cuz Mr. Robinson would say 'well guys, just try to memorize the formula and if you understand it -- but sir I don't understand exactly why this is like that, he would say -- you know, he would try to explain it to you, but I didn't always understand his explanation, and more or less he would always say, just try to memorize it. But my brother he, like insisted that I understand exactly what he was teaching me. And it got really tedious after a while result, or Κ

but in the end I did understand a lot better. And I mean, it helped a lot because if I didn't know the basics of that stuff, then I would have been lost.

I: This question -- I have some highlighted in yellow. You say, sometimes, think hard about my own ideas, or do investigations my own way, find my own way of doing investigations. Why did you answer there....sometimes, rather than often.

T: Because, um, if there are more than one, if there is more than one way of going about a problem, I would have to say the way the teacher knows or the way the textbook knows has to be superior to my way, because....

I: Why should that be?

T: Because they are the ones, the editors and the teachers, they're the ones who have been to university already....

I: But if I tell you opposite examples. Like, I read about a grade 2 and in another case a grade 5 classroom, where the students developed mathematics strategies that were superior to the ones that the teacher wanted to teach them. But the teacher gave them the option, left it open so that they could actually develop their own. And they were superior.

T: Well, I guess I tend to -- okay, its that, for one thing, I think that the teachers or textbooks would be better than mine, but I don't know, in another way, I find it sometimes in physics and stuff, I don't know exactly what I am doing, and it would be -- I wouldn't know if I was doing the right or wrong thing, if I was trying to go about something in my own way.

I: If there are many right things, or if there, if its not really wrong...

T: Well, is it productive or not, what I am doing?

I: What some people find is that they learn a lot, even if they don't get an answer that the book would have, they still feel that they learned a lot by seeing...

T: by seeing the mistakes that they made.

I: Yeah, by tinkering through it. You prefer another -- what you call the more direct way.

T: Yeah, the cut and dried, use the experienced, do it, get the 99% accuracy and learn the topic. I don't know -- I guess thats the way....

I: ...because -- this is why I wrote here -- among other things as you do the labs, why does it have to be 100% accurate. At least, I never stressed, you know 100% accuracy. Because to me I am happy when you go through it and you struggle with the experiment. It doesn't really matter if you get ....

T: ....often the errors you wanted us write....

I: Yeah to pretend.... so that you think about the errors. Yeah. But the actual result is, at least to me as a teacher, its secondary. But you stress the 100%.

T: Well, I think, its probably the way that I go about doing the experiment then, is not the way that its supposed to be because when I go about an experiment, its more like... From the beginning I want to know what I am doing, and I want to know what the results will be -- I don't want to have to guess, I don't want to have to think too much about it, I just want to...

I: Why not?

T: Because I don't want to get the wrong answers, for one thing. I don't want to .... sometimes when I think about it, I don't know...

I: At what point then, in your education, would that come in, because....

T: when I have to start...

I: You know, you have four years university and then you get a job, and then you do problems, and you don't know what the right answers are?

T: Well, I don't even know what job I'm going to have.

Sometimes, I think maybe I just want to be a dentist or something where there won't be any problems. Or a doctor, because....

I: But there still might be cases where you don't know....

T: Where I would actually have to think about it myself -- it won't always be there for me. I dunno -- I guess I hope by then to develop better problem???

I: But where will that come in -- if everyone just -- the teachers -- at what point will you make the decision, then, to say 'okay, ....

T: I dunno, I never thought about -- I understand what you're saying now, because I wrote in my essays that I wanted the teachers to teach directly or whatever, instead of... but I understand that

I: But at some point in your life, you know, you will be standing there, and you will have to make the decisions. And they are not cut and dried any more. And so the question is, when do you learn it, if you always have teacher who present everything cut and dried, because you want cut and dried stuff.

T: Maybe it should be ... maybe it should be slowly integrated into the learning process, instead of....

I: And, at what point? Because some people argue that it should start, at least for science, it should start in the elementary school.

T: But to what extent? What are you going to give little kids to do -- here, do this all by yourself?

I: No, but there is some -- have them start asking questions. Like, what we do with grade 7s and 8s -- they basically will pick, or win by lottery, a parcel of land here and they have to find out as much as they can about that parcel of land. They have 8 weeks or 10 weeks time.

T: Well, I guess -- its an important skill to learn but I think, like all methods of teaching, it will work for some people and it won't work that well for others. Like, it will work for little Neil Smiths, and little Todd Alexanders, and stuff, but I don't know -- I don't know how that would work for me. Maybe if I found the topic interesting, then yes, I would do as good job of it as I could, and I would research it enough to find some information myself.

I: Here, I have -- Carl Rogers, he is a very well know psychologist, you know, and he thinks of the human person as very very important and he said about learning -- self discovered learning, truth, which is truth that has been personally appropriate and??? cannot be directly communicated to another. Which is -you said, you want the teacher to tell you directly, but Carl Rogers says, its not possible.

T: .... possible to relay that information...

I: At least as it relates to experience, and you know, being able to deal with problems and so on.

T: Pause -- Well -- I guess you can -- a way of thinking -- an example of that but in a different sort of way is like, if you were doing a subject in algebra or something and the teacher gave you the formula, and you would think, there did this come from? You would know what it meant, and you would know what the different aspects of it were and everything, but I guess not until you go through the steps of deriving the formula, not until then do you really have the experience essentially.

I: See -- I'm just reading a book where they mention that -- there was a -- I forget what grade level, I think a grade 6 -- and they got the principal to allow them not to teach any mathematics to that grade -- for one year no mathematics. But what they did, they gave them LOGO, which is a computer program, instead of math they did LOGO and at the end they tested them for their math skills, and they wrote better tests than all the other grade 6s where there was direct teaching. And all they did, they figured the fractions , and geometry out for themselves.

T: Is that on average or...

I: On the average -- there classes average was higher, was significantly higher than the average of all the other classes. And it wasn't an exceptional class.

Okay, there is just some last questions -- you said that in practice, you write about the practice that you have -- ??? have the practice, you sort of know that you are not doing well, because -- I remember

your ??? example. You said that you have to memorize formulas and concepts. And.... peer group. Does that help you?

T: I guess that the ideal way that a peer group should run that would help. But, maybe, at senior year at Appleby, we're not... we're not mature enough to go about doing, you know, working in a group as we should be. I: Why -- are there problems that are?

T: Well, last year, when I was with Dave and Michael ???

I: ---they're procrastinators

T: Yeah, well, we always did the experiment on the weekend before, or whatever, and more or less, my job was to sit there and type whatever they said, and whenever I would say something, Dave ??? would say -- 'shut-up Tom' ...I didn't, the most I got in, maybe was a word in or something, in the whole assignment, or I would do the words, or relative words or whatever on the B-map, but I didn't have much input there. I guess that wasn't a very good group I had there. But I guess this time I had...

I: In the beginning, didn't you work with Chris on your labs? On all those independent lsbs last fall? In the fall, four labs, where you could choose your own topic -- who did you work with?

T: O really, that was Maxwell -- was that this year or last year?

I: No, no, all these experiments -- in the fall, on motion, different motion experiments.

T: Yeah, I think I did those with Chris and Penny?

I: And that worked out?

T: Yeah, they worked pretty well, but I think its almost the same thing there again, in the sense that, when I am doing a project with Chris, it has to be his way -- it has to be. Just like the calculus project we did on Sunday morning, like ???? or whatever, it had to be his way -- I'd say, shouldn't we ??? No, we're doing it my way. I don't know...

I: Do you find that frustrating?

T: Yeah, sometimes, but I just don't say anything any more. Just say fine. Cuz he gets also marks anyway, so why should I bother wanting to have it modelled my way.

I: ....two things. Does lab help you understand, and does peer group?

T: Do the labs help me understand?

I: Like you said 100% accuracy you .... chemistry labs. Does it help, or do you just go through, more or less through the motions? T: I think in chemistry, its more through the motions, because in chemistry you do the experiment and then later we interpret what we have done. You know, we put the two solutions together, we put in the indicator, we see it turns pink, and then later we realize that the ions or whatever form together here, and its not until then that we really understand what's going on, so while we're doing our lab, we're not doing anything, because we're not thinking, like as we're dropping ??? you don't know 'yes its going to turn this way', the ions will have done this or whatever, so, I guess the most that you can get out of those labs is the physical experience of working with the chemicals in the lab, and thats good. I: What about the labs that you planned yourself last fall. ??? or did Chris decide?

T: Oh, no, it was???? I remember it was hard to think of a lab to do because...

I: ....what labs you ...

T: We had some on centrifugal ???? extending....we had motion, we had an acceleration ??? like last year (unclear). I think the labs that have helped me the most, that I have actually been learning from the most, are the ones that we all did together, ??? like the ???? That's where I have been getting the most.

I: Why do you think?

T: Because, when, if we had done that, if I had done that lab with Chris and Kevin, we would have -- you know 'put this lid in front of the thing and record the results, put the next lid in, and record the results, repeatt a, b, c. You can do it, but you don't know why. When we were doing it there with you, I had questions, and I did ask, and after I asked then I started to understand what was going on, and I think knowing what's going on, while seeing it at the same time, that helps a lot.

I: Thanks Tom, thanks for coming in -- that helped me a lot and....

END OF TAPE.