Turmoil and Opportunities in Higher Education

The road of an academic department at the dawn of the 21st Century

Toh-Ming Lu
Turmoil and Opportunities in Higher Education

The road of an academic department at the dawn of the 21st Century

Toh-Ming Lu
To the students, staff, faculty in our Department,
Dean of the School of Science,
and my family,
who have made this unusual period of my life memorable
Preface

Under the impact of information technology, American higher education institutions have experienced a tremendous turmoil at the turn of the century. Not only what and how we deliver education were seriously questioned, but also the fundamental existence of the present form of higher education institutions was challenged.

This memoir tells a real life story how a “research-oriented” university in higher education institution was transforming itself and excelled in the midst of this turmoil. It also describes how technology impacts what faculty think, what they do, and what they value. It reflects the anxieties, the tension, the conflicts, the pressure, the excitements, and the joys that the faculty in the department had felt and gone through in this period of time.

The memoir describes a market philosophy and a business approach that the Chairperson had taken to deal with the budget crisis and to create a new balance between undergraduate teaching and graduate research. A detailed account on how a new teaching and learning environment known as "Studio Classroom" was created and implemented. It presents a view of how a higher education institution might evolve the way we teach and do research towards the beginning of the next Century.

The author is in debt to Professor J. Levinger for his help in editing the manuscript.

Toh-Ming Lu, Spring of 1999
(http://www.rpi.edu/~lut/people/lu.html)
## Preface

### Chapter 1. The Dean Called
- The change (1.2)
- Root of the turmoil (1.3)
- The talk (1.5)
- The struggle (1.6)
- What kind of job is this? (1.7)

### Chapter 2. The Meeting
- The proposal (2.2)
- The philosophy
- Management (2.5)

### Chapter 3. The Response
- The desire (3.2)
- The demand (3.4)
- The “market” (3.6)
- Democracy (3.7)
- The old timers (3.9)
- The guide (3.10)
- The promise (3.10)

### Chapter 4. Our Priority
- The crisis (4.4)
- Solution? (4.4)
- The priority (4.5)
- Great tradition (4.7)
- The environment (4.8)
- More than survival (4.9)

### Chapter 5. Our Customers
- Who were our customers? (5.2)
- Our customers (5.3)
Chapter 6. Customer Oriented Education

Customers’ value

“Can I help you?”

Job description

Faculty’s complaint

Chapter 7. Departmental Value

Performance evaluation

“Why my raise gets worse?”

The 0.5% leverage

The conflict

Staff evaluation

Proactive attitude

Chapter 8. Teaching vs Learning

What was it?

The debate

Efficiency of learning

The experiments

Watering down the course?

The dilemma

Chapter 9. The Studio Physics

Meeting at Crystal City

Studio Physics

Integrated learning

More Studio Physics

Computers in class

Chapter 10. The Expansion

The worry

Why us first?

Excel in turmoil

Scientific proof

Chapter 11. Evaluation and Implementation

The effectiveness

More data
Chapter 18. Looking Down the Road

18.1 Business on the move
18.2 Long distance learning Studio Classes
18.3 Long distance courses
18.4 Sharing teaching load
18.5 Other possibilities
18.6 The change of academic programs
18.7 Are we obsolete?

Chapter 19. More Than a Business

19.1 We can learn
19.2 Enjoyable career
19.3 Farewell note

Appendix A. The Response
A.1

Appendix B. The Reply
B.1

Appendix C. First Year Review
C.1

Appendix D. Third Year Review
D.1

About the author
Chapter 1. The Dean Called

That was about seven and half years ago, in the early fall of 1991.

I was sitting in my office working on a paper or something. The Dean called. He said he wanted to talk to me. And he said he wanted to come to my office to talk to me.

Boy! That was strange.

First of all, I did not, and never liked to deal with administrators. In fact, I always purposely avoided them.

It was difficult to know why I behaved that way. Could be tradition. Could be that I just wanted to be left alone and mind my own business. After all, a university was a place where I could do my own research and teaching. The administrative part of the Institute did not have much to do with me.

That’s probably exactly the reason I, and many of my colleagues, want to be a professor so much---so that we can have our freedom to do what we want to do and not be bothered by our bosses. “Unlike in industry......”, as we always say.
The change

That talk changed my life. Or, more precisely, began to change my life and the way I see things.

The most profound change was for me to eventually recognize (over the years) that a faculty cannot be immune from the organizational development of the Institute anymore.

What do I mean by organization? To put it in, perhaps, a simpler language---the business part of the Institution. That includes, first of all, the financial part.

Faculty least like to get involved in the financial part of the business. I remember a meeting held between the Dean and our Department sometime before I assumed the Chair’s job. In that meeting, the Dean mentioned something about the difficulty ahead and said we were going to have problems in balancing our budget. I remember very clearly a faculty member made a statement, which I believe to be very typical (at least at that time), when responding to such an issue: “That’s your (Dean’s) business!” It was generally believed that things like balancing the budget is the Dean’s, the President’s, and the Trustees’ job. Definitely not our faculty’s job. Why bother mention to us? Get your job done and leave us alone!

Another part of the business is recruiting.

Faculty do not get involved in undergraduate recruiting. (It is done by an undergraduate admission office who normally has no connection what-so-ever with the departments and faculty.) Meaning: we don’t worry about where and how we get our “customers” not to mention how we can satisfy our customers’ needs. If you think about it, it is incredible!! Have you heard a successful business where you don’t have to worry about where your customers are, let alone their needs? But we have survived and have done so well for so long!
Students automatically came to us (until recently) and paid high tuition for us to “teach” them.

Yet there is another part: the administrative branch of the Institute.

We do complain very often why there are so many people and so many non-academic divisions formed to “run” the Institute. The Graduate Admission Office, the Purchasing Office, the Human Resource Office, and the Development Office, the Stockrooms, the Vice Presidents’ Offices, the Mail Delivery Room..... Well, we complain. But we never actually know, or really care about their functions, how they are run, and how they fit our business. Of course, how do you expect us to know all this if we think we do not have much to do with the business part (or the organizational part) of the Institute?

I don’t know for how long we have lived in such an environment in the world of academic in the past. Probably for many decades. At least when I was hired (1982), it was clear to me what I should do to be successful in the university. I just had to achieve high scholarship and be well recognized or in a fast track to be well recognized in my field of research, in a relatively short time (five to six years) before the tenure consideration. The focus was clearly on the scholarly achievement. Other things such as teaching and routine committee work were not very difficult to satisfy.

Root of the turmoil

The turmoil in the academic world, in my opinion, is clearly a result of the impact of the incredibly fast growth, fascinating, and ever bewildering information technology. The technology changes what you learn, the habit of learning, the path to creation, the working relationship, the value in a workforce, the focus of competition, and
finally, the distribution of wealth (which is related to the affordability of education by parents).

In order to survive in this change, faculty are forced to get involved in every aspect of the business, financial, recruiting, and administration. We worry about the efficiency, the market, the products, the competition, the speed, the deliverables, the customers’ satisfaction.... All that stuff modern (the 90's) industries are worrying about.

Wait a minute!

We are supposed to be a non-profit organization and we are educators. We are not supposed to talk about things like “market”. We have a sacred mission of educating the youngsters for the future. Well, I don’t know exactly how to answer this question. But I know now that selling knowledge and the way you sell knowledge is, or at least, has become a business. And it becomes clear to me that if we want to draw salary out of this (or any) business we probably still have to follow the law of business, whether or not it is a non-profit organization.

How about life?

Don’t we worry about education in leadership, humanity, teamwork, relationship, having fun.....?

Absolutely! In fact, I think the universities probably have to sell more of these things. No, we cannot monopolize knowledge anymore. And technology is bringing human interaction closer then ever. A PC based video conferencing can even provide a certain degree of human touch such as eye contact and body language. But technology probably would not be able to provide a complete menu of human touch, not in the near future that I can foresee.
But humanity alone do not seem to justify completely why people would send youngsters to college. It appears that we have to do both, knowledge and human touch, keeping in mind that human relationship also evolves as the technology evolves.

**The talk**

I still haven’t explained what the Dean wanted to talk to me about.

“If you don’t help solving the crisis, you will be the next Chairman of your Department!”, he pointed at me.

Wow! What a threat!

I hardly knew him. And I believed he hardly knew me either. But the threat was actually very effective. I got to work on it immediately after he left.

The crisis he referred to had to do with the conflict between our Chair and the Department faculty. I, and some other faculty in our department tried real hard to work out a common ground between the Chair and the faculty to run the Department. It did not work out. The chemistry was not there. I am not going to say much about the detail of the situation. But the net result was that we failed.

But to think myself as the Chair of the Department was unimaginable! That was not the kind of work I ever dreamt about. Definitely not my goal of life!

Obviously I refused to take the job.

I was at the high point of my research career and had every sign to grow scholarly. I had ten graduate students working in my lab
and had a large and exciting research program to run. Besides, I did not have a slightest clue how to be a Chairperson of the Department.

I have to say that most professors engaged in research are like me. They do not like to be an administrator. Administrative work hurts research career.

The struggle

The situation dragged on for about 6 months. During this time, I consulted with many wise people whenever I had a chance. My former mentors, my friends, and my peers.

“Ignore them! Don’t trust them!”

“You will be screwed from both ends. You won’t be appreciated no matter what you do. I can give you tons of horrible examples. No, especially not at this time!”

“You must be nuts if you consider that kind of job!”

“Only crazy people, or people who cannot compete in research would do that kind of job!”

“If you want a miserable life, this would be it!”

What a unanimous opinion!

The feeling was, first of all, in general, good researchers don’t do administrative work. Secondly, these times are the worse times to be administrators. You not only don’t have resource, but have a shrinking resource. You got blamed from all angles no matter what you do or don’t do. This job would be 100% not rewarding.
One friend asked, “What did the Dean promise to offer you to do the job?”

Well, nothing. In fact, he made it crystal clear that there would be very hard time ahead facing our Institution and the departments. He added, “No one can continue his/her research/teaching operation the way we used to and at the same time ignore the Institute problems any more.” “We want you to help finding out new ways to do our business.”

What a novel way to recruit a new Chairperson of a department!

**What kind of job is this?**

While the struggling was still going on, I began, for the first time, thinking: were we really running into that much trouble? What really was the problem we were facing? What would and could I possibly do to help the Department to excel in these times if I actually became a Chair? What would our future look like?

I was frightened even more after I thought about it.

How came I got frightened? Wasn’t that what I did all the time: to explore new and unknown frontiers in research? Wasn’t that I always do to challenge myself and to attack those really critical issues in research? Wasn’t that the thrills I always looked for: to walk into an unknown world?

Why was this so different?

Well, I did not know. Maybe because there was more risk involved this time, not only my own risk, but the risk of the Department, and perhaps the whole Institute.
May be because the Chair had to deliver speeches every now and then. (I could not deliver speeches, particularly spontaneous ones, except talking about physics.) But I was sure of one thing: it was not a research problem. Not a well-defined problem on how to teach well either. It touched territories that were not familiar to me, such as business, finance, sociology, culture, etc.

Prior to that time, I did hear about issues such as student enrollment, student quality, students’ complaint, parents’ complaint, the prediction of the Institute financial difficulty, the declaration of the job market for the students (in that era of corporate downsizing), research funding direction changes, etc. But up to that point I really did not feel like these issues were directly related to my life (or the well being of my life) except perhaps the change of funding direction.

Did I have any idea at all to tackle these issues? But, hold on! Was it the job of a Department Chair to solve all these issues? If not, what exactly was the responsibility? What were the expectations from the faculty and the Dean?

The Dean was persistent as well as the faculty. More discussions with the Dean and the faculty. More thinking...... More discussions...... More thinking......

Two things were in my mind for days and weeks.

One was the Dean’s words: “No one can continue his/her research/teaching operation the way we used to and at the same time ignore the Institute problems any more....”

The other thing was snap shots of my life in the Department in the past 9 years with the faculty/staff/students: the lobster dinner during my interview for the faculty job, the backpacking in the Adirondack mountains, the cross country ski through the lakes, the
volley ball at the fall picnics, the graduation luncheons, the Christmas feasts, the visits and flowers and cards when I was sick one time in the hospital......

Finally, with a confusing and frightening mind, I called a meeting with the faculty of the Department. There were 23 faculty in our Department at that time. (We had about 120 undergraduate students and 100 graduate students.) I collected and jotted down some thoughts the night before and presented a proposal in the meeting.

That was early 1992, just after the New Year.
“Our Fall Picnic”
Chapter 2. The Meeting

In that meeting I presented a proposal and a philosophical view of how I would handle the job if I decided to do it. And a few specifics. I asked for a formal response from the faculty on my view before I made my decision.
The proposal

I proposed a term. I would do the job for one year.

After one year, if the department still wanted me to continue, and if I felt I could still handle the job without hurting my life (family life and research life, in particular), then I would proceed for another two years.

After another two years, that was, after a total of three years, another evaluation would be made by the Department and by myself. If that evaluation came out to be positive, from both parties’ point of views, then I would continue another two years. That would be the end of the term.

What a drag!

If you think the proposal sounds stupid, you are not alone. Me too. Obviously I did not have much confidence, neither with myself nor with the Department.

The philosophy

In the meeting with the Department, I spelled out some of my thoughts on how I would look at the issues regarding our Department’s future and how I would handle these issues, philosophically.

The central theme I presented was:

☐ Any organization needs a good market to survive.

---- our products: teaching and research.
---- our customers: students, parents, and employers

2.2
for the students....

- Market always changes.
  ---- products have to be changed to meet the market.
  ---- we have to continuously improve our products and create new products.

- Therefore my philosophy is: change, adoption, and creation.

Based on this philosophy and the following would be expected:

  ---- less fair for certain items: hiring of faculty has to be market oriented, and resource goes to developing new products.
  ---- less democratic for certain items: would not go for a vote to determine certain issues, and would not like to “educate” the higher administrators for certain items.

No kidding!

What did I know about business? In fact, I’d never been in any business. Gosh!

To date I still don’t know how I came up with those statements. Not only that, I did not think I liked those statements. Those philosophies were the reasons I did not want to work in an industry. Those philosophies were the reasons that I wanted so badly to be a professor.

But I had a gut feeling that all the problems came from the fact that we did not treat the enterprise as a business. Without this in
mind it would be impossible to deal with the future, I thought.

It was intuition. The intuition was probably based on what I sensed the environment was at that time, my experiences in the past decade as a faculty member living in an academic world, and my contact with the industrial world where I made deals to secure funding.

I was sure that all my colleagues didn’t like those statements either.

And I thought if the faculty were scared of my philosophy, then they would just say “go to hell!” Then the deal would be off and I would not be bothered again!

Anyway, in the meeting I discussed why changes were needed. Fundamentally our society did not want to support us anymore the way it had been. The society viewed us (physicists) as citizens who could produce military weapons to protect the country and through the Government and private sectors, we were supported, both in teaching and research. We developed an illusion that the society actually supported us in such a large scale to do whatever we wanted to do in the interest of science.

It even got pushed to the extreme that we came to think we had the right to do what we were interested to do and the society had the obligation to support us.

That was a tragic illusion and wishful thinking.

My guess was that the society still wanted to support us to do interesting sciences, but definitely not at the scale that we had enjoyed before and not for the same reasons as before.

Now the focus changed. One thing was clear that if we wanted
to excel, we would need new directions commensurate with the societal needs. That means new market. That means business. Both in teaching and in research.

At least that was the way I thought why we, the physics community, had difficulty.

**Management**

I also listed quite a few items outlining how the department would be managed daily.

It was along the line of a self-governing type of management style. Among them:

1. The Graduate Committee determined who get TA (Teaching Assistant) awards for returning students.
2. Graduate Recruiting Committee determined the new TA award offers. All Committees were authorized to sign relevant documents. (The Chair would practically sign no routine documents, a deviation from the normal practice in our Department.)
3. A Planning Committee would be established to advise the Chair and to coordinate important initiatives.
4. The Associate Chair would do the teaching assignments and help supervise the office staff.
5. Some of the main responsibilities of the Chair were: faculty evaluation, budget, public relation, department heads meetings, and fund raising.

I mentioned that a strong emphasis would be on innovative teaching and to increase the research funding level (including funding for teaching innovation and the conventional research). I would encourage the faculty to submit more proposals (targeted to grow to 3
millions/year from current 1.5 millions/year in research volume).

Some specific direction on hiring was mentioned, including the decision to hire an intermediate energy experimentalist and an optical science experimentalist, but not to hire a hadron theorist as requested.

I also mentioned several general thoughts:

1. My approach would be a mixture of idealistic and realistic.
2. I foresee that our department would be smaller, but better.
3. We would all be much busier, but more enjoyable to work.

I requested that the faculty submitted written comments in response to the presentation and discussion in the meeting. Basically I would like to know how faculty feel about the issues of concern, my philosophy, and the approach I would take. I requested to see their response to my thoughts before I accepted the job. This way there would be no serious misunderstanding of each other after I took the position.

If the expectations from each other were too far apart, then I simply would not accept it and they would know why.

I woke up in the middle of the night that day and thought I made a fool out of myself! “Forget it!”, I said to myself. The whole thing was out right stupid!

“One year trial period.....” “Business.....” What a joke!

I slowly calmed myself down in the next few days. The faculty submitted their comments (Appendix A). I read them with great
intensity. I merged into deep internal fight with myself. This is a place where I grew up (career), with all the care and help from people who I owed much to. A sense of guilt emerged. My heart softened. With this mixed feeling and really not knowing what I was getting into, I wrote a reply (Appendix B) to their comments and agreed, very emotionally, to take the job.

(People may argue for me that at that time there wasn’t much choice. (I don’t want to get into the political situation at that time that leads to the thought.) But still, I did have a choice not to do it. At the very worst, people would think that I was a selfish fellow who did not want to help. But I was a Professor! There was no obligation for a good Professor to get into an administrative position, at least according to traditional values!)

In the next few years, deep in my heart I continued to have a mixed feeling about the job. On one hand I felt vulnerable every time we faced a tiring issue that was controversial and time consuming. On the other hand, I felt excited that the faculty were willing to take on so many new initiatives and were willing to take different routes to walk into the unknown world.
Chapter 3. The Response

The response (Appendix A) from the faculty after the meeting, which was anonymous, reflected the state of the mind of the faculty and the situation at that time.

The response reflected the era of turmoil in higher education in the 90's. Conflicts and harmonies, insecurity and confidence, traditions and innovations, trusts and suspicions, anxieties and hopes......

I was somewhat surprised to see that after my strong statements in the meeting, the faculty still did not get totally scared. In fact, I sensed quite a bit of encouragement from the response despite some disagreements in the philosophy.

My reply (Appendix B) to their response was equally emotional. It reflected my psychological barriers, my worries and hopes, my doubts and determination... But overall, my tone softened after reading the response.

The response and my reply became the basis of my approach in the five and half years as the Chair.

I shall now go through some of the main issues discussed in the response and the reply.
The desire

The first impression you might notice was the feel of uncertainty, anxiety, and even desperation. The morale had not been good.

“The present time - winter 1992 - is not the best of all times for the U.S. or for Rensselaer and future of the latter is irrevocable interwoven with that of the former. The economic plight of our nation is reflected in the economic plight of our university. Of even more concern, the low esteem of science and technology in our country manifests itself in our difficulty in recruiting and maintaining a first class student body. The solution to Rensselaer's problems cannot be found without some movement in solving the national crisis. The best we can hope for in the near future is symptomatic relief to our difficulties - not a cure for all that ails us.”

“Rensselaer and the School of Science in particular, is under tremendous economic pressure. Unfortunately, our problems need to be considered in light of a national trend for the number of undergraduates in Science (and in Physics) to decrease. Thus, I do not expect there to be any "easy" fix but I do feel that there is room for significant improvement in what we are doing.”

The situation was, of course, not unique to us. If you read through Physics Today (a physics magazine) in the 90's you would sense instantly the era that we have been in higher education.

The long for a Chairperson was obvious. It had just not been easy to get someone who was willing to chair a department like ours at these times. Not much incentive. Not rewarding based on any conventional measure.

However, it was crystal clear that the faculty had a very strong desire to succeed, in whatever sense. Not clear on how, but they
definitely wanted to define something meaningful in our profession even during these difficult times.

The faculty were also very sensitive about my own loading and the possible impacts on my research career.

“I understand that we have difficult issues and hard work ahead and I am willing to contribute as much as possible to move the school forward and to make Lu’s job bearable. I am concerned that the demands of the chairmanship will damage Lu’s research excellence and I will attempt to carry my share of the burden.”

“I share Paul Stones’ concern about your own loading. Do not let the chairmanship duties prevent you from continuing an active research program! Keep the time you spend on the chairmanship down to 40%. Be ruthless about that!

.........Finally, TM, I want to say how pleased I am that you’re willing to take on this dreadful chairman’s job. You certainly have my support and my willingness to do all I can to push things forward for the department.”

“I wholly support the suggestion to make Lu chairman of the Physics Department and pledge to do everything possible to help him achieve success for himself and for our department.”

“.... my willingness to do all I can to push things forward for the department.”

“I am willing to do anything I can to make your term as chair a success.”

The hearts were warm, very warm.
The demand

One the other hand, it was also crystal clear that the faculty demanded openness and honesty. They wanted decent communication with the administrators.

“.....We did not get the sense of the institutional problems nor did we have the opportunity to offer solutions.....”

“A lesson learned by good managers and leaders, and not learned by bad ones, is that to get enthusiastic cooperation of those being managed and led, they must have a real sense of "ownership" of the decisions.”

Apparently my discussions with them in the meeting were considered to be direct, honest, frank, and open. And I did not anticipate that the reaction was so strong on what I did. It surprised me that they considered the approach I took to be even more important than what I actually told them.

I never even thought about the issue of openness. I did not think anything beyond what I had in mind: “I tell you exactly what I think. If you like it, take it; if you don’t like it, don’t take it!” In other words, I did not think that my approach was anything special.

“I found Dr. Lu’s comments open and frank. I do not agree with all of his priorities (markets); I do agree with most of them. I do not expect to agree with all of his decisions as chairman but I shall respect them as the product of deep thought and commitment.”

“I thought the department meeting yesterday went very well, and I congratulate you for the open way you chaired it. Your success in raising our morale at this meeting promises similar excellent results during your three years as chair of the physics department.”
“TM, I was very pleased at your willingness to speak so openly and in such detail at yesterday's meeting about your views of the chairmanship. After the chaos of the last several years, it was most refreshing to have such a frank discussion. I welcomed your forthrightness and your openness to our views.”

“I appreciated the open discussion provided by yesterday's meeting. .......this "openness" is welcome and it should be encouraged as the basis of chairman - faculty interactions in the future.”

Professors are perhaps one of the most creative groups of human being on earth. At the same time they are extremely independent, independent in thinking and independent in working habits. These characteristics and personality can be traced back to their individual childhood. The later training as researcher enhances the independence of personality.

Academic freedom even brings this personality to its highest form.

Rules and regulations, and threats and demands therefore do not seem to work very well for professors.

Does it mean that professors are totally hopeless and cannot work together on common goals to survive and excel in a crisis?

A faculty member commented in the response:

“..... We have always reacted more positively to appeals to our intellects than to threats and demands.....”

I think this is a profound comment.

It was this wisdom that I seek to follow.
**The “market”**

The most worrisome was my use of “market” and perhaps, the implications behind:

“I'm not happy with your emphasis on 'the market'; but I don't know what to substitute at a time of national recession/depression combined with disenchantment with science. One alternative (that could be used on its own, or combined with finding a market) is to "get by with less".

“I was concerned about your total emphasis on marketability as a criterion for deciding on department directions. I understand how the current economic and demographic situation in the nation (and at Rensselaer) is driving decisions around here. But things are not going to be like this forever. I agree with Paul Kern - we need to take a long view in our planning. And there are other considerations we need to keep in front of us besides marketability. A university is not just a business. Physics is an intellectual activity, and there are intellectual considerations in determining the directions of a physics department. For example, if we were only concerned with marketability, we'd never hire another theorist as a faculty member, even in condensed matter. And that would be a shame.”

“My main concern in surrounding the pet word used by Lu frequently during the discussion "marketability" and "products". In spite of his explanation, it is not clear what he means by these words on how he is going to decide what "product" is "marketable".”

“I understand your philosophy about change and market, and I agree that we must be poised to be leaders when new opportunities arise. However, one can also get into trouble by simply following the latest trend. It is also the chair’s responsibility to see that we don’t
lose our basic character as a Physics department.”

“Marketability: Using this as the main guiding principle may be dangerous, if it goes so far that the physics faculty could just as well be accommodated in the Material Science Department or the Engineering Physics Department.”

Obviously the concern of the word “market” is overwhelming. My reply was:

“If my interpretation is correct, I do have your understanding (not necessary agreement) of my philosophy and the motive behind. Many faculty don’t agree with the wordings I use, particularly the term "market" (and perhaps the implications behind). I have no problem with that. My intention was to ask for "understanding", meaning: when I made certain decisions in the next few years, I hope you would say "I understand why he does that", rather than "I don’t understand why he does that".

To date, I feel that just “understanding” is really not enough. In order for us to enjoy our profession, we have to accept this as a matter of fact and be proud of what we are doing. If this line of thinking is right, I should able to convince myself and the faculty to actually immerse into this philosophy and be a natural part of our life.

**Democracy**

Another item that worried some of the faculty was the issue of democracy:

“I thought your use of the term “non-democratic” was unfortunate and not accurate. I take it you don’t want to put important decisions to a faculty vote. Fine. But I also take it you’re willing to consult with us about major decisions. That’s very good. I
was concerned, though, that you have already decided there shall not be a nuclear theory appointment. I’m sure that appointment would indeed have a very tough time right now. But it does seem that you have not yet consulted with anyone about the merits of this case. I’d like to see some consultation and discussion before you make decisions like that, even if your decisions are the right ones.”

“Also I am somewhat dismayed by the statements like ‘I am not going to be democratic’. While I expect the chair to exert his leadership in setting up the priorities within the given boundary conditions (financial and otherwise) I hope he will consult fully with the concerned faculty before reaching decisions.”

My reply was:

“I agree that the term "non-democratic" was a bad choice. A better description would be "for some items, I would not like to put it to a faculty vote". I will definitely consult with the faculty on major decisions. I will try to bring the departmental and the administration viewpoints closer instead of further away, so that in a few years the number of these items be minimized, or totally eliminated. At the present time, realistically, because of the lack of communication between the administration and the department, a vote of certain items might mean a direct crash between the department and the administration. I simply cannot handle that. I ask your "understanding" of this point.”

My feeling is that consensus has to be built between the department and the upper administrators on important issues. Consensus in the department is not enough. I remember in the late 80’s the department voted to create a high energy physics group by hiring 5 new faculty. This initiative was driven by the fact that all high ranking physics departments had high energy physics groups. In fact, the rating of a physics department is probably very heavily depending upon a high energy physics research program.
After the Chair was unsuccessful in fighting to realize the decision of the department, everybody got very frustrated.

**The old timers**

Breaking the tradition and inheriting the tradition always appear to be forever contradictory paths, particularly in difficult times where the resource is scarce. The uneasiness among the retired faculty and staff was understandable.

I felt very comfortable with the old timers, both faculty and staff. On one hand I certainly felt that the new era requires new solution. However, the continuation of a community life needed not to be interrupted.

My reply to the old timers:

“For the retired people, you are most welcome to continue your activities here in the department. If you are interested in participating the committee work, please do so. I am sure that you have a lot of creative things that you like to do. Any degree of participation are all very welcome. If you don't like to do any specific job, fine, just "hang around" and enjoy some reading and may be a lunch with us, and chit-chat a bit.

I share a lot of common interests with you "old timers”. Hill inspired and encourages my "painting career" (I was touched to see him come to the faculty meeting last Wednesday), Joe taught me to make wine, Wily taught me how to invest, Walter inspires me the art of administration, I share the same thrills with the Sternstein's each spring when flowers blossom, the Kissinger's and my family are greedy animals - like to eat good food....... In the process of this "take over", in addition to the advices I got from the present faculty, I
have numerous consultations with Walter and Gery to formulate my thoughts.

*In exactly the same spirit, the retired staff members are most welcome to visit us, to chit-chat a bit with the faculty and with the staff, and to participate our departmental events.*”

**The guide**

As I mentioned above, the response and the reply became my guide to work with the department.

In fact, this was the only guide that I could get hold of. It was a collective wisdom. They were truthful and honest statements on what they and I liked and didn't like from our hearts.

Nothing was more valuable than this from the Chair’s point of view.

**The promise**

I did have one promise: to do my best to make our lives exciting, meaningful, and hopefully happy. Nothing is more important than making ourselves happy when we do the work. This was what I wrote to the faculty after I formally accepted the offer from the Dean’s office:

“I look forward to working with you all in the next few years. My slogan:

*CHANGE, ADOPTION, AND CREATION!*

Let’s all work together to create the most exciting and
enjoyable period of life in this most difficult period of time in our lifetime!”

I did not, and still do not, know what our Department, our Institute, and the high educational system in general, would eventually become. But I had a gut feeling that if we understood our business well, we could define our work in a purposeful way and would see the impact of our work. As a result we would enjoy our work.

This, I seemed to have some confidence. Perhaps the only little confidence I had.

Based on my more than a decade long living in the Department, it was beyond doubt that our faculty enjoyed education and took education to our hearts. The focuses and approaches might need to change, but the fundamental belief that we did have a noble mission in education had never changed. If we could make ourselves to see that we were fulfilling this mission, we would be happy!

Fundamentally, I still believe that the business notion of running an academic institution should not bother faculty and staff in the long run. As soon as we see that we can excel and our mission can be accomplished, we will be a happy bunch, as happy as we have ever been.
Chapter 4. Our Priority

One may ask why do I have to go through such detail to describe how I became the Chair of the Department.

Well, it is very important. Very important indeed. For one thing, it shows how ill prepared department chairs are when taking over the job. (I believe many department chairs are created in a similar path as I went through.) There was no such thing as department chair training school or workshop that taught people how to be a chair. The only experience I had was managing our research group, which was, at that time, about a dozen people.

I also want to say that, many chairs are like me, who never take a management job as their career goal. In fact, in the back of many people’s mind, a successful professor would not like to be an administrator.

In particular, at this changing time, the position makes it even less attractive.

The office was too big. It was chilly.

I brought a potted jade tree from home to look at.

I also brought a painting entitled “not yet spring” and hanged it in front of my desk.
That was February, 1992, when I assumed the Chair job. I saw and felt many intriguing things. But I will begin with the ones that occupied my thought most.
“Not yet spring”
The crisis

I began to ask myself: what was the No. 1 key issue facing our Department and the Institute?

The Dean showed me the School of Science enrollment history. It was at all-time low.

Our School was not unique. The acceptance rate (the number of students we accepted to the freshmen class vs the total number of applicants) for the whole Institute was an all-time high. Meaning: the total number of students applied dropped dramatically. The retention rate was low. Meaning: many students dropped out after a period of time.

One argument at that time was that it was a national trend due to the reduction of college age population.

The reason didn’t matter. How was it relevant to our business?

It was very relevant, from every respect. In particular, financially, I was told. The tuition net income, after the scholarship awards to the students were deducted, did not increase over the years. (Poor retention played an important role in the low net income.) But our expense increased about 2 to 3% just from inflation alone. This would give us 2 to 3% operational deficit yearly.

We were not alone, it appeared that the research universities, big or small, all run into trouble. You heard it in the news all the time.

Solution?

One solution for the institution like ours, a small technological
university, was to eliminate our graduate programs altogether and to become a teaching university. A teaching professor could teach 8 courses per year while a very active research professor could only carry 3 courses per year. So you chopped the faculty size into half and removed the research infrastructure. You probably could balance the budget, provided you still had a steady enrollment and an increase of the tuition income each year.

Well, we really didn’t, and still don’t want to do that.

Lots of discussions, within our department and on campus. Ideas for saving: cutting services, outsourcing services, eliminating the administrative offices including the Dean’s offices, reduction of forces, curriculum reform, increasing teaching load..... Ideas for new income revenue: raising tuition income (not a very new idea, isn’t it?), long distance teaching, professional Masters degrees ..... (Over the years many of these ideas have been implemented, often time through budget reduction imposed upon both academic and administrative branches. I will touch upon some of these later. The story is still evolving. The budget adjustment is still going on and a new “incentive budgeting scheme” was just implemented.....)

But one thing appeared to be clear: the undergraduate enrollment and quality had to be a major part of the equation.

So we just had to sell the right products and compete.

**The priority**

The issue of teaching vs research was, and still is, a focus of debate on campus.

In our Department, our research funding had grown
considerably over a decade. It illustrated the change from a teaching oriented to a research oriented department.

We had over the years, picked four focused research areas: infrared astronomy, intermediate energy physics, condensed matter/optics which had a concentration in electronics and photonics research, and teaching research. The growth had been in the optics area. Overall our research activities had grown (and continued to grow) steadily.

The question was: could we survive and still do well in the next century by maintaining a vibrant research Department without changing the way we do business?

Knowing the data from the Dean’s office and the troubles I heard from other research institutions, it took me very little time to recognize that it would not be possible.

The next question was: could we excel in teaching, improving the quality of students and retention rate, and at the same time maintain our high profile in research?

It seemed to me that was really the challenge in front of us.

It did not seem to me that there was any other better strategy for us to survive and excel.

The proposal to put teaching development as our No. 1 priority in our Department resonated very well with the faculty.

There was no doubt in our mind that we needed to build an attractive undergraduate program, both for our own Department and for the Institute as a whole. (Even though the number of our majors might continue to drop, new business opportunities continued to open up for us.)
It was clear that the Institute as a whole had to attract more and better students to have a viable business. Our Department played a major role in that. Traditionally we taught and still teach Introductory Physics I, II, and III for the whole campus. Introductory science courses, including math, physics, and chemistry, are vital in defining the quality of undergraduate education. (In the future, we may also offer other general service courses such as “Origin of Life”, “Cosmology”, or information technology related courses to the whole campus. Not only that, as some of us suggested, we may teach our introductory physics and other service courses to high school teachers and high school students through long distance teaching. Not all of these ideas are practical, of course. But we probably need to be open minded.)

In the past, trying to be excellent in both teaching and research was considered to be a formidable task. It was a frightening preposition for the researchers in a research oriented university.

Without knowing exactly what we were getting into, we began to work on it.

**Great tradition**

I hate to say that because we needed to survive, therefore we needed to improve undergraduate education. Or, because we needed to balance our budget therefore we needed to attract more students.

It did not sound very exciting. In fact, it sounded somewhat discouraging.

But we did have many “positive” and exciting pictures to look at.
Although my own focus since I came to this Institute had been on graduate program and research, I, and other new comers were strongly influenced by our “old timers” in the philosophy of teaching. Our department had a strong tradition in teaching innovation. We had a group of great lecturers, lab instructors, and text book writers who had made a major contribution in physics education since the Sputnik era.

Although most of these great teachers had retired, the younger generation, although hired primarily to develop research programs, inherited the tradition---the sense of an honorable mission and the feel of great joy and satisfaction of educating youngsters.

It took little effort to stimulate and enhance this feeling in the Department. The urge in doing something innovative in teaching was in our souls.

**The environment**

The environment was great!

I could not remember a single Chairs Meeting (once per month in the Dean’s Office) in the School of Science without talking about teaching innovation. The Dean kept on distributing to all the Chairs the latest essays regarding the trends in higher education. “We cannot do business as usual anymore…….” This was stressed over and over again....

The Math Department just had their experience in teaching computer-assisted calculus. They had developed something very interesting: to use computer to help teaching calculus and to encourage team work in the learning process.

Mathematical concepts such as “limit” were learned through
hands on work using computer. Incredible!

There are great teachers in the Math Department. You always get excited by talking to them. Their last two Chairs that I had worked with were dynamos.

The Math’s computer calculus development and other experiments done on campus led to the institute wide focus on something call interactive learning. I will discuss this more in the later Chapters.

Professor Jack Simpson, a renowned physics educator, was just hired to head the newly established “Center for Innovative Undergraduate Education” at our Institute. Professor Simpson is also a member of our department. He and others developed a well known computer software for running a physics laboratory and simulations.

He provided the latest ideas and pedagogies in physics education and was tremendous in educating us on the theory and practice of modern higher education.

More than survival

As we went along, more and more we recognized that it was much more than survival. The challenge, to be outstanding in both teaching and research, was something much more interesting, much more forward looking, much more dynamic, and much more profound.

In the short term, could we do it? How would we do it? In what form?

In the long term, do students need to come to “campus” to
learn and to earn their degrees? If not, how will education be delivered?

I certainly put my major energy into these issues, particularly the short term ones. I salvaged all the resources that I could lay my hands on to push into this direction.
Chapter 5. Our Customers

Ok, we appeared to have the consensus that undergraduate education is our first priority in our Department, at least in a general sense.

The first thing we needed to know a bit more is, of course, the market.

Who bought our products? Were our products competitive? Were our customers happy with our products and our service?
Who were our customers?

First of all, what was our product?

Traditionally we defined our students as our major product. Our customers were companies and Government organizations who hired our students, our product.

Something did not smell right about this definition.

Look, we found it more difficult to attract science and engineering students to enroll in our Institute. Our ability to select and choose students to come our institute deteriorated. Wasn't it very clear that students were our customers, not our product?

Although I had an intuitive feeling about the importance of this issue, I did not have a strong supporting argument until I heard the following story.

Michael was a good student. His SAT score was well above our acceptance level. He visited us with his parents. He applied to Rensselaer and asked for aid. He had every sign of a successful student. We offered him $5,000 per year scholarship.

You think the story ended and he would accept our offer happily and prepared to come to Rensselaer?

No-oop!

He also applied a couple of other New York State private universities, in fact, all of them not very far from us.

He faxed our offer letter to the two other universities and mentioned that we offered him $5,000 per year. Obviously he was asking to see if the other two universities could give him a better
offer.

One of the universities did. It was $8,000 per year.

You would think that the story ended. He would then enroll that school?

No-oop!

He faxed the offer letter with the $8,000 per year to us!

If this was not business, what was business? If the market was not important, what was important?

Now, there wasn’t a slightest doubt in my mind that students were actually our immediate and the most important customers. There was more to that. I will come back to this point later.

(Although the pricing practice told me who were our customers, I must say that I really didn’t like the practice. Charging different students different prices just did not seem right. We got to produce a product so that people could afford to buy, paying out of the customers’ pocket, or loan, or something. Otherwise forget it.)

**Our customers**

The next question was: were the customers happy with our products?

(Let’s not worry about what our products were at the moment. Let’s see how our customers feel first.)

I remembered when I took over the job, I was pretty nervous
to find myself not knowing where our 120 undergraduate physics majors were.

I knew a lot of graduate students. I was in many committees related to our graduate program, but never in an undergraduate related committee. We did have an undergraduate program committee. I was never a member of the committee. A long time ago I taught a senior (elective) course for a couple of years. I occasionally taught one or two sections of our introductory physics course for science or engineering freshmen or sophomores.

Another opportunity was our senior course on research participation. Very often I had one or two senior students working in our research group.

We had a departmental fall picnic every year. But that was only for faculty, staff, graduate students, and their family. We never invited our undergraduate students.

I began to look for them.

I began to talk to the faculty who taught undergraduate courses and had more contact with the undergraduate students. Especially the old timers (faculty). They had been focusing more in teaching undergraduate courses and had much more contact with the students.

I found that students were scattered. Most of them came to attend a physics class and disappeared into the campus with different groups of people doing different things.

That was strange to me.

I remember when I was in college (in Taiwan), our classmates were very close. We always did thing together. I guess these days
people have more diverse things to do.

They did have different activities on campus, some organized by themselves, some with guidance and help through the Vice President of Student Affairs.

But we did have some physics students who stuck together in the Department. One example was our local student chapter of the Optical Society. Another was the local student chapter of the American Physical Society. I began to know more of them.

I became friends to some of these students.

I became to know some parents too.

The customers’ complaints

“The system is like a two-way screw driver. We get screwed no matter which way you go.” A student mentioned to me.


“Why pay so much more money to come to a private institution to get the same treatment like some of the public schools?”

Many of the complaints could be mechanically fixed. For example, to make the registration procedure more efficient. But the most serious problem was perhaps the lack of care.

There were two types of lack of care. One had to do with the
attitude towards the students. This could be by an office staff, a professor, a TA, or a dorm supervisor. The other had to do with the lack of attention from the professors. Particularly in the introductory courses where the lectures were delivered to a very large class, with a few hundred students. Many of the recitation classes associated with the lecture course were taught by TAs.

The news media (including the CBS 60 Minutes Show) showed no mercy to higher education. They reported many stories on how badly the students were treated. The teaching job was to leave to TAs who were inexperienced and spoke poor English. It was under the impression that Professors did not do much in universities.

The consequence appeared to be very clear: if we were not willing to change, the society would change it for us.
Chapter 6. Customer Oriented Education

Care about students?

That’s easy! Couldn’t we just more often say “hi” to students and be more patient with students who were slower than others. Or do a better job in advising students what courses they should take.

Wasn’t our Department already recognized for a long time as one of the best Departments on campus when we talked about attitude towards students?

That’s true. But we probably needed more. Much more.

What we needed was probably a more complete menu if we would like to serve our customers well. It was probably much more than just a caring attitude towards students.

The basic value in the Department might have to change. The performance evaluation system might have to change. The reward system might have to change. The old teaching materials and notes might have to be thrown away. New materials might have to be developed. The balance between research and teaching might have to be re-adjusted. New teaching pedagogy might have to be developed. The relationship between the Department and the Institute might have to change. Society’s need and students’ employment might have to be part of the equation............
Customers’ value

There was no doubt that we had (and continue to have) a fundamental belief in the value of education. There was also an urge to serve our students better. To say something like “customer oriented education” really did not bother anybody, at least not at the surface.

Customers are part of our lives, a permanent part.

When they are gone, they are still our customers---in a different capacity. It has to be a permanent relationship.

Remember how mad we were after we purchased a car and the dealer turned his/her back to us? “Zeee, this problem was not in the warrantee. I would suggest that you go to a garage to take a look.”

Remember their slogan? “Nothing happens until the deal is made!” An ordinary salesperson feels very good about the sale after the deal is closed. A good salesperson feels very good about it only after he/she learns that the customer is indeed happy. Because a good salesperson knows that his/her future depends on whether the customers are happy, happy through the lifetime of the car......

Customers are always right.

This stuff is old. We know that. Couldn’t you think of something really new?

Well, I agree. It is old stuff.

But it is also new. New when applied to “us”.

I remember one faculty was terribly unhappy about an annual evaluation I wrote for him one year. It was about a course he taught.
(At the end of each semester, the Department distributes evaluation sheets for students to grade the course and to give comments on the quality of the course and the effectiveness of the instructor.) There were quite a few students making specific comments on the way the course was delivered, particularly regarding the speed, that they did not like.

I made a summary of the students’ comments and put it in his annual faculty evaluation. All I said was that students did not appear to like certain things in his course and he might want to consider the possibility of adopting a different strategy next time.

That was explosive!

How dare you put such comments in my evaluation! How dare you question the way I taught!

What did students know about teaching!?

Many arguments, directly or indirectly, were presented to defend himself. The Chair should not trust the students’ comments that much. Faculty had more experience and knew better what and how the students should learn. Students always complained and they were not motivated. Faculty had the freedom and should be protected the way how and what he/she chose to do in a course.

There might be nothing fundamentally wrong with the way the course was delivered from the faculty point of view. But the customers were not happy. When the customers were not happy, it was terribly wrong! It was dead wrong!!!

To put it to the extreme, the students’ (customers) input was the only thing that count in my book, when we came to teaching evaluation.
When the customers were not happy, we were not doing our job.

We don’t ask them to change. We change ourselves!

Wait a minute!

What happen if a student wanted to screw up a faculty? All he/she has to do is to write some nasty comments that have no base and the faculty would run into trouble. Isn’t that faculty also need to be protected?

Come on! That would really require an unusually dumb Chair to get fooled.

In my case, sometime I am dumb. But not that dumb.

In the five plus years of my tenure as Chair, the students’ opinion (positive or negative) on faculty teaching quality in our Department matched very well with my own opinion and judgement. I could not think of a single exception! Of course, sometimes there were random nasty comments by the students on faculty teaching which did not generally reflect the ability of the faculty. I believe that I did have the ability to recognize that.

You might argue that we could very easily make our customers happy and get a real good evaluation from the students by making the course real easy and let everybody get an A.

Well, you grossly underestimate the students’ intelligence.

You can try it. But I don’t think you need to. I have seen such a case. The students made critical comments to a faculty member because they thought the course was too easy. You do not have to wait until the students have graduated and have gone into the work
force or gone to graduate schools to find out that he/she did not learn much in the course.

Tell you a secret. The best teaching evaluation by students were given to those faculty who challenged the students most and demand most in their courses.

Another example was our physics laboratory. I always think that physics is an experimental science. It is important for the students to do hands on experiments. I read the students’ evaluation on our lab experiments. They brought up some issues on the way we ran the lab.

I went to one of our technical staff. He, without even thinking what the comments were, immediately responded that students always complained about the lab. Meaning: it’s all their fault. Let’s not worry about it!

Obviously I swore, in my mind, in my heart, in my throat, in my stomach, in my soul.... But not in my mouth. You don’t swear in your month too often if you want people to change.

So, the concept of serving customers appears to be trivial, but when applied to ourselves, we may have more fun than anticipated.

“Can I help you?”

I remember several years ago I went to our computer center sales division to look into the possibility of buying a laptop computer.

There was a display room showing many different kinds of computers that were available for sale.

Near the room was a window. Through the window you could see another room where two staff members were in there, working.
After I looked at some of the portable computers I had some questions. I went to the window. They glanced at me and went back to their work.

I thought that they might be in the middle of something and should wait until they were available. So I waited. A few minutes later, one of them looked at me again. I smiled back, eager to be helped. But she did not seem to have any intention to talk to me. Back to her work.

Zeee. I thought they were really busy. I should walk around and look at the computers again and should come back to the window sometime later to get help.

So I wondered around for a few more minutes in the display room. And then I went back to the window.

They again glanced at me and back to their work.

This time, I thought I should try my luck.

“Excuse me.” I said.

Both of them looked at me. I said, “could you help me with the computer? I have some questions regarding the laptops.”

“What do you want?” One of them said. Listening to the tune, I immediately said to myself, “Shit! Sounds like I owe her a million bucks!”

Anyway, she came close to the window and I asked the questions.

After the questions being asked and answers given, I asked
how do I go about to purchase the laptop through a grant. With an iron face, she turned around and began to walk back to her desk. While she was walking back to her desk, she said to me without looking at me, that I needed to go back to the Department and ask my advisor to sign a purchase order.

I did purchase the laptop. It was cheaper through the computer center because there was an educational discount through the Institute. And also, later we could get service through the center if there was something wrong with the merchandize.

They obviously did not need to serve their customers well (nor did they ever think that we were their customers!) to maintain their business. Their raise each year probably did not depend at all on how well they served their customers.

On the contrary, I have many pleasant experiences with the reference section in our library. They really like to help and I enjoy talking to them every time I go there to ask for help. The number of reference journals has been cut these days due to budgetary constraints, the explosive growth of the number of journals, and the price hike of the existing journals. (Many of the journals are now available in electronic forms.) However their pleasant service can actually make me feel good when I couldn’t find the references I want and have to ask them for an interlibrary loan.

I remember there was a very nice staff (she retired) in our Department whom every student remembered even after many decades. She was a charming lady. Whenever any student came to our office, she always gave a warm welcome and always tried to see how she could help even the question the students asked was not her job or our Department’s job.

Students were already getting screwed because there were so many different offices on campus dealing with different students’
affairs. Registration, grade transaction, financial aids, course changes.....It had been so frustrating for students to go from place to place to get things done.

**Job description**

It did not take much effort to convince our office staff that students were our customers. Without our customers we did not have a business. I requested that we did not turn away any student who came to our office to ask for help.

All office staff have their specific prime duty to do. If a student wants something from our office and the particular staff member who handles that work is not in at that time.

What would you do?

There are two possible approaches.

One approach is, very naturally, to politely say to the student, “This matter is handled by Mary, but she is not in at the moment. Can you come back tomorrow? She should be back tomorrow.”

There is nothing wrong with this approach from the office staff point of view. There is a specific job description for each staff. If the job description does not include that item relevant to the student’s request, he/she would have no obligation to provide the service.

This approach is bureaucratically driven, not customer driven, not business driven.

Imagine that you run a business. A customer comes to your office. You cannot provide the service because one of your staff is not in. Do you feel comfortable to turn your customer away knowing that
you may lose the business?

I hope not.

“Shit! I have to come back again.” The student might not swear in his/her mouth, but certainly in his/her mind. From the student’s point of view, it is definitely not a good service. The student would have no way to complain. Mary is not in. What can you do?

How about a second approach.

“This is normally handled by Mary. She is not in today. But I can check into her file and see if I can help you.”

Or, “Mary has your record. But she is not in at the moment. But I can log in through the network and see if I can pull out your file.”

An immediate response from the student would be, “Thank God, I don’t have to come back again!”

This approach probably sounds a little closer to a customer driven business.

In order to have this kind of office service and capability, one staff has to know other staff’s job, at least the routine ones. I would say 80% of the questions students ask are routine. (Sometimes they may be very specific cases that only a specific staff member knows enough history of the cases to serve them properly. In those cases, the customers would understand the reason why they are turned away.)

In order to achieve the goal, I asked our staff to cross-train each other. So that each staff can do 100% of their “own” job and a good percent of some “other” staff’s job.
For our office staff, they are also serving another group of customers, the faulty. I will come back to this later.

**Faculty’s complaint**

These days we often complain about how low the students’ standard are. Little math skill, little motivation, no discipline, skip classes, do not pay attention, always ask why do they have to learn Taylor expansion.....

In our days, we studied hard because it was our job to do so. We did what our teacher said. We were disciplined. We studied Taylor expansion, because it was our job to do so.

But how about comparing our generation to the previous generation?

I remember our teacher always made remarks how unmotivated we were compared to their generation. In their generation, they learned with very scarce resource. They went through lots of hardship to get their education. They were so very disciplined and much more motivated than we were.

I remember when I was in the grade school (6th grade?) one of my uncles gave me a real hard time. He asked me to write a letter. I either couldn’t do it or did a poor job. He then humiliated me by asking me why didn’t I learn anything in school after going to school for so many years. He said he went to school only for three months and knew how to write a letter. “These days kids get spoiled real badly”, he said.

I cried.

I thought I was really dumb.
Only after many years later I recognized that my uncle did not have to learn math, geography, social science, etc, when he was in school. The goal of schooling in my time had very little to do with his goal at his time.

But I remember the humiliation the rest of my life.

Back to the comparison between our present students and us when we were students. At our times, did we have computers? Did we have to take a course in computer science? Did we do e-mail? Did we do networking? Did we spend time in the World Wide Web? Did we have the kind of knowledge that the kids have these days from these sources? Were we as fast as they are in getting these kinds of knowledge?

Most importantly, what is the kind of knowledge and skills that the society would want out of these young students when they get out of school? Are they going to be hired by Bell laboratory to do what they want to do in pursuing knowledge? Are they going to be given a laboratory and be left alone to perform independent scientific research topics? How many are preparing to go to graduate school? How many of them will look for jobs? What kinds of jobs?

So, for God’s sake, let’s stop complaining about our customers! Do something to help them in their growth process so that they can be useful for their generation, not for our generation!

They are certainly not dumb. The wealth that these “young kids” have made exceeds that of any previous generations. The speed that they accumulate the wealth has been mind boggling! Isn’t that enough to make “our” generation a little humble?

No product lives forever. Clothing changes. Cars change. Houses change. When you can’t sell your old product, you don’t
blame on the customers. You change your product.

There was no doubt that the K-12 education system needs to change too. In fact, in certain sense, it’s even more urgent. The standard should be set in such a way that the kids can compete globally, in their generation, in future business. The standard should not be set with respect to our generation.

What I was saying was that we should not use the K-12 problem as an excuse for our reluctance to cope with the changing world by saying, “It’s not my fault! It is all because they are no good.”

I thought only when we overcame this psychological barrier that we could focus our attention to creatively come up with strategies to serve our customers.
Chapter 7. Departmental Value

Ok, students were our customers and we needed to serve them well. In order to be meaningful and to have a long term impact, it appeared that we needed to build a culture and to establish a Departmental value based on this philosophy.

I slowly recognized what a decisive role a Chair could play in building such a culture.

One key element was the performance evaluation (and the reward system went with the evaluation).
**Performance evaluation**

Each year everybody (both faculty and staff) has a performance evaluation.

Very few people do not get excited about their performance evaluation. I certainly do. (Unless the person who evaluates me is a big moron.)

I asked everybody to do a self-evaluation. I then generated my own opinion on their performance in different categories such as teaching, research, and service. (These three categories were suggested by the Institute.)

You know what? I never had too much difference in opinion in overall rating of faculty performance from their self-evaluation!

I hate to say negative things in the evaluation. The most I said was that students did not like the way you handle the exams, or students did not seem to like the text book, etc. But I really never gave any nasty comments. Putting students’ comments in the evaluation was enough to show that I was concerned about the issues. As I described in the last chapter, it already could cause much excitement even if the overall rating of the faculty member was still quite good.

But I praised things that faculty and staff had done to enhance Institute’s business and needs. Serving the customers well, directly and indirectly, was obviously one big item in the consideration. Another item was things that had to do with the financial aspect, either saving money or generating new revenue. New teaching initiatives, new curriculum development, and new ideas to recruit better students were examples.
Of course, scholarly achievements of individuals were still a major part of the evaluation. But it was *not* the only thing that counted anymore.

And that was precisely the change.

*“Why my raise gets worse?”*

The evaluation, of course, was correlated to the raise.

“My evaluation has been good but my raise gets worse? I continue to have a good recognition in my scholarly activities. Why am I getting a below average raise while my performance has been as good as ever?”

One faculty complained bitterly why his raise had been below average. This hurt his feeling. In the past his raise had been above average. Now his achievements in scholarly activities were clearly as good as before but he got a below average raise.

In my opinion this was precisely the change we needed.

And I believed that the faculty would understand this (the change) if I communicated well to them. The change was such a way that faculty contributed to teaching innovation (very often in addition to their research activities) also got rewarded, recognized, and appreciated by the whole department. When it came to raises, the teaching innovation part also deserved a share.

I would say almost all faculty in our Department had performed exceedingly well and beyond anybody’s expectations. Many of them had excelled unusually in the changing environment.

If we look at the large volume of research we had brought in
and the innovations in teaching we had launched, it was quite easy to explain why majority of our faculty evaluations were at least “very good”. (While we pushed the change, our faculty size continued to shrink over the years due to the Institute wide budget cut.)

But the raise was a relative scale. In another words, we could not have an above average raise for everybody. (Although I had been trying to come up with other means than raise in an attempt to reward more faculty, it was not an easy task.)

So, as far as the raise was concern, one had to compare performance between faculty.

**The 0.5% leverage**

In order to reward teaching innovations, the Dean’s office set aside 0.5% of the raise pool in his office to reward people who made unusual contributions in teaching innovations. For example, if that year’s average raise was 3%, the Dean would cut 0.5% to reward teaching and would give only 2.5% to the Department for raises.

After the Department Chairs had made the recommendation for the raises, the Dean would sit down with the Chairs to identify individuals who had made unusual contributions in teaching.

I had interpreted the teaching innovation in a broad sense. It included contributions in classroom teaching, pedagogy development, application of information technology in teaching, curriculum reform, and undergraduate recruiting.

Where did that 0.5% come from?

Of course, it came from the general pool of the raise money. It was at the expense of the traditional reward that was given to faculty
who excelled primarily in scholarly activities.

In another words, there was a new balance between teaching and research.

What happened if the Dean did not reserve that 0.5% in his office to reward the teaching?

Well, we would probably think of a way to do it ourselves in our Department.

This practice, of course, was to ensure that teaching innovation also got rewarded. Over time, I believe, when teaching innovation is equally respected on campus, and when reward is given to teaching innovation naturally, then I think we do not have to deliberately set aside a separate pool of money to do it.

**The conflict**

“That’s bull! I was not hired to excel in teaching! I was not hired to worry about the Institute’s business!”

You were right. All of us were not hired to do these things.

I remember when I was hired, the emphasis was definitely on how to achieve scholarly and how to earn tenure. No mention was made regarding the Institute’s needs.

One would frequently argue that scholarly achievements are what brought the reputation of an Institute in higher education. Therefore one has to emphasize and encourage that. Without reputable scholars we would not have a first class Institution and first class students would not be attracted to us.
You were absolutely right!

We’ve got to have first class scholars. We have to create a first class research environment to nurture first class scholars. We have to build a state-of-the-art research infrastructure which would enable us to compete effectively. These are terribly important issues for a research Institute likes ours. I will come back to his topic later.

But that alone, I believe, was not enough. That alone, was probably not going to save our Institution and it would not survive in the future.

“We cannot do too many things! You will ruin our research!”

I didn’t think so and I hope not.

In our Department, I think there are evidences that we can do both. Our tenured, research active faculty members have contributed in both. In fact, in their tenure evaluation of our several young faculty, they clearly showed outstanding achievements both in research and “teaching”. The latter included contributions to undergraduate education such as pedagogy development, undergraduate student projects, the use of new teaching technology, curriculum reform, and recruiting.

“We may lose high caliber faculty who are not happy with the change and may decide to leave our Institute.”

Fortunately, it has not been the case in our Department, so far. I do hope that it won’t happen in the future either. I have a fundamental belief that high caliber faculty would appreciate the new environment we are facing and would enjoy the new Departmental value we are nurturing. I also believe that into the next century, a successful research university will probably have faculty with very different value than that in the past.
Staff evaluation

In addition to students, staff have another customers---the faculty

I remember that the supervisor of the office was not quite thrilled when I requested that the staff should be evaluated by the customers they served. Specifically I asked her to send out an evaluation form to the faculty to solicit input on the performance of all the staff.

She asked how important were these inputs from the faculty on the final Departmental evaluation on the staff performance. A lot, I said to her. In fact, that’s about the only things that counted.

She was really not happy about it.

The argument she gave was that the faculty did not know enough to have a thorough judgement on whether a particular staff was doing his/her job well.

That’s partially true, I said. But a collection of opinions together would make a pretty good picture of the quality of the service provided by the staff.

Also, she said, we had a well defined system within the administrative branch regarding the organization of the office and the distribution of jobs according to the job description of the staff. It was a well organized system attempting to serve the faculty and students well. She, the supervisor, would know better if a person had done her/his job well.
Job description again! How annoying!

I said to her, it did not matter how well you organized the office according to the book. The ultimate judgement whether our office had done a good job or not was whether our customers, in this case our faculty, were happy with our service.

I told her that everybody should be evaluated by everybody else. She would be evaluated not only by the faculty but also by the office staff. I should be evaluated by the faculty, students, office staff, and the Dean.

How could a staff perform well if he/she knew that the only person who was going to evaluate him/her was the supervisor?

How could an office supervisor perform well if he/she knew that the Chair was the only one evaluating her/him?

How could I perform well if the Dean was the only one who would evaluate me, the Chair?

I remember a familiar story in the Bible. It goes like this. A man came up to Jesus and asked how he could serve Him well. He said to the man, he who served his brothers well served Him well.

That’s customer oriented value system!

I did what I said. The input from the faculty became the major factor in the evaluation of all the staff.

The staff face their customers, not just their supervisor or the Chair.

Proactive attitude
I mentioned to the staff some tricks that they would really make their customers happy. I gave an example.

It was a proactive attitude when serving the customers. Say, a faculty came to the office and asked the staff if she could notify a perspective student to send his Senior year’s transcript to us quickly for graduate admission consideration. (Traditionally the Department did not play much role in the undergraduate admission, but the Department did play an important role in graduate admission.)

The staff was in the middle of doing something. She says, “Would it be OK if I call him early this afternoon?” The faculty said, “Sure”.

Early afternoon she called the student and he was not in. So she wrote an email to the student asking him to send his Senior year’s transcript. Late afternoon the student replied and said he did not have it at the moment and his school would not be able to issue an official transcript until a week later.

From there on the staff could follow two different approaches.

The first approach was that she would wait until next week to receive the transcript.

But two days later the faculty came to see her again and asks, “Did you have a chance to call the student yet?” Somewhat unhappy.

The staff would say, “Yes!”. And went on to explain that the student could not send the transcript at this time because his school would not be able to do it until next week.

We could not say that the staff is not responsible. She had done what she could do. The delay was not her fault.
However, it did cause quite a bit of anxiety on the faculty side. The fact that the faculty came to the office again in two days and asked about it meant that the faculty apparently had been worrying about it for two days.

How about a second approach?

Right after the staff found out that the student could not send the transcript that day, she immediately called the faculty and notified him that the official transcript would not be in until next week.

The faculty would be thrilled by the responsiveness of the staff. He might immediately respond that if the student could send him an unofficial one at this time, it would be fine. The staff might then communicate to the student immediately and she might get an unofficial transcript by fax late afternoon that day. The faculty got the job done.

Moreover, the faculty would feel that the staff was reliable and would have trust in her work. It would save lots of time and avoid unnecessary anxiety in both sides.

This approach would seem to be more “proactive”, or more “responsive”.

This would guarantee a good evaluation from the faculty when the time comes.

Customers’ oriented education and service would probably mean something only if it is supported by the evaluation and rewarding systems. Otherwise it would be another “bull” from the administration, as we always say.
Chapter 8. Teaching vs Learning

The biggest debate in our Department regarding the teaching pedagogy to serve our customers best had been concentrating on the issue of teaching vs learning.

The debate is still going on. But I believe we have a much better understanding on the difference between these two teaching philosophies. A number of experiments were tried for a comparison.
Not very long after I became the Physics Chair, Professor Harry Duke, a Mathematic Professor, talked to me about his experience in one of his courses.

He said he did not lecture very much in his course. Instead he and his assistant gave out problems for the students to do in the class. He broke the class into small groups of about four students in each group.

The students talked to each other and he served more like a coach in the class.

Lots of discussions among the students and between the coach and the students. Students were actively involved in the learning process instead of passively sitting there to listen the lecture all the time in the class.

He said it was what they called “interactive learning”.

According to many experts, he said, this mode of learning was more effective than the conventional teaching method where the Professor taught the whole period of time in the class.

He said he did have to spend more time outside the class the first time to prepare the worksheets for the students to do work in the class in addition to the homework assignments. But he said he did not have to sweat so much in the class because students did most of the work.

Most of all, he said he enjoyed so much direct interaction with the students.
It has always been so enjoyable to talk to mathematicians. They are so adventurous and romantic!

**The debate**

Our faculty discussed Harry’s experience in one of our Departmental faculty meetings.

The discussion was lively!

Most people agreed that more discussions among the students and between the faculty and the students in a class were a positive thing to do.

But there were also many questions raised.

How could you have enough time to cover all the materials in the course if you did only very little lecturing? You were watering down the course!

How could you expect students to organize and learn by themselves the subject matter that they never seen before? It would be a mess!

How could you expect students to be happy to pay so much tuition and found out that they had to learn by themselves? A rip off!

This was the beginning of our long debate on the philosophies of “teacher centered” learning vs “students centered” learning in our Department.
Efficiency of learning

Coincidentally, in the middle of these debates, I found something exceedingly interesting that my son brought back from his grade school.

It was a sheet of paper shown in the figure.

The paper was self-explanatory. I immediately recognized the meaning of it. It was a description of the efficiency of learning by different approaches. (Later I learned that this theory was from a book written by Edgar Dale, entitled Audio-Visual Methods in Teaching, Holt, Rinehart, and Winston (1969)).

The percentage of the things you absorb or retain in your brain depends very much on how you learn them:

- What we read: 10%
- What we hear: 20%
- What we see: 30%
- What we hear + see: 50%
- What we say ourselves: 70%
- What we do ourselves: 90%
What do we absorb or retain?

- 10% of what we read
- 50% of what we hear + see
- 20% of what we hear
- 70% of what we say ourselves
- 30% of what we see
- 90% of what we do ourselves
The most efficient way of learning appears to be that the student actually do something themselves!

That’s the way the grade school students are learning. If you walk into a grade school class, chances are that you will see the students are working on something, either by themselves, or doing something in a group.

The least efficient way of learning appears to be just listening (and perhaps seeing the professor sweating.)

Boy! Isn’t that the way we do in universities all the time? Professor teaches and students listen.

We deliver lecture after lecture. Students jump from lecture to lecture. We assign one credit for one hour lecture per week.

Students come to lectures and take notes. They go home and study the notes and do the home work assignments. When doing homework they are actually doing something.

You can argue that in the lectures faculty can ask students questions and students can ask faculty questions. That way it would be more interactive and would be more efficient in learning.

That’s true. But normally the interaction, if it exists at all, is only limited to a very few more active students. It normally does not involve the whole class.

What has happened as we go from the grade school to the college? Why does the learning process change so dramatically? Why do colleges adopt a different way of teaching?

Well, may be the adult learning behavior is different from kids. May be adults can remember better by just listening.
May be many college classes are too big and it is more economical to do just the lectures.

May be there are too much materials to cover in a college course so the faculty has to keep on lecturing to get it done.

For whatever reason, or reasons, we do it differently in college.

I found this issue intriguing.

In college we do more “teaching”, where professors teach and students listen. Professors are active. Students are passive.

In grade school we do more “learning”, where teachers coach and students learn. Teachers are passive. Students are active.

The experiments

After our debate on Harry’s idea and our discussions on his experience, two of us decided to do our own experiments.

Professor Steve Heins did an experiment in his Physics Honors Course. It was a Sophomore course on Waves. There were about 30 students. In his course he gave two regular lectures per week.

What he did differently was that he created two extra “interactive learning” sections (each section ran two to three hours) for students to come to class and do problem solving in groups. He and his assistant would spend hours in these sections working with the students. Of course, the students also interacted among themselves.
I observed some of these sections. They were lively!

The net result was amazing!

Students’ evaluation of the course was staggering! Many commented that it was the best course they had taken and they felt that they learned a lot from the course.

One thing struck me hard was that they liked the learning environment so much that they enjoyed hours of learning.

Who says students are not motivated these days?

The next year students demanded to continue the format of the course.

There was only one catch in this course that I think would be difficult to generalize (the teaching format) to all other courses.

It was incredibly time consuming. Professor Heins spent hours and hours with students in the working sections. He said normally a three hour course would become an eleven hour course.

But the experiment was precious.

At the same time, a second experiment was done.

That was my graduate Quantum Mechanics course. There were 28 students. We met two times a week (just like any other regular graduate course) and each time we spent 1.5 hours.

I spent some time in the summer to prepare a set of problems that were suitable for in-class work. These were typically short problems which would illustrate basic concepts but were not tedious
In each class, I would discuss/lecture a certain concept in mechanics. Instead of illustrating the concept by doing some examples myself, I gave out a sheet with one or two problems which would illustrate the concept, or were a direct application of the concept.

I asked the students to work it out by themselves first. I would walk around to check how they were doing.

It took me only seconds to find out who got the point and who had difficulty. Basically with a glance at the student’s sheet while I was walking around I obtained a very clear picture of what’s going on in their minds.

The feedback from them was direct and instantaneous.

Traditionally I would do the illustrative problems myself on the overhead and might challenge them with a couple of questions. But the problem was that only a very few people (always the same ones) would care to respond. I would then go on without knowing whether the majority of the students were following me or not.

It was probably not easy for students to continuously pay attention to what I said for the whole 1.5 hour.

In the new approach (how could you say “new” while the grade school students are doing it all the time?), all students paid attention all the time. They had to listen very carefully (for a short period of time) what I said and they had to immediately go to work on the problems themselves.

They had to stay alert all the time. They had to respond all the time. All of them. Not just a few people. The whole class.
And they had to display their progress of their learning right in front of me in real time! I knew what they knew all the time. They could not possibly day dream in the class.

While they were working, I discussed with some of them. Very often I gave some critical hints or reminded them things that they should know (but forgot) in order to tackle the problems.

After a little while, I saw not all of them got the same answer and some of them still had difficulty in getting the point.

I then asked them to form groups, normally three to four people per group. And I asked them to discuss the problems/issues among themselves.

They argued. They fought. When they could not settle by themselves, they asked me to be the judge.

They were noisy and lively!

Clearly I was not the only “teacher” in the class!

The difference between my approach and Professor Heins' approach was that in my class I spent exactly the same time (two class periods, each 1.5 hours) in class as in the old lecture format.

The comments from the students in their evaluation of the course were that they liked it very much and advised me that I should continue this teaching strategy.

These days, the first thing I tell the students in my course is that they should learn as much as possible in the class and I would try to create an environment for them to do so.
To date, many of the faculty in our Department are experimenting and delivering their courses in some form of “interactive” manner. However, there is no single and uniform format used by everybody.

Now many of us do think that interactive learning, whatever format you may take, appears to be more efficient.

**Watering down the course?**

Could I “cover” all the materials I wanted to cover?

Depends on what you mean by “all the materials”. “No”, if you mean to go through all the materials in class by the Professor the way we did before. Yes, if you mean whether the students have enough time to learn the subject matter in the course.

It is accomplished by not going through all the detailed derivations, issues that are more related to the history of the subject, and lengthy problems and illustrations, in my lecture time. Instead, I left some of them as homework assignments.

In fact, by clarifying the basic concepts in the class it would help them do homework assignments better later.

One secret about physics is that there aren’t many important concepts in the subject that you really have to know! If you master these few concepts, you have basically mastered the subject.

(In fact, I tend to think that many other fields are the same.)

The rest of the course is applications. Areas of application increases with time. We cannot possibly cover all important applications. What we can do is to cut the old applications and do a
few selective new applications. It would be a disaster attempting to “cover” too many things. Thoroughness is far more important than “covering” more of the subject.

(We tend to put in more and more stuff in a course without cutting out the old stuff. We tend to create more and more courses without cutting the old courses.)

I certainly think we are not “watering down” the standard!

I think selection, particularly in this information explosion era, is very critical.

Students need to learn the very basics, particularly the ability to learn to grasp the main ideas, the ability to set priority to learn, the ability to analyze them, and the ability to make connections.

Students do not need to know too many things, but a few things very thoroughly. They need to know where to look for things that they don’t know. They need to know how to use them when they find them.

The dilemma

Actually changing the way we teach for a class of less than 50 students would not be a terribly big problem, if we agreed that we need to change.

(Well, not quite. There was still a small problem, though.

The classrooms, especially the structure/layout of the furniture (desks/chairs), were not suitable and were very awkward for this kind of interactive learning. The traditional classroom furniture was more suitable for the audience listening to a lecture, but not very
The real test came from the introductory courses where we had to serve about 1000 students each year.

In fact, as discussed in Chapter 5, the most serious customers’ complaints came from the way we handled the introductory courses. These courses typically consisted of big lectures with several hundred students in the class (two lectures per week), smaller recitation classes (also twice per week), and a laboratory section. In these big lectures, the interaction between the faculty and students was difficult. The attendance in these lectures were very low (a nation-wide problem). Half of our recitation classes were taught by teaching assistants. All the laboratory sections were run by teaching assistants.

In our Department we had a number of truly outstanding star lecturers. They delivered fantastic big lectures. The students’ evaluation (from those students who actually attended the lectures) for these star lecturers had been excellent.

But that did not solve the problem.

The problem was the format of delivering the course. Students just did not have much chance to interact with the faculty and the overall learning experience was very passive.

Then why not eliminate the big lectures and break the student body into smaller classes and teach them as any upper level course?

That’s really not a new idea. But why had not major research university actually done it?

“It’s economy, stupid!”
Everybody knew that it was better to have smaller classes. But who were going to teach them? How many more faculty you needed to hire to do that?

That’s the problem.

No matter how much we improved our upper level courses, if we did not come up with a way to deal with the introductory courses, we still would not have served our customers well.

That was the beginning of our relentless pursuit of a fundamental change in the way we teach the large enrollment introductory courses with an affordable price.
Chapter 9. The Studio Physics

The first time I heard about “Workshop Physics” was from Professor Thompson. He told us that Dickenson University Physics Department had tried a very different way to teach an introductory physics course.

The class was equipped with laboratory apparatus and computers. The students came in the class exploring the subject by themselves. The Professor was in the class to give some guidance.

No traditional lecture.

Lots of discussions in the class among the group members and between the students and the Professor.
Meeting at Crystal City

Later, I actually had an opportunity to hear a talk by the Professor who taught the course. She was Professor Priscilla Laws. It was at the 1993 Annual Physics Chairs Meeting in Crystal City, Washington, D.C.

I was advised by a friend to attend at least one such meeting to get a feel of what was going on in other Physics Departments in the country.

I was so glad that I went.

Her talk fascinated me.

She had a relatively small class (something like 15 students). It was a liberal art school. The course she taught was a non-calculus based physics course.

She showed a transparency of a classroom where students were working. There were several sets of apparatus equipped with computers. Students were divided up into groups. They sat (or stood) around the tables, some working with the apparatus, some with the computer.

She said she let students explore physics by themselves.

This was definitely a “learning by doing” type of strategy that I discussed in the last chapter!

The situation was so similar to the scene you would normally see when you walk into a kindergarten classroom where the kids are crowding around a table working on something.

9.2
After her talk I raised one question in the question and answer period:

“Do you have any suggestion how to implement this kind of learning with 1000 students in the course?”

On the way back in the plane, I kept on thinking this question myself.

**Studio Physics**

There were more discussions and debates on campus on the philosophy of teaching vs learning. This time it was more focused. The workshop type of strategy was the focus of attention.

In the summer of 1993, our annual one-day retreat (all physics faculty) was devoted on this subject.

In the fall of 1993, the Math Department decided to try it.

A new classroom was renovated. A pilot “Workshop Calculus” class was created.

It was a classroom which could take 60 students. The classroom was equipped with workstations. Students worked in groups of two.

In the mean time, a plan was underway in our Department to create what we called the “Studio Physics I” pilot class (primarily on mechanics). It was taught in the spring of 1994.

In addition to Professor Thomson, who led the planning, we asked another faculty, John Kline, to develop the course with Thomson. The workload (especially the teaching load) of Professor
Kline in that semester was reduced to take on the job.

In Professor Thomson’s calculation, 60 students appeared to be a good number for such a class.

We did not have regular classrooms which could take 60 students (except those big lecture rooms which were not suitable for interactive learning). But we did have several physics laboratories each about 1000 sq.ft.

So we renovated one of these labs to take 48 students. (In fact for the pilot class we admitted only 30 students.) The room was networked. Comfortable chairs and tables were installed. Fifteen PCs were purchased.
Studio Physics classroom
**Integrated learning**

While the philosophy of Studio Physics was based on learning by doing and shifting the learning to students themselves, the mechanics of carrying it out was quite different from that of the conventional format.

In the conventional introductory physics course format there were five different classes a student had to attend in one course: two big lectures, two recitations, one laboratory. All together the student had to spend 5.5 hours in classes each week. (The lab was about 1.5 hours.)

In the Studio Physics format, students just have to attend two classes instead of five. But each class is two hours. So you spend a total of four hours instead of 5.5 hours. The saving on the students’ part is enormous! You don’t have to struggle with five separate class schedules and jump from class to class all the time in which students not only wasted much time but also were under great tension.

In that two hour class of Studio Physics, we combine lecture, recitation, and laboratory work altogether. Lectures are normally conducted for about 10 to 15 minutes. The other times is used for problem solving, discussions, experiments, data analysis, computer simulations, and worksheet activities. All work is planned ahead. Of course you have the usual homework assignments too.

In each class, we have one Professor, one graduate teaching assistant, and one undergraduate assistant.

The students have plenty of opportunity to discuss with the faculty face to face in the class. The class is always supervised by a faculty all the time. The teaching assistants would not run the class by themselves.
Remember the complaint from our customers that they did not have a chance to talk and meet with a faculty the first year they come to the university?

No more such complaint for the Studio Physics mode of learning.

More Studio Physics

The students’ evaluation of both the pilot Workshop Calculus and Studio Physics were extremely positive.

Hold a second!

These faculty who taught the courses were some of the better teachers we had in our School. These faculty would earn outstanding evaluations from the students no matter what and how they taught!

You couldn’t trust the evaluation that much!

I didn’t.

All I knew was that we did not fumble. In fact, it was more than that.

First of all students all came to class in the pilot Studio Physics course! What a change!

If a student missed a class, the Professor would know that, instantly. You had no way to hide. You had to turn in the in-class work every class. Classroom activities were counted as part of the final grade. The grade did not totally depend on the exams.
Secondly, their test score showed that they learned at least as much as that from the old format. No sign of degradation of quality.

This was done by only having two classes per week at a much reduced time (and headaches) for the students!

The result was encouraging enough that in the summer of 1994, Professor Kline volunteered to develop a second Studio Physics, that was, Studio Physics II. The content was the same as the old Introductory Physics II course which was concentrated on electromagnetism.

More PCs were purchased. Another two Studio Physics classrooms were created.

At the same time, another Professor began to develop a Studio Physics III course (the old Physics III course on waves and modern physics) where no computer was used.

In the fall of 1994, about 500 students went through the Studio Physics classes.

**Computers in class**

Right from the beginning when we debated about interactive learning, the use of computers in classrooms had always been a hot issue to argue about.

“Computers cannot replace physics.”

“I can use paper and pencil to explain physics much better.”

“Computer is only a tool, we should not depend on it too much.”
“Hands-on experiments are more important than computer simulations.”

Indeed initially there were some negative comments from the students regarding the use of computers in the class. They said either they wasted too much time in making it work, or they did not know what was the use of it.

But somehow I never really got involved deeply in debating this issue and I never worry about this issue that much.

I just tried my best to fight for and to raise money to purchase enough computers for the Studio Physics classes.

There is no doubt that we should make the computer software as friendly as possible so that we don't have to spend too much time in figuring out how to use it. But that doesn't mean that we should not try to use it.

There are clearly many exciting experiments we can do if computers are used in the data acquisition and processing. In fact, because of this capability, students are brought up to a higher level of reasoning through these experiments than you normally would be able to get without the use of computers.

In addition to the data acquisition and processing, computers can be used to do simulations that can help students to visualize a physical process.

However, I do agree that computer cannot replace hands-on experiments. I religiously believe that physics is an experimental science. You cannot offer a high quality Introductory Physics course without hands-on experiments, at least not for science and engineering students. You have to touch the apparatus and do the
experiments to have a real strong feeling of what is going on.

You can certainly learn a good amount of physics without experiments. For example a long distance physics course can be offered with simulations but without real experiments. But in my opinion the quality is probably just not as high as compared to an on-site course with real experiments. (This does not exclude the possibility of offering a quality long distance course with a local arrangement, or other types of arrangements, that allow hands-on experiments.)

In my opinion, if one has 10 experiments in each of Studio Physics I and II courses, with all the activities centered around these experiments, then one should have a decent physics course.

Now let me turn around and ask:

“Could we offer a modern, high quality Introductory Physics course without the use of computers?”

I certainly say no.

It would definitely not be a forward looking physics course that is going to fully prepare the students for their upper level courses and eventually for them to walk into the workforce.

Without the power of data analysis through the use of computers in the experiments, one just cannot visualize the meaning of velocity and acceleration, or the change of magnetic flux in a coil, that well. In fact, you cannot even make measurements without the use of computers in many important experiments.

My comments on the debate on the use of computers is: “Come on, let’s not waste our time in debating it! If you can come up with the resource, buy the computers!”
Chapter 10. The Expansion

The responses to our pilot Studio Physics I course greatly encouraged us.

We renovated another two Studio Physics classrooms: each could take a maximum of 48 students. Studio Physics II and III were developed. We accepted many more students into this learning format.

We were excited about these experiments. We also worried.
For myself, I worried about a lot of other stuff, but somehow never worried about this new format of learning as much. At least not as much as some of our faculty.

I didn’t know exactly why.

Might be because I sat at the back of those big lecture halls enough times listening to the old format of lecturing and saw the problems associated with this kind of student learning enough times that led me to think anything was better than the old format of lecturing.

Might be because I had read enough bad comments from the students’ evaluations on our laboratory sections that I thought any format other than the conventional laboratory format would be better.

How come students hate the lab so much?

How come they didn’t have the same feeling towards the lab in the Studio Physics format?

Another reason I did not worry that much about the consequence of the Studio Physics expansion was that if for some reason, or reasons, that we could not afford, or if there were enough students who could not stand the Studio Physics format, we would offer both the lecture format and the Studio format at the same time.

I thought that would be the worse scenario.

But I thought the argument stimulated my thought most was a
question asked by a faculty member in a Departmental meeting.

The question was why did we have to be the first to try new things.

It would be much safer to wait for others to try first and if it was successful, then we would follow. The risk would be much smaller compared to try first by ourselves.

This was a profound question.

Actually the “first” was never directly our goal.

What had been in my mind, nearly all the time, was on how to survive and how to excel in this turmoil of higher education. Never mind who was doing what the first time.

Ever since I came to this campus, I have constantly heard people talking about how to push our academic rank in higher education into the top tier.

Everybody recognizes that it would be a tough target to reach.

Just look at the size we are and the resource we have. Our resource certainly isn’t unlimited.

To compete and reach the top tier rank comprehensively in the conventional way was out of the question, at least in my mind.

When you have unlimited resource you tend not to think too hard. You follow the tradition and grow.

When you have limited resource and you have the brain, then you may be able to break in and compete the business in non-tradition ways.
For us, the only chance was perhaps to think more cleverly than others.

The chance of success becomes bigger when the whole business is in turmoil, which has been the case in higher education.

All research universities appeared to run into some trouble.

Wasn’t that a good news for business?

This would be a single most important chance for us to excel and beat the biggies.

Especially when nobody seemed to have a better idea.

In that sense we wanted to be the first!

What about the risk?

Come on! Was the risk smaller if we just sit and wait to go out of business?

Excel in turmoil

To beat our competitors definitely sounded like an exciting and challenging venture.

But not as exciting as the opportunity for each of us individually to create and to excel in what we are good at!

Especially if it is once a lifetime opportunity.

In Chinese the word “crisis” is a combination of two words:
danger and opportunity.

I remember one time we asked our Dean to come to our Departmental faculty meeting to give us his perspective on the current state in the higher education, after the Institute announced a 3% cut.

The next day I wrote an e-mail to our faculty:

“Several of you mentioned to me that you felt depressed after hearing the Dean’s talk in last week’s faculty meeting. I think most people in higher education feel that way these days. But it is the reality. For many of us, it is the first time that we have to justify so hard the value of our business.

However, in Chinese, there is a saying: "Heroes are created out of turmoil". I think we have a much better chance at this time to excel and to get ahead of those institutions which are better than us (at the present time) if we are brave enough to change and to continuously push forward with creative ideas both in teaching and research. For "heros", it seems that it is an exciting era and a rare opportunity..... That may explain why we are so busy these days. Have you seen a lazy hero? Cheers.”

Scientific proof

Another question asked was that we did not have any scientific proof that the Studio Physics format would work.

That was raised by a faculty from another Department.

He was in fact very mad. He said we had been scientists all our life. We believed things that were scientifically proven to be true.

To invest such a major part of manpower and resource into
something which had not been proven was not scientific and never
was our practice.

It has been difficult for us to answer these questions.

But somehow I feel that to do things that has been proven has
not been our practice, or any other researchers’ practice.

In all my research career, and I believe for other scientists too,
we always want to be the first to discover something new and always
try to prove scientific work that have not been proven before.

There are good merits in following other people’s work,
especially if the work has not been completely done. But by far the
most valuable thing is the one you discover or explore first and then
you are followed by many other more detailed investigations by other
scientists.

There is just not that much scientific value to do work that has
been proven, or work so obviously can be proven.

Our whole culture and training has always been to create new
things.

I just cannot get excited about the notion that we should wait
for other people to try it first or should wait for other people to prove
it first.

How uninteresting this kind of life is! And how depressing it
would be!
Chapter 11. Evaluation and Implementation

Many people requested us to do a formal evaluation to access the effectiveness of Studio Physics. One year after we first tried the pilot Studio Physics format, I asked an expert how much $$ we needed to spend if we hired a consultant firm to do a thorough evaluation.

The answer was about $500K.

“Shit!” I said to myself, “That was the total money we spent so far to do the Studio Physics!”

It would probably take years to complete the evaluation.
The effectiveness

Fortunately in the fall of 1994, a faculty member from Rutgers University Education Department was interested in doing a survey and evaluation of the effectiveness of our Studio Physics. He sent a graduate student to be at our Department and to conduct the evaluation.

Students who took the Studio Physics courses and the faculty who taught them were involved in the process. There were 251 students and 6 studio classes involved in this study. The study continued into 1995. The graduate student eventually wrote a PhD thesis in education based on this work.

Obviously this study only focused on a “short term” effect. The long term impact (after the students graduated) was definitely much more complicated to assess and would take a much longer time to accomplish.

We invited the graduate student to give a colloquium at the beginning of 1996 after she completed her PhD study. It was quite a lively talk!

I won’t go into the detail of the survey, but the following were students’ perceptions of strengths and weaknesses of the learning format:

Strengths:

- Provides the opportunity for more direct interaction between students and instructors, teaching assistants, and other students;

- Questions can be asked as they arise, and answered
immediately, with the possibility for demonstrations, simulations, or lab investigations immediately available;

- Integration of a variety of activities allows for immediate application of new concepts;

- Responsibility for learning is shifted from the teacher to the student.

Weaknesses:

- Responsibility for learning is shifted from the teacher to the student;

- Some students find the book too difficult;

- Most lab investigations are computer-based: either computer interfaced using traditional equipment, or based on digitized video clips. Some students would prefer the more traditional style labs.

Note that the shifting of learning responsibility from the teacher to student was considered to be positive by some students but negative by others.

More data

By that time more data were also collected by ourselves.

The overall students’ rating of the Studio Physics courses were about the same as the conventional big lecture format. Again, the test score showed no difference. In fact, in some cases students in
both the lecture format and the Studio format were given exactly the same tests.

It was difficult to seriously compare the students’ ratings. The questionnaires were the same for both formats, which were not really adequate. For example, one of the questions asked was the effectiveness of the lecturer. But in the Studio Physics format, there wasn’t much lecturing to talk about.

The most challenging part is to evaluate the long term impact of the student learning in this format.

My believe is that active learning mode and habit of self-learning will have a much more profound impact on students’ future life long learning and work habit.

Some students were not used to the student-centered learning and commented in their Studio Physics course evaluation:

“It’s a self learning class. There is no need for any assistance.” “Studio Physics is not an effective method. We have a great lecturer, but no one can give an effective lecture when they have to squeeze a 50 minutes lecture into 5-10 minutes at the end of class.”

If we put the issue of long term impact aside, a short term benefit was pretty clear from one student’s comments:

“Professor Ron Christner leaves much to be desired. There is that faculty to faculty respect issue, but let’s not allow that to lessen the education value. I cheered the defense of studio physics in the Poly! No class is perfect, but two-hour classes is better than 6 hours, 6 classes. One friend of mine in regular Physics I has 3 1-hour physics classes in one day. That is pointless and wasteful.”
The plan for complete implementation

After the spring of 1995, many of us got serious about thinking the possibility of a complete implementation of the studio format in all the introductory physics courses.

To me, a complete implementation of Studio Physics was the key. No matter how many different better ways one could come up in teaching, if they could not be scaled up then it did not really excite me that much.

A more thorough study was conducted on the implication and consequences of the complete implementation of Studio Physics on the teaching load in our Department.

Professor Michael Aman took the lead in our Introductory Physics Course Committee to come up with a proposal. The proposal was based on an earlier version outlined by Professor Thomson who conjectured such a possibility. This proposal was more thorough and was based on the new experiences we gained recently in studio learning.

The proposal was presented and debated in our 1995 annual summer retreat.

The vote for the proposed complete implementation of Studio Physics format was overwhelming. In fact, it was unanimous.

It was a very courageous step that the faculty took. This decision was done in the middle of a continuous budget cut and the reduction of faculty and staff positions. By that time the total number of our faculty had dropped to 19 from 23 in 1992 and the laboratory technical staff from 3 to 1.
A fourth Studio Physics Classroom was created in the spring of 1996. By the spring of 1997, all students who took the first two introductory physics courses were in the Studio Physics classes. (Introductory Physics III course was recently eliminated for Science students and had become an elective course for Engineering students.)

**The manpower issue**

The greatest concern, of course, had been the manpower issue.

Did we have enough staff to cover all the Studio Physics classes?

There would be about 20 sections of Studio Physics in each semester. Recall that each Studio Physics section requires a team of instructors including one faculty, one Graduate Teaching Assistant, and one Undergraduate Teaching Assistant.

The answer seemed to be “yes”, under certain conditions.

It was clear that we had saved some Graduate Teaching Assistant positions in the Studio Physics format, primarily because the recitation and laboratory sections in the old format were combined into one class in the Studio Physics format.

Great! (Great from the manpower point of view. But may not be so great from the graduate research point of view.)

How about faculty?

Here was where many of us had great concern. However, if we transformed the saving in the Graduate Teaching Assistant positions into two faculty positions who would help running and
teaching the Studio Physics courses, then it appeared that we might be able to break it even.

Two such faculty positions (so far non-tenure positions) were indeed created and filled in the next two years.

Also, it was not clear how we would assign the teaching load for professors who teach the Studio classes. The actual contact hours were more. But they did not break into pieces and you did not have to sweat that much in the class.

The class scheduling was an issue. It was essential that we populated each class to its full capacity. (In reality, at that time our average population in each Studio Physics class was about 32. This was definitely too small.)

Although the issue had not been completely settled down yet, the proposal appeared to be feasible. A key factor was the population of the class. We could probably break it even if we could put 45 students per class.

To me, if we could break it even (the manpower change from the old lecture format to studio format in the introductory courses), it would be tremendous.

In the long run, a solid gain may come from the upper level classes and the graduate classes, particularly the latter, when we teach in the studio format. As I will explain later, a small enrollment graduate course can be taught in the studio format with much less manpower.

*The infrastructure*

We had renovated altogether four Studio Physics classrooms.
for our introductory physics courses. The latest one was for a pilot Studio Physics class we developed during the spring of 1996 for laptop (portable) PCs. Students brings their own laptop PCs to class to do work.

(We projected that in one or two years all Studio Physics courses would be run by laptop PCs brought by the students. These PCs, which are owned by students themselves, will be used in upper level courses too.)

These four Studio Physics classrooms were enough to serve all the introductory physics courses. The classrooms were opened from morning to late afternoon to run the courses.

Our lab equipment was duplicated so that we could handle two parallel Studio Physics sections.

In the spring of 1997, we also created a smaller Studio Physics classroom for upper level courses and for long distance teaching. This room was equipped with multimedia and long distance teaching tools. It has been fully functional for experimenting. I will come back to this effort in a later Chapter.

Actually the job of teaching reform will probably never be truly completed, in my opinion. At most we can say is that we have tried to initiate something more compatible to the information age. It will evolve into the future with many changes. But we hope that the infrastructure we have built will serve as the basis for future changes.

**Financing Studio Physics**

But how much total money had we spent on Studio Physics?
I would say about one million dollars or so, spanning a few year period.

(It sounds a lot of money. But if you think of it, it is really not. That is, if you compare it to other projects going on on campus and if you realize what we wanted to achieve for the Institute.)

Obviously there was no money in our yearly Departmental budget which would allow us to do what we wanted to do. In fact, there had been a continued Institute wide budget cut since I became the Chair until 1997. The Department operational budget and the number of faculty slots were continuously reduced for a number of years to meet the cut.

So we adopted Plan 2.

Plan 2 had no budget in it. But it had two fundamental ingredients: persistency and the belief that if we knew what we were doing there should be enough internal and external resources that we could tap.

We were focused. We had only one priority. We were relentless.

Internally (within the Institute), we said studio format of learning would be a key to attract first class students and therefore a key to the survival of our Institute.

Externally, especially to corporations, we said studio format of learning will prepare a powerful workforce who would be able to learn quickly by themselves and be able to adopt a fast changing environment in the next century.....

To parents, we said studio format of learning would allow
your child access to first class professors the first day he/she came to class and would allow him/her to learn the life-long skill of learning....... 

To our alumni, we said we were preparing leaders in science and technology in the next century who could comfortably excel in a team environment....... 

We were like a small startup company. The Dean and the Institute were like venture capitalists..... 

The million dollars we spent came from a combination of Institute “Strategic Initiatives” money, many industrial grants, NSF grants, individual donors, and Department money. Many of these monies were a result of many proposals written by members of our Department and numerous presentations given by them over the years. 

The monies were spent in the renovation of the classrooms, purchase of the computers and networking hardware and software, purchase of the lab equipment, and the faculty, staff, and students’ salary to develop the materials. A good part of the development was done in the summer time. 

“Damn the torpedoes!”

It had not always been smooth, though. 

I remember the headaches of purchasing the first set of computers. 

That was towards the end of my first year of the Chair’s job. After a careful planning, I thought we had enough money to buy a set of computers to begin our multimedia Introductory Physics
laboratory. (This facility was eventually used for our Studio Physics classes.)

I asked our Department staff supervisor who did the accounting to place an order to purchase these computers.

Just at the time she was doing it, the President’s Office announced an executive order to freeze all the spending on campus.

This was an attempt to save money and balance the Institute budget at the end of the physical year.

My first reaction was, “Shit!”

Here in our Department we spent so much time in discussing and planning how to change our teaching, how to get students involved in learning, how to serve the 1000 freshmen (not just our own Department), and how to improve the learning environment. And now just at the time that we wanted to begin doing something, here came the freeze.

I asked myself, was I prepared to sit on my rear doing nothing in the next few years waiting for “freezes” and “cuts”? What did the Institute need me (a Chair) for?

More importantly, why should I waste my time doing the job of doing nothing?

I struggled a lot that night.

Also, it got me thinking something more fundamental.

I imagined that if you were the CEO (Chief Executive Officer) of a company, what would you do if your company was in deep trouble?

11.11
You obviously wanted to cut, or freeze, or doing something to reduce spending.

But would that alone really going to save your company?

Might be you need to look at your business a little more broadly.

Might be there was something else. Might be your company was out of tone with the market.

Might be more importantly, perhaps, what you should do was to invest. To invest where you think would be critical to the survival of your company.

That’s not easy. Needed a lot of thinking, together with a good judgement and decision. There were of course risks involved. But at least you had a chance and the hope to survive.

In our case, did I believe that the things we planned to do were indeed critical to our Institute’s future?

I thought I was pretty sure. Might not be 100% sure, but reasonably close to 100%.

The next morning I asked the staff whether there was a way to purchase the computers without going through the normal process of placing a purchase order through the Purchasing Department and the Institute bureaucracy (which would be rejected if we did that and would be difficult to fight, I thought).

She came to me in the afternoon saying that there was a way. That was to purchase directly through the campus Computing Division and she asked me what should we do.
“Damn the torpedoes!”, I said.

So we did get all the computers, spending quite a bit of money.

Obviously I also ran into trouble, a reasonably big one.

The upper administrators went banana when they found out. I took a one week vacation at home.

I was told that I knowingly did it and it was not ethical or moral for a Chair to ignore an executive order.

Well......

The Dean bailed me out.

He came to my office when I came back from my “vacation”. He asked me not to give him more “big” surprises.

I think I never did since then.

I did not need to.

I think the event did not have to occur that way if I had a little more experience and a little more confidence in the job.

In retrospect, I think there were other less dramatic ways to get the purchasing done. I just had to be a little more patient. Everything we wanted to achieve required persistency. Every penny we wanted to get required hard and continued work to earn it.

Later, the Institute created a “Strategic Initiatives” to support key development in teaching and research on campus. Faculty on
campus would write proposals to compete for this money. We obviously would not miss the chance to submit proposals for this initiatives. That became an important part of the resource to renovate the Studio Physics classrooms later.

**Interactive learning**

While our complete implementation of Studio Physics was going on in our Department, an entire building was totally renovated on campus into extremely attractive classrooms and labs for Studio Chemistry. Each of the two main Studio Chemistry rooms can take 60 students. Chemistry labs are separated from, but are adjacent to the Studio Classes. The are also smaller rooms suitable for interactive learning.

A pilot Studio Chemistry course was taught in the spring of 1995. One of the introductory courses, Chemistry of Materials was totally taught in Studio format in the fall of 1997. A complete implementation of other introductory Studio Chemistry courses was planned soon.

A studio class for Engineering Analysis (an engineering course for a large number of engineering freshmen) was also created in the School of Engineering.

Another building renovation was completed recently for Studio classrooms.

Obviously these buildings and classroom renovations cost quite a bit of money. They were under the general plan to transform our teaching to an “interactive learning” environment.

Many faculty, the Dean, upper administrators (particularly Professor Simpson, who became the Dean of Undergraduate
Education), the President, and the trustees had put an enormous amount of effort to make this happen.

All the teaching innovations, especially the interactive learning modes, have led our Institute to win several national awards in higher education: the 1995 Theodore Hesburgh Award, the 1995 Boeing Outstanding Educator Award, and the 1996 Pew Leadership Award.

In the last few years our enrollment has gone up (mostly in the information related disciplines). Most importantly, our retention rate has been continuously going up. I do hope that these good news are at least in part a result of our Institute overall effort in the educational reform, particularly the teaching innovation.

The story is continuously unfolding.........
Chapter 12. Reviews of Chair’s performance

Let me pause and describe some other things that happened over the years.

This can best be achieved by starting to look at the faculty’s evaluations of my performance as Chair. There are two such evaluations. One was done after the first year term. The other was done after the completion of my third year term.

These evaluations were part of the agreements between the Dean and myself before I accepted the job.

The evaluation questionnaires were sent to physics faculty from the Dean’s office as I requested.

The first question was to request putting one descriptive word on my performance as the Chair of the Department. The second question was to request comments on my strengths and weaknesses as the Chair.

The results of these two evaluations are in Appendices C and D.
General comments

As you read through the comments from the faculty, there really isn’t much controversy in the first year’s evaluation, except for the unhappiness expressed regarding to the elimination of the secretarial service. My poor communication skill (speaking ability) was mentioned many times.

But the comments after my third year term were much more lively, critical, controversial, and interesting. It touched upon several issues including loading and the push of Studio Physics. It touched upon my management style. Poor speaking skill was again mentioned many times.

After each evaluation (one for the first year and one for the third year), I called a faculty meeting to go through the comments, particularly the issues that concerned most to the faculty. In these two meetings, I discussed those issues raised by the faculty and gave my responses to them. I also stated what I would do to improve certain categories and what I would not do in other categories.

Let me begin by going through some of the comments that are related to my personal characteristics.

These are not terribly relevant to the main issues that we are dealing with in this book. Nevertheless I would like to make a few points.

There was absolutely no doubt that I had (and still have) a clear weakness in speaking communication skill. I couldn’t make a decent speech of any kind except technical talks and presentations.

I don’t know why. Just seems not born with me.
It has very little to do with my English. I can’t make a decent speech in any language.

I always admire people like Professor Thomson who can articulate an issue so beautifully and flawlessly in front of an audience.

There are many things that I want to win in my life. But not this one. Public appearances have been a nightmare to me.

Forget it. I give up.

Some commented that I took some of the criticisms personally. I think I felt this myself too, especially towards the end of my third year term. When I didn’t have enough confidence to deal with certain issues, or just became impatient, I took things personally.

I will come back to this point later when I discuss the teaching load which is a critical issue that reflects key philosophical differences in the Department.

*Elimination of secretarial support*

In the first year’s comments, some were not happy about the change made in the role of office staff. Although this is not a big issue now, I still would like to mention very briefly what had happened.

One of the items I pushed to change right after I assumed the Chair’s position was the secretarial support from the office.

I discussed several times with our Planning Committee and Executive Committee, and later in our summer retreat, why we needed to change it.
(The Planning Committee was where I ask for help or consultation dealing with Department directions and major issues. The Executive Committee members were elected by the faculty to represent faculty’s voice and set agenda for Departmental meetings.)

The reason for the elimination of the secretarial support was simple: to make the office operation more efficient.

Basically the function of a “secretary” was obsolete.

Since I came to the Department in 1982, I have written lots and lots of proposals and papers (by now my students and I have published more than 250 papers). I have written lots and lots of letters, including recommendation letters for students. None was done through a secretary.

Nobody can help me except myself.

I have to change any document I write many many times before it is done. If a secretary was doing that I would have to spend hours and hours just going back and forth in order to make the changes. Not only I would waste the secretary’s time, most importantly I also waste my own time.

It is just much more efficient for faculty to type the documents themselves into PCs.

The majority of our faculty were doing exactly the way I did my paper work. Only very few people relied the help from the secretary.

For those who needed help, the office would provide the typing. But I proposed to phase out the assistance in a year or so.
During that transition period, we hired a part-time typist to do the work. It cost us a lot less than the cost of our staff time to do the job.

Then what would our office staff do?

They would take different responsibilities. For example, the staff responsible for the graduate program would work with our Graduate Program Committee and Graduate Admission Committee to take care all the ins and outs of student applications, financial aids, payroll, qualifying exams, student files, etc.

Our accountant would take care of Departmental budget, spending projection, student office assignment, lab construction and renovation, running conferences, etc.

The staff responsible for our undergraduate program would be responsible for undergraduate recruiting, undergraduate student payroll, open houses, etc.

The staff were cross-trained for each other's jobs and sometimes would team up to do a project together.

Over the years, the number of our office staff was reduced from 8 to 4 people. We needed to function very efficiently.

We need independent workers, not the traditional type of secretary working in a more passive mode.

**Continuing education for staff**

I was religious about continuing education for the staff.

I asked all office staff that no matter how busy they were, they
should either take courses (say, one course per semester) on campus to build their knowledge base, or set aside some time for themselves to learn new skills every week.

If you don’t learn new skills, you would become obsolete very quickly.

I have seen many very nice people whose skills are not up to date and have difficulty in performing tasks that required new skills. The office technology changes so fast, if you don’t keep up, you won’t be happy.

It’s nobody’s fault. It is the new era that we are living in.

For example, sending letters and brochures to recruit potential students were no longer competitive strategies. You needed to create illustrative home page and needed to use e-mail for quick correspondence to communicate with potential students.

You need to learn new software and its application all the time. You need to interact with people and communicate with people all the time. You have to make independent judgement all the time.

I will come back to discuss a much more controversial issue regarding the service Departments on campus. This was something I felt we needed to change much faster than it had been changing.

**Loading distribution**

The work load distribution among faculty members has always been a very sensitive issue in any Department in higher education.

In our Department, during the decade of transforming from a
teaching oriented Department to a research oriented Department, there had been many attempts to re-distribute the teaching load.

The reason was that the teaching load of faculty who ran a research contract (or contracts) was only slightly different from those who had no research contract and those did not do research at all. Normal teaching load at that time had been three to four courses per year.

But none of the attempts was successful. We discussed. We proposed. We in principle agreed to change. But never successful when came down to implementation.

When I became the Chair, the issue was raised again.

I went through a lengthy process to discuss this issue with the Planning Committee and the Executive Committee. Consensus was that it had to change. We came up with a plan that appeared to be acceptable to all faculty. I then presented a quantitative loading guideline in a faculty meeting.

According to the faculty handbook of the Institute, a normal teaching load of a faculty in our Institute should be 8 courses per year, or 4 courses per semester, plus some reasonable committee work and student advising. (There are two semesters per year.) Each course would be 3 credits, 3 contact hours each week. This would translate into 12 contact hours (in class) each week. (Now all our courses have been changed to 4 credits, 4 contact hours.) Of course, you have to add office hours and preparation time.

The teaching load at most four year teaching college is 12 contact hour per week too.

However, we have research which is the focus of our scholarly activities. Research can take all your time if you have a choice.
In our Department, at that time, 2/3 of us had external research contracts. Many of us had more than one contract. Each one of us had a pool of graduate and undergraduate students working in our labs. (Traditionally, our Department has an unusual large pool of undergraduate majors participating the research projects. In fact, all undergraduate majors are required to take a research participation course.)

Although the other 1/3 of our faculty did not have an external contract, most of them also performed research (without funding), except one or two faculty who were Institute administrators.

The loading formula we came up looked like this. For faculty who did not have an external research contract, the Department would be willing to subsidize their research efforts by reducing their load from 4 courses per semester to 3 courses per semester. This means 9 contact hours per week for 3 credit courses.

For faculty who had heavy research load who had to supervise many research students, their nominal teaching load would be 3 courses per year, or 1.5 courses per semester.

For faculty who had “charge-out” (use contract money to buy out teaching time during the academic year), sometimes we offered further reduction of teaching load to as low as 2 courses per year.

Faculty who took on new teaching development such as Studio Physics would also had a reduced nominal teaching load.

This explains the background of the comments on “unevenly” distributed teaching load mentioned in the review of the Chair’s performance.

There is no doubt that securing external research contracts has
not been a trivial task. One has to spend enormous amount of time to accomplish that. The faculty and students have to work very hard to produce results that would attract a continuation of the research contract awards. The competition has always been fierce.

This was the logic behind why we came up with this “unevenly” distributed teaching load.

You may argue that sometime non-funded research may also lead to important discoveries.

That’s true.

But who should support the effort? One time I proposed to the Department that for some selective and very promising research programs which were not funded externally, we might want to consider further subsidizing them by reducing an appropriate teaching load. That thought was rejected by the faculty instantly.

They argued that subsidizing one course per semester (reduction from 4 to 3 courses per semester) was the most they would be willing to offer.

In reality, it is almost impossible to do research without funding. You need to support students, buying materials and supplies, pay publication charges, go to conferences, etc. All require financial support.

The new teaching load guideline was executed quite rigorously. This “policy” was crucial in maintaining the research funding level in our Department.

There were many questions raised regarding this policy.

On one hand we all believed that maintaining high research
activity in our Department was the only way to ensure the quality of our faculty which was essential in delivering the best education for our students (both undergraduate and graduate students).

On the other hand, could we really be excellent in both teaching and research with the existing manpower?

What happened when *all* of our faculty members become research award winners? Who were going to teach all the courses?

My answer to the first question was yes and we had to show that it was possible. For the second question, I think although adjustments needed to be made, we still could accomplish both teaching and research even if all faculty members had research contracts. I will come back to this point later.
Chapter 13. Small Enrollment Classes

Actually the teaching load re-distribution was not a great controversy in our Department. Although some of us were not very happy, we got used to it after a few years. The Department appreciated it very much for those who took a heavier teaching load. They had made a major contribution to our Department in an attempt to excel in the turmoil.

The real controversy came from the assignment of teaching load credit for small enrollment classes.

This was where I got “personal” and “autocratic” as commented by some faculty in the review of the Chair’s performance.

This debate occurred at the end of my third year term as the Chair. This was the issue that almost caused me to lose confidence in myself and in our faculty. Although no formal meeting was held totally devoted to this issue (as I think we should have), there were enough disturbances that I felt I did not like the job anymore and was ready to step down after the completion of the contract (the first three year term).

Then came the third year evaluation.

After reading through the comments from the faculty, I gave myself a real hard soul seeking.
My conclusion was that it was probably my own fault. I did not give the faculty a chance to fully discuss the issue the way I think I normally had done on major issues.

By reading through the comments, I came to believe that if a thorough discussion had taken place, we might be able to come up with a solution that everyone would be able to accept.

So I decided to continue the job.
The issue

The issue was how we should deal with the small enrollment courses. There are always some courses, mostly graduate courses, where only a few students register. Sometimes we have courses having only 3 to 6 students.

Some Departments let faculty teach these courses as an “overload”. Meaning: the Department would not count this as part of the loading of the faculty.

I thought that’s bull! I didn’t like it.

Each faculty has certain number of working hours a day. If he/she spends time on these small enrollment courses, then he/she would not be able to do other things for the Department. There is no such thing called the faculty member’s “own” time.

So I preferred not to talk about “overload” stuff in our Department. Any teaching should be counted as part of our faculty’s teaching load.

Should we cancel these courses? That’s what some Departments would do.

No problem with me. As I will discuss later, the value of graduate education should not depend on how many specialized courses you take.

But if we insist not to cancel them, I think that’s also fine. We can do it differently and students can learn them differently.

The issue of small enrollment courses is likely to be an important issue on campus as time evolves. It is not only related to the faculty loading issue, but also touches the more fundamental issue
of teaching vs learning, faculty centered learning vs student centered learning, and the relative importance of the skill to learn vs the absorption of knowledge itself.

Meaning: it touches the entire philosophy of learning and the essence of education in universities.

It touches the philosophy of how we run our business. Obviously it is too expensive to run a small enrollment course if it is treated like a normal course and is assigned as a regular course load.

Then, how could we have maintained our business for so long time?

There is no secret that we have always used the income generated from the undergraduate tuition, particularly the introductory courses, to subsidize our graduate program. Teaching these small enrollment courses is one very clear example.

This is a critical area where we have to make significant adjustments in the future in order to survive.

It also touches the fairness issue. The time and effort a faculty spent in teaching a small enrollment course is definitely, in my opinion, less than a normal course with 30 or more students, say.

The conflict

That semester a few small enrollment courses were offered. Each of them had less than 5 students in these classes.

I tried to convince the faculty who taught these courses to do them differently. For example, instead of meeting 2 or 3 times a week, one would meet once a week for a longer period of time. Pick a
Friday afternoon for 2 to 3 hours, say. You might want to assign students to do some reading and do some work (asynchronous learning) before that. You might want to give a summary of the subject during the class and get the group to discuss the subject. You might want to give in-class work sheets for students to do work in the class interactively. Or you might also spend part of the class time to go through the homework assignments.

It would be very much like a Studio Physics class for the introductory physics courses that we offered to our freshmen and sophomores.

This was not like a conventional reading course. There should be homework assignments and exams.

I believe that students would learn more this way. The faculty would save considerable amount of time by formally meeting the students only once in the class each week and did not have to lecture that much.

The teaching load of this course would be less than a full course. We could then assign the faculty to help out in other areas, particularly the introductory Studio Physics courses.

One faculty member insisted that he had to teach the small enrollment course in a regular way. That was, doing the usual lecturing to his few students in the class according to the regular class schedule (2 to 3 times a week).

He insisted that he spent an equal amount of time teaching the small class compared to a normal class, because he spent the same amount of time preparing them and spent the same amount of time lecturing them. It did not matter how many students were in the class, the effort put into the course was the same.
Therefore, he argued that this small enrollment course should be counted as a full course load and be “subsidized” by the Department.

What a bull!!!

Even if one taught the small enrollment class the same way as a normal class, that was, lecturing according to the regular schedule, the effort one put in would be different compared to that of a normal class and would depend on the actual number of students in the class. Unless he never cared about students’ learning and just lectured and left, never saw students after class, never had to grade the exams, never had to write recommendation letters for them later......

I felt like I was treated like a moron.

But that did not get me mad. What made me real mad was when he came to my office to argue about how stupid I was.

“Fxxx out!”

He came to my office one day.

He said the whole Department but me thought that the small enrollment courses should be treated the same way as any regular courses.

He pointed to my nose and said I never listen to the faculty and everybody was behind him.

I said to him, if that was the case, then I should step down from the Chair job instantly. But if that was not the case, I said, “You fxxx out of our Department, and fxxx out of our School!”

13.6
Apparently our office staff thought that my voice was too loud. She came to close my office door.

The faculty member did not want to make the bet. He revised his statement by saying that he had talked to a few people and they agreed with him.

The next day I wrote an e-mail to all the faculty.

This was the first (and I think, the last) bureaucratic memo that I wrote to the faculty.

I hated this e-mail and I did not enjoy writing it. This was definitely not the way to win the support of the faculty to perform.

But I did it and I learned. The three year review gave me a chance to see how I performed in this issue.

**The memo**

“.....Let me now address the teaching load issue.

Teaching load assignment is determined by me and Mark. (Mark and I normally go through the assignments with the Executive Committee just to make sure that we do not miss something critical and also make sure that Mark and I do not abuse anyone. We also welcome general advice and suggestions regarding the teaching load issue from the Executive Committee. We shall continue carry on this practice.) If you are not satisfied with your teaching load assignment, you should talk to me or Mark. My general feeling is that the teaching load guidelines that came out as the result of last year’s discussions was a good one and we will follow that.

We will continue taking class enrollment into account when
we do the teaching load assignments. (I hope that we won’t have many small enrollment classes at all in the future. This semester, I consider Quantum III, Nuclear & particles, and Theory of Solids I as small enrollment classes.) I do not want to treat the equivalent teaching load of small enrollment courses very quantitatively at this time, because it depends on a number of things, including the number of students in the class and the way that the course will be delivered in the future (after the Curriculum reform discussion). I would hope to see more experience gained in future delivering of the small classes to get a clearer picture. But one thing is clear to me: the teaching load for a small enrollment class will not be counted as a regular course load, regardless of how the course is delivered. It is my decision. I have included both academic and business considerations in this decision.

I specifically do not see any need to have a departmental meeting on the issue of teaching load of small enrollment classes at this time. I think it would be more constructive for us to spend our energy to discuss the issues that the Curriculum Committee handles at the moment. But according to our practice, if there are enough people interested in a meeting to discuss the loading of small enrollment courses at this point, we will have it. If that is the case, please let me know and I will call a meeting. I will ask Mark (if he agrees) to chair the meeting. Specifically if you are very sympathetic regarding the teaching load of any particular individual, I will provide all the information regarding the individual to you for discussion, including his/her overall teaching load over the years, his/her number of PhD students, his/her committee service, etc. I will go over the conclusion of your meeting with the Executive Committee and see if we have mistreated that colleague badly.

Although I see no need of this kind of meeting at this point, but I am always willing to listen to you individually regarding this issue (or any other issue) any time........
Happy New Year!”

(Mark was the Associate Chair of the Department.)

Basically what I meant was, “Shut up! I am the Chair and I make the decision on loading.”

As I have said, I believe that was my first bureaucratic memo I wrote and I think it was the last one. I hate bureaucrats myself, deeply.

This approach did not challenge the faculty “intellectually”.

Whenever you don’t follow this very basic principle when you dealt with faculty, you would run into trouble.

At the present time we have the small enrollment class issue somewhat under control. For some specialized courses, we offer them every other year if the enrollment is low.

The fundamental issue has not been resolved completely and needs to be dealt with in the future.

The simplest way is of course, to do away with the small enrollment courses (which are mostly specialized courses) and each research group would guide the students to do reading and projects that can enhance the students’ knowledge in these specialized areas.

Or, we can deliver these courses using a combination of synchronous and asynchronous learning techniques mentioned earlier. This can be a very effective and powerful way to accomplish our goals.

Another strategy we have been thinking is to teach these courses with other universities having similar problems of small
enrollment. We are now setting up PCs to PCs video conferencing equipment in an attempt to teach these courses with several other universities. Since these courses do not involve laboratory work, it may be easier to do it through long distance. Faculty in these universities would take turn teaching the courses. That would cut down the teaching load tremendously.
Chapter 14. Graduate Education

The fight on the small enrollment class issue actually brought out an even more fundamental question.

The question is whether in the long run we can be at the forefront in undergraduate teaching at the same time at the forefront in research.

“First class teaching in a first class research environment” has been a slogan I use many many times.

Can this be achieved?
Research funding

While we were creating new undergraduate learning environment, we continued to grow our graduate program. During that period of time, our faculty research and scholarly activities, including research volume (between $2.5M to $3.0M), quality and quantity of papers published, and number of invited talks given, had grown to an all-time high. (We hope that we can continue to grow into the future when hiring resumes.) We achieved this while doing all the undergraduate teaching innovation.

The emphasis had been to encourage faculty to compete and generate more external funding to do research. As one faculty put it, “Money, money, money, that is the only thing counts.”

Now I have to make one thing clear. I had very little to do with the increase of our research volume. The growth was expected because we had hired quite a few young and energetic faculty into our Department in the last decade.

In fact, in the last decade, 4 out of 10 Institute Early Career Awards were given to the faculty in our Department. This award is given in each year to the most outstanding young faculty member on campus.

So the growth was natural.

However, I do believe that one can establish a viable research program only if one succeeds in competing for research funding. (The Institute must create an environment to compete. For examples, we need operational supports for key proposals writing, proposal matching funds, start-up funds for new faculty, and build-up of key research facilities.) Otherwise I don’t know how one can build a research program and support students to participate in the research
work.

There have been arguments frequently raised regarding the issue of funding.

The first argument is: the fact that a faculty does not have research money does not mean that he/she cannot perform good research.

That’s true.

But where does his/her time come from? Who supports his/her students? If you are an experimentalist, who supplies him/her with materials, equipment, and lab space?

Someone has to subsidize the faculty to do the work.

If the community you live in is willing to do it, that would be no problem. But thinking that one can do it by his/her own with actually no cost involved, or thinking that your community has to support you to do it because it is your right, is not realistic in our present environment.

The second argument is that having a funded program does not necessarily mean good research.

That’s also true.

But in my view each major funded program in our Department has been awarded because the subject matter is a very important research topic and the investigator (or investigators) is (are) among the best people to work in that particular field. They are all, in my opinion, very worthy of support.

To think that the sponsors (and the reviewers, your peers)
would be stupid enough to give away money to do nonsense research is beyond me. I reviewed numerous proposals for others and I haven’t seen such a case. That does not mean that all the judgements in ranking the proposals are perfect every time, but I have never seen a bottom rated proposal get funded.

When you establish a major research program, you already beat many others in the first step. The community will notice you when you produce results. You will get invited talks on the subject. Without this step, it is very difficult to do your research and build your reputation.

“It’s all politics!”

That’s another complaint for some who are not very successful in winning external funding or have no desire to write a proposal.

For this I would say, “That’s nonsense!”

Sure, there are politics involved, as in any other sector in our society. But to say that it is all politics is grossly exaggerating.

As in any work, the success of securing funding also depends on human factors such as your determination, your interpersonal skill, your communication skill, etc. To say that you have a good idea and it is all the agency’s fault that you don’t get funded is an oversimplified statement. It ignores the fact that we are living in a human world.

An analog to teaching would be to say that you know the subject matter very well and it is all the students’ fault that they do not understand you and cannot learn from you.

Although there are always human factors in all human activities, I am not saying that the present review/refereeing system is
perfect. Obviously there is a lot of room for improvement. That would be a different subject matter and I am not going to talk about it here.

What I do want to emphasize is that funded research is the most important item in establishing a viable graduate program. I had also mentioned this point many times to our graduate student body. Without the resource the students would not be able to perform their research efficiently. Here was where I would like them to help the Department and to understand when we dealt with other items that might consume faculty’s time. One item clearly on the table was the balance between faculty’s teaching time, proposal writing time, and research.

**Graduate courses**

In the teaching area, the balance between undergraduate teaching and graduate teaching will, over time, becomes an increasingly important issue.

In the last few chapters, I discussed the conflict regarding the issue of faculty time spending in teaching small enrollment courses. I view this as the beginning of a possible re-adjustment of the priority, and re-evaluation of the learning methods used in graduate education.

Let me make a concluding remark before I discuss the issue of graduate courses.

My feeling is that traditionally faculty spend far too much time in teaching graduate courses. Not only the number of courses, but also the time spent in each course.

In the British system, they offer no graduate courses. The PhD
candidate goes right into research after earning a Bachelor degree. The system produces outstanding researchers.

In this Country we ask graduate students to take course after course. Then research, or at the same time research. The system produces outstanding researchers.

A PhD student graduated from a US university perhaps has a broader knowledge compared to a British trained student, at least at the time of graduation.

But in this information age, that advantage is too costly, and very often unnecessary.

In fact, the philosophy of “absorbing as much knowledge as possible so that one day one may use it” is totally opposite to the essence of the information age. In the information age, you do not want to store as much knowledge in your brain. You learn how to deal with the information and to analyze the information. You need the basic mathematical and analytical skills and basic physical concepts to do that. The rest of the knowledge you learn it when you need it.

In this regard the British system is closer to the culture of information age. You learn the basics first. You begin to work on your research. You learn more as you go along (learn in time). You expand your knowledge base through needs.

A few basic graduate courses may be justifiable. But definitely not those specialized courses.

Even if we want to teach those specialized courses, one can teach them more efficiently. Like the suggestion I gave for small enrollment courses, one can teach these courses in an interactive manner and let students be the center of learning. Put the materials on
the Web. Do a little asynchronous learning by the students themselves. Instead of lecturing many times a week, you meet the students in a class once a week, say. When you meet, focus on discussions, in-class work, homework problems, presentations.....

The effective teaching load of the course may be only half of the regular course taught in a conventional way.

Or, do shared teaching through the long distance learning strategy that I discussed in the last Chapter.

In my opinion, this is where higher education has to change dramatically. The learning in the specialized courses is not efficient and the tuition income generated from these courses is just too small to pay for the faculty teaching time. One has to stop subsidizing them and at the same time improving the graduate learning.

Basically we will go out of business if we don’t seriously re-evaluate our graduate educational goals. Graduate education has to be part of the equation when we come to the allocation of faculty time.

**Essence of graduate education**

The analytical skills, the process of creation, and the creation of knowledge, are the most important ingredients in graduate education. At least in my mind.

We emphasize far too much the accumulation of knowledge in our graduate program. Very time consuming and expensive too.

A student joins our research group requires a strong, basic undergraduate training. But that’s all he/she needs initially.

The student would have already some idea of what we are
doing. He/she would talk to the senior graduate students in my group or look into our Web pages.

I sometimes would talk to a potential student about a problem that we would like to attack and would suggest some reading. An initial task would be given. I also leave lots of flexibility in assigning the task.

Very often he/she would work with my senior students to get into it, especially for experimental skill needed.

The most important resource that the student can tap into is our research group. It is his/her job to make friends with the group members and people around the campus so that he/she can get the task done.

I always tell them before they join our group that their academic ability is only half the background they need to do the research work. The other half depends on how they get other people to help them to achieve their goal. In order to get other people to help them, they have to offer their help to other people.

None of our work can be achieved without help. The students have to come up with strategies which lead to the successful completion of their tasks.

This is the basics of team work and entrepreneurship. But their individual responsibilities are clear.

We have weekly research group meeting. Each person is required to present clearly his/her work in the previous week and the plan for the next week in about 5 minutes. Everybody else would listen and give input to the presenter. The presentation is rather formal, using overhead projector with view graphs.
Students learn different subjects from each other’s work.

Very quickly a student would gain the basic skill to attack a problem and at the same time build his/her knowledge base. In a few years, he/she would gain tremendous knowledge in the electronics/photonics area, which is my current research area. New knowledge is generated on the way.

Students are required to write reports and papers and eventually, of course, the thesis. Sometimes I ask them to help in preparing proposals too.

Presentation, report, paper, and thesis are basic forms of communication.

At the time of graduation, the student would be ready to lead, organize and execute a research or development task.

Yes, the employers expect a PhD scientist to lead.

Showing that you have taken 20 graduate courses does not necessary help when you come to creation and leadership.

Accumulation of knowledge and creation of knowledge are two very different things.
Chapter 15. Research Directions

The greatest debate in the physics community in recent years is perhaps on the directions of physics research in the post cold war era.

Using post cold war as a dividing line may not be the best approach to describe the changes occurred.

The real driving force behind the change was, I believe, due to the impact of information technology. In fact, it was information technology that destroyed the cold war.

The end of the cold war was only one particular symptom of the impact of information technology.
**Competition in economy**

In the past (post second world war) the support of physics research, in the fields of nuclear, high energy, solid state, and atomic physics was largely driven by defense needs.

When we talked about physics, many people immediately linked it to the nuclear bomb. The society recognized the need of physicists to carry out the defense mission. No question asked.

(It is a great illusion to believe that society actually is willing to support, in such a major way, physicists in their pursuit of pure science or curiosity driven research. It was never that way, and it will never be that way.)

I remember that I was supported by the “Atomic Energy Commission” (it was changed to the Department of Energy later) when I was a graduate student in the early 70's.

Then came the PCs. Then came the faxes. Then came the Internet. Then came the World Wide Web.......

Couldn’t hide anything anymore. Barriers torn down. Cold war ended.

At the same time, economy globalized. Resource globalized. Competition globalized.

In a very short time, defense was no more our main focus. Economy has become the main focus of competition, world wide.

Then the entire government based research support system went banana. The dual use, the industry-government joint venture, the restructuring of NSF, the redefinition of DOE’s goal, the mission of
Government laboratories, the debate on direction of universities research......., all came to us in a very short time period.

Members in the entire physics community, whether in academy, industry, or Government, all have been greatly affected by this turmoil.

**Basic vs applied**

I think the debate of basic (or fundamental) vs applied physics misses the target altogether. If fact, I think we are wasting a lot time to talk about this topic.

There are many fields in physics that are very difficult to be described by either “basic” or “applied” physics.

Perhaps the only field that can be rigorously classified as really basic or fundamental is high energy physics.

Some people thought that condensed matter physics is all applied. (But I think things like fractional Quantum Hall effect and superconductivity are pretty fundamental physics.)

How about plasma physics? Astrophysics? How much is basic physics and how much is applied physics?

A subject that I and another Professor in our Department have been studying deals with a particular type of rough surface morphology (fractal) driven by noise during the growth of thin films.

It is quite obvious that this study is directly applicable in controlling the quality of thin films used in high tech industries. So it seems to be an applied research.
On the other hand, it is a novel phenomenon related to the physics at far from equilibrium. So you may say it is very fundamental in nature.

You can see now the difficulty in classifying the nature of physics research in this way.

In lieu of the new need in our society, we may want to define terms which I believe may be a little clearer.

Technologically driven research

Personally I prefer to classify physics research into two categories.

One is curiosity driven and the other is technologically driven.

Curiosity driven physics research can be basic and can be applied.

Technologically driven research can also be basic and can be applied.

The need and purpose to support curiosity driven research has been clear. It really does not need to be debated. The research leads to enhancement of our knowledge of the nature. And as demonstrated in the history of science, the net results of curiosity driven research very often lead to important applications that are not foreseeable at the time of research. It benefits the society immensely in the long range.

The purpose of technologically driven research is strongly linked to the economy, particularly in global competition. The need is also clear. No need to debate either. It benefits the society in the shorter range (relatively speaking). There are areas in technologically
driven research where we make use of the existing knowledge in science to achieve certain technological goals and the results of the research are more predictable. There are also areas in technologically driven research which require new knowledge in science to achieve certain technological goals. Technologically driven research can therefore also greatly enhance our basic knowledge of the nature.

Both type of research, either curiosity driven or technologically driven, can be basic or applied or both.

The debate should be on how much Government money should be spent in curiosity driven vs technologically driven research and where should they be performed.

In NSF, for example, should the proportion of curiosity driven vs technological driven research be 1:1, 1:2, or 2:1?

I think this debate would be much more meaningful compared to the debate on basic vs applied research.

Would the technologically driven research be recognized in the physics community? I certainly hope so.

(The invention of transistor was technologically driven. The research on transistor has been both basic and applied.)

Recent overwhelming response of the Industrial Physics Forum within the American Physical Society is a clear indication along this direction.

Industrial physics is close to what I call technologically driven research. It can be both basic and applied. Automobile and flat panel display research are two such examples.

In the academic sector, I think technologically driven research
within the physics departments would give physicists a new and great opportunity to contribute and the society would appreciate our efforts.

Instead of crying and lobbying the society to support more physics research, why not go directly to the heart of what the society needs and make new contributions? I am sure that the society will then be willing to give more support.

There are several barriers we have to overcome.

The first barrier is, of course, the recognition.

Technologically driven research has been perceived by many as “too applied”, and “too much like engineering”. But it does not have to be that way. It can be applied, can be basic, and can be a mixture of applied and basic. It is the researchers who have to choose.

I remember I was the first faculty hired as an Assistant Professor in our Department to do what I would call technologically driven research. The area is microelectronics. I was associated with the Center for Integrated Electronics at the same time. In fact I was the first newly hired faculty member to work at the Center. (Now the Center has merged with other electronics research operations to become the Center for integrated and Electronics Manufacturing, the largest Center on campus.)

Many friends and colleagues worried that I might not be able to get the recognition in the Department which was a typical traditional Department in nature.

I really did not have much time to worry about it. I was so terribly busy in my work. There were so many interesting research topics generated from the push of this particular technology. These research topics cannot possibly be defined and generated out of the traditional physics territory and practice.

15.6
Also you cannot possibly classify these as “all applied”, or “all engineering”. I published papers in Journals such as Physical Review Letters, Physical Review B, Applied Physics Letters, Journal of Applied Physics, and occasionally, IEEE journals.

My research definitely has been a mixture of both basic and applied. In fact, that makes it so much fun. I had reasonable confidence at that time that my colleagues would eventually recognize my work.

At the same time I produced lots of non-traditional PhD students who were hired directly into the high tech industry without going through the postdoc route.

I was tenured “early” and promoted “early”. In the different stages of tenure and promotion decisions in our Department, I was told that the votes were always “unanimous”. The openness of our faculty was very clear.

Now my formal students are making contributions in cutting edge R&D in information technology at IBM, Intel, AMD, Motorola, Analog, National Semiconductor, Applied Materials, Lam, MRC, Eaton, and Sharp. Their starting salary is as high as any engineering graduates such as Electrical Engineers.

After I was hired, there were quite a few faculty hired to do high tech driven research in our Department. We actually did not specifically use this terminology. But the newly hired ones were in the field of electronics/photonics research, which I would classify as technologically driven and is the heart of information technology.

**Why information technology?**
There are many areas in high tech driven research, including automobile and aviation. Why are we so crazy about the information technology?

Obviously this is because the technology is the driving force for the information age. The technology changes the society in such a dramatic way. For physicists, how many other areas of technologically driven research can be more exciting, challenging, and stimulating than the information technology at this point in time?

Important and new applications of information technology continue to appear at the horizon. In biotechnology, in education, in business……

The electronics research has grown over the years to become the largest Center on campus. Many faculty and students from different Departments and disciplines involve research in this Center.

Many of us have pushed very hard to create a unique environment for teaching and research related to this information technology, both software and hardware.

Many of us have argued for many years that in order to be an outstanding institute of technology, we have to be a leader in information technology. We have to use our resources and hiring in a focused area. The focused effort has to be a cross Departments and a cross Schools. Many of us have spent lots of time to help building the infrastructure to support the research.

I used to call it a “mini Bell” concept. While high tech giants such as Bell and IBM eliminated their long term technologically driven research, the university system like us should pick up the responsibility to create Centers similar to the old Corporate R & D Center at Bell and IBM. The Center would be supported by Government and industry jointly. One important difference between
this research Center and the old Corporate R&D Center is that we produce students and teaching is part of our mission.

New concepts would be proposed and researched at the Center. Fundamental knowledge base would be established for future technology. Students would be an important product who would be eventually employed and “transferred” to the industry too.

Physicists have an unprecedented opportunity to break into this kind of non-traditional research.

How many faculty members should be involved in this kind of Center operation is a matter of debate. Right now I believe we have something like 15% of the total number of faculty on campus involved one way or other this high tech driven research. It shows a tremendous strength when we focus our research effort in this way.

The rest of the faculty would be doing either other type of technologically driven research or any other disciplinary (traditionally) research.

The traditional departmental boundaries obviously do not fit very well with the “mini Bell” concept. The infrastructure has to be changed dramatically to fit the new needs. But this is beyond the scope of the present discussion.
Chapter 16. Business Culture

The nature of the conflict concerning small enrollment courses is also deeply connected to the culture formed in the academic community.

When I was hired as a new faculty in the Department, I sensed that scholarly activity was the number one priority that I needed to establish to get recognition from my colleagues.

All I had in my mind was to create an environment around me so that I could maximize my productivity. It was a place where I should establish myself and get myself protected.

There was absolutely no need to think about, or worry about the Institute’s business. The reason was that there wasn’t anything anybody needed to worry. There was no problem in higher education.

I think the staff and administrators were also brought in under a similar culture. Many administrators were one time faculty themselves. When an administrator was brought in, he/she was probably looking for how much money was there ready for him/her to spend.
Are we employees?

I remember an interesting lunch conversation. A very well respected Professor was very unhappy about the change of our Institute in recent years. After he argued how stupid an administrator was and added:

“He (the administrator) thinks we (faculty) are employees of the Institute!”

Basically he laughed at the stupidity of the administrator who implied that faculty were employees.

I think this statement is very profound.

Are faculty employees of the higher educational Institution?

I do not have a simple answer to this profound question. I will let you make your own conclusion.

But one thing I am pretty sure is that we cannot ignore the business part of the Institution anymore. (Don’t I sound like our Dean who told me this many years ago?) Everybody brought into our community has to understand the overall health of the Institute and the reward system has to include this part.

That includes the faculty, staff, and administrators.

Space issue

The fact that we could totally ignore the economy of teaching a class of only a few students showed very clearly the culture. Especially when we knew that we could come up with better and less expensive way for the students to learn.
Space utilization is another example.

The time I took over the Chair’s job, I found some labs and offices that were under the Department’s control had not been utilized for at least 15 years.

It was like throwing dollar bills into the river everyday, every minute.

It was amazing that on one hand we complained bitterly about the Institute budget cut. On the other hand we could totally ignore the waste.

Not only that, we stored lots and lots of “potentially” useful apparatus and equipment into lab space.

In fact, the larger the space you used the “cooler” you were. Some boast the area he/she occupied to show their prestigious positions.

I remember years ago when I visited Bell labs. I was humbled to see how small the lab space those great scientists had. You could hardly walk into the lab. You had to squeeze yourself and to meander around to see relevant parts of the equipment.

That tight space environment has not changed today. When I visited their labs, they kept warning me, “watch out!”

“Barbarian from the East!”

Fighting for space is a common theme in an academic institution.
I mean, we really fight!

Like defending it with your life!

I remember one day I brought a new faculty member (a research professor) to look around in the Department and see if we could find a place for him to set up his lab. We walked around and came to a lab which was used basically as a storage space by a faculty member. The new faculty and I were discussing what he wanted to set up and the size of the lab space he needed.

Somehow the faculty who “owned” the lab was around and saw us.

He was furious. He shouted at me, “....Like barbarian invasion from the East!”

Holy cow!

I hadn’t even make any suggestion that we would take away the lab space! We were just looking around. And for God’s sake, I was the Chair of the Department! Didn’t I have the responsibility to “look” around and make plan for a new faculty?

There was more to it.

I am an oriental. The word “East” bothered me a lot, when it was used in this context.

Needless to say, I was boiling.

But I did not say anything, I took the new faculty away.

After my guest left, I went to the faculty’s office and close the door.

16.4
I used all the swear words that I could remember from my childhood.

He argued that he did not mean Chinese. He said he meant Mongolian!

More swear words from me.

I told him that I did not like to fight with or screw up any faculty in our Department. There wasn’t any challenge for me to do that. But if he did it again, I would make sure to make the issue BIG.

It had been always a struggle for me when it came to fighting with individual faculty on this kind of “personal” issue. Sometime I felt like I wanted to choke the person, or at least fire him. But the next day when I saw all the other hard working faculty running around busy talking, laughing, enjoying...., I told myself, “Why do I have to spoil that?”

Also, the joy of screwing up a faculty did not really satisfy my ego. I had a much bigger ego to satisfy.

Also, more fundamentally, it is probably wise (like my mother always advises me) to give others some tolerance. People were brought up in different environment and under different culture. I cannot guarantee myself to be perfect all the time. Why should I demand others to be perfect?

I was glad that I did not give the faculty too much hard time. During the consolidation of space in a later year, he asked my help and planned to reduce his space and to make use of his old storage space.

Over the years we have renovated thousands of square feet of
storage spaces and “not useful spaces” into quality spaces. Also, in recent consolidation of space, we “gave up” thousands of square feet of space to other Departments and other usages.

But I did get very fed up dealing with space issues. I mentioned to the Dean that Departments should not “own” space. The School should coordinate the use of space directly.

I agree with the Dean’s statement that “If you don’t use it you loose it”. But I would also like to add, “when you need it we will find the space for you.”

That way, the faculty would not worry about getting space when needed and it would be easier for us to give up a space when it is not used.

Answering machines

I remember when I first assumed the Chair’s job, I was watching the daily operation in our Department office.

Telephones were ringing all the time.

I heard one staff member said, “He is not in his office. Can I take a message.....”

“No, I don’t know when he is coming back. But let me check see if he has a class........”

“He does not have a class at this time. He must be in a meeting.....OK, I will let him know.”

She took the message. She walked to the mailbox and put the message in the faculty’s mailbox.
Sometime later, the faculty came to check his mailbox. He found the note.

He walked to the staff. “I don’t understand this message. Did he say anything more?”

This happened over and over again each day.

The messages could be from his colleagues. Could be from his family members. Could be from the service person from a car garage who was fixing his car.

I sat down with our Department office manager and did a little calculation.

It was obvious that it was very expensive to use the staff time to answer the phone for the faculty. If we eliminated that service, we could save a lot of manpower.

So, we ordered answering machines for every faculty.

The purchase order got stopped somewhere along the line in the administration.

The question bounced to us was, “Why do you need that many answering machines?”

The Dean’s Office kindly did the explanation for us and we finally got the machines.

That was many years ago. Later, the Institute installed a centralized answering system serving the whole campus.
Chapter 17. Administrative Infrastructure

One of the possible savings might perhaps come from making use of the information technology to replace the present administrative supporting system.

The admission, the registration, the financial aid, the student affairs, the personnel, the purchasing..........

Many of them were really not up to date and are still undergoing changes.
Admission vs recruiting

For example, the Admission Offices, both Undergraduate and Graduate Admission Offices.

We didn't really sit in the Office anymore to wait for people to apply and then selected a group of promising candidates to admit.

Recruiting was really the spirit. Marketing was really the theme.

Call them “Recruiting Offices” would be closer to reality, if you didn’t like the words “Marketing Offices”.

When you talk about recruiting you need a crew who knows marketing very well. They need to go out and work like salespersons. You don’t have the luxury to sit in your office and wait for people to come. You have to go out (or reach out through the World Wide Web) to get your customers.

Your tools change.

Each recruiting member should be required to have a portable PC and can log in from anywhere in the Country to the campus. You need to give the customers on site all the information they need. And more, you need to make a decision to admit them on site. You cannot afford to wait.

Doing this way, you need staff who have higher educational training and who can understand the business. The recruiting people have to know exactly what the Departments offer. If you don’t know the detail, you need to be able to log in your portable PC and find out the information in real time.
As one might have guessed, I had not been very happy with the recruiting infrastructure.

Our Undergraduate Admission Office seemed to be the last office who got the resource to buy good PCs. You can understand why it took forever for us to get the applicants' names.

*Elimination vs reduction*

One time I had an opportunity to talk to our higher level administrators regarding the reduction of forces and financial saving during the downsizing period.

The general feeling among the administrators was that all divisions should share the burden of the budget cut.

I felt that in many cases this would not work. In fact, sometimes it made it worse.

We really had to fundamentally re-think the way we ran our business.

My argument was that we should re-organize and eliminate certain divisions, not to reduce force uniformly, in order to be effective. I was asked to think about it and to come up with a concrete example.

I used our Graduate Admission as an example.

The following was a memo I wrote to a higher level administrator regarding my view of a structural change to increase the efficiency of operation and at the same time saving money.
Ref: A strategy for efficiency enhancement and financial stability of the institute

Thank you very much for the opportunity to discuss possible strategies to reduce Institute spending and to enhance the efficiency of institute operations.

The strategy

After several years of struggling with the budgetary reduction I have come to the conclusion that we need to do more than what we have been doing. I believe that the continuation of cuts in all divisions in the Institute will not lead to more efficient operations nor financial stability of the Institute. We have to eliminate divisions and redefine the way we do business. I believe that not only can this be done, but we can also greatly enhance the efficiency of running the business. A key ingredient to achieve this is the use of information technology. I also believe that this change is inevitable due to the impact of information technology. If we have the courage to make a decisive move earlier than others, we will be leading educational reform in the administrative area just as we lead the way in undergraduate teaching.

An example: Graduate Admissions

I will use our Graduate Admissions Office (GAO) as an example. According to our directory there are nine people working in the GAO and they occupy a separate building on xxx Avenue. The GAO authorizes the admission of new graduate students. They help screen applications, collect application fees, send Institute brochures, compile a data base of international and domestic undergraduate degree programs (the basis for determining the suitability of a candidate to be admitted to our graduate programs), and so on.
Typically perspective students send inquiries to our department (many of them through e-mail), and our Department staff answer their questions the best they can and then submit the names and addresses of the students to the GAO. The GAO then sends them a package including the application forms. At the same time the GAO sends us the address labels so that we can send our own package to the students describing our programs. (This procedure is going to be changed somewhat during this summer.) Of course, there are students who send inquiries directly to the GAO. After completion of the application and pre-screening, the GAO sends the application package to our Department for review. Our four member (faculty) Department Admissions Committee then reviews the applications and submits our recommendation of admission/rejection of the students to the GAO. We also send separately the financial offer to the candidates.

**Proposed solution to replace the Graduate Admissions Office**

I asked myself: do we need the service of the GAO at all? Can we do without the GAO and yet not increase the number of our office staff? My answer is a resounding "yes". Our staff would have to learn more about the admission process. We can eliminate the whole GAO and replace it by a **graduate admission coordinator** (GAC) serving the whole Institute. There are many advantages: the authorization of admission comes from the Department and the efficiency of the admission process is greatly enhanced. Furthermore the Institute saves a significant amount of money.

It can be done in the following way. The GAC is the general information provider. He/she does not authorize admission. The general information includes government regulations, insurance information, campus living, number of degree programs in each Department, and so on. The GAC should communicate with the Department admission staff member routinely through the network. The GAC sets up a "hot line" to answer questions from the
Departments and from the applicants. The information that the GAC provides helps the Departments make decisions. The Departments also communicate their admission decisions through network to the GAC. The GAC compiles Institute admission statistics. The data then becomes available in the network.

As for the academic Departments, the admission process becomes much simpler. We send a single package to the candidate including the application forms, Departmental program description, and Institute brochures. We create our data base for the applicants. We make the decision and send out the admission offer together with the financial offer without going through another office for approval. The Department would communicate with the GAC if additional information is needed. The position of the GAC is therefore to help the Departments make decisions instead of making decisions herself/himself. The GAC does not have to work on campus. He/she can choose to work at home through the network. We therefore not only save manpower but can also potentially save overhead on offices.

The philosophy

The key point in this arrangement is to use information technology to replace middle management divisions and to use information technology to help the front-end workers (Departments) to make efficient decisions without unnecessary delay. The net result is efficiency plus saving. In my opinion, re-engineering without this ingredient is not likely to be successful.

I believe that the work of many divisions on campus can be done this way, including the Purchasing Department and the Human Resources Office. In doing so we may have to upgrade the function of the staff in the Departments and in the Dean’s Office (with pay increases, perhaps), but not the number of people. The staff would have to broaden their knowledge and make more decisions. In the
elimination of these divisions, I strongly suggest the Institute re-train people working in these divisions so that they can work in other areas.”

(I learned the word “front end workers” from a book entitled “Job Shock”, by Harry S. Dent, Jr, published recently (St. Martin’s Press, 1995)).

What “other” areas? Well, for example, a Graduate Recruiting (or Marketing) Office who could help us to recruit Masters Degree students (domestic or international) to study on campus or through our long distance learning programs. Meaning: going out (including creating web pages) to “recruit” potential customers and help our business!

Keeping the present responsibility of the office but continuously cutting it’s budget did not seem to work very well. As long as the Graduate Admission Office still authorizes admission, a severe reduction of force is going to make their operation even more difficult.

This, in fact, happened in our Purchasing Department. After the reduction of force, I heard that the Purchasing Department actually had to re-hire some of them back to do the job.

The process of purchasing an item initiated in our Department required us to enter the data on a requisition form. The form was then sent to the Purchasing Department. They then re-typed the data in their data base to be approved.

OK, doing a very careful work of looking at everything we purchased sometime could save some money. But for God’s sake how much more money we spent in hiring a whole crew of people to “catch” this and save a few dollars?

17.7
Also, how about the invaluable time that we very often had to wait and waste before we got the merchandize we wanted to run our business, including experimental research?

Again if the Purchasing Department became a one or two person crew who could help us to gather information (and to follow the regulations), instead of signing the purchase order, it would be eternally helpful.

Also, if this one or two person crew could help us to figure out doing purchasing through electronics (paperless), that would be really forward looking.

These days, every Division has been trying to be more efficient and working continuously to improve the supporting system. Good changes are being made. But some of the changes do not seem to be fundamental enough. The system probably needs much more dramatic changes to meet the challenge.

**Outsourcing**

One year, a crew of workers came to paint our Department office.

It drove me and the staff nuts!

It took them almost two weeks to complete the job! (The smell killed everybody!)

Everyday a crew of workers came and set up their equipment to work. The speed amazed the world. Amazingly slow!

I could very easily get a couple of outside workers to finish the job in one weekend!
The benefit of keeping our own crew of workers to serve the Institute was beyond me.

Outsourcing does not necessarily mean losing the loyalty of service, not in this information age. In fact, I strongly feel that we have to re-define the meaning of loyalty in this new era.
Chapter 18. Looking Down the Road

Regardless of what the higher education institutions will become, one thing is sure. We must integrate business notion into the system in order to survive.

New products have to be generated. The enterprise we run has to be lean, simple, responsive, and cost effective.

At the same time quality has to improve continuously and has to be customer oriented.

Put it simply: better quality, newer products, and lower price.

Even if we do all that, would there still be a possibility that we (higher education institutions) might be obsolete?
Business on the move

The studio mode of interactive learning is, I think, just the beginning of a continuous change of the way we teach and the way students learn.

Unlike the traditional classroom teaching, which has survived for so long a time, it appears that future teaching pedagogy may have to change continuously because of the continuous change of the information technology.

At the present time our Department is very keen in knowing the manpower required to do the Studio Physics for the introductory courses in the “steady state”. We have some knowledge of the requirements for the present complete implementation of the introductory Studio Physics courses. But I believe that a steady state will not be reached due to the fast advancement of the technology.

Regardless of the details of the change, studio format, which is more student-centered learning, should be inherently more cost effective and of higher quality, particularly when applied to the upper level classes and graduate programs where the cost (manpower/income) have been traditionally very high. I believe that this is where the saving will come from.

Cost has to come into play. The pricing has to be in such a way that an average American can afford to pay it. Otherwise we will be out of business regardless of the quality.

I think that (constant change) will be the characteristics of our business.

Newer and better products with lower cost.
Some of us may not like it. We have treated our business statically for so long. It is difficult to imagine that we have to change and to compete constantly.

Some of us will like it. Because it gives us an opportunity to be better than others in the changing world.

**Long distance learning Studio Classes**

At the beginning of last year, a new studio classroom (the fifth one) was just completed in our Department which was equipment with PC based long distance, real time, video conferencing/learning facility. This room was designed by Professor Simon Leng in our Department.

There are several possibilities.

a) We would like to see if we could teach the small enrollment courses with other similar universities (who have a similar problem) to reduce the faculty load.

b) We would like to see if we could offer courses/programs to larger audience off-campus, including international students, learning from their home countries.

c) We would like to see if we could offer courses to larger audience on-campus through a combined synchronous and asynchronous learning.

The new long distance studio classroom is smaller (can take about 30 students). Again it is equipped with PCs. Associated with each PC, we have an Intel Proshare Video System and a Video camera. We use inexpensive ISDN (integrated Service Digital Network) for communication. This strategy is very convenient and is
inexpensive to install. At this time it cost about $2K plus the cost of the PC for each set. We think this, or other similar type of technology might gain a widespread use in the future for long distance learning.

This facility is different compared to the well-established long distance teaching facility on campus. The few long distance teaching classrooms on campus are either through satellites or cables and are much more expensive. We can have only limited access to these classrooms.

**Long distance courses**

However, our first long distance course taught in the spring of 1997 was through cable using one of the long distance teaching classrooms on campus. (The construction of our new long distance studio classroom had not been completed at that time.)

That was a course taught by Professor Simon Leng who was very keen on developing technology-aided learning. It was a one credit course entitled “Survival Skills for Research Scientists”.

There were 32 students signed up for the course: 12 from our own campus, 22 from Hong Kong. The class started at 7 am in US and 8 pm in Hong Kong.

The course involved in-class exercise, grant proposal writing, oral presentation, and homework. In-class communications included visual and verbal material through Picture Tel. Data were transmitted through Internet using Learnlink, a software which allowed us to do interactive learning.

Course announcements were placed through electronic mail. Homework were submitted in electronic form by ftp and they were graded and returned electronically by ftp.
I delivered a “guest-lecture” for the class.

It was a thrilling experience.

From this course we learned several important things regarding long distance learning including the cultural aspects of international education and the feasibility of “paperless” communications in teaching and learning.

**Sharing teaching load**

Let me come back to discuss one of the potential short term benefits of long distance learning using our long distance studio learning strategy.

It is the small enrollment courses that I discussed before.

I talked to several Department Chairs of similar universities regarding the problem of small enrollment courses. They have exactly the same problem.

Our proposal is to share the teaching load for these courses.

Let us pick the “Solid State Physics” course as an example.

Let’s say we form a “consortium” of five universities to teach this course. Each university would have about 5 to 10 students in the class. So all together we may have something like 25 to 50 students.

In any year one of the universities would assign a faculty member and be responsible to teach the course (he/she can do it for two years consecutively). The faculty would come up with the syllabus of the course and distribute the homework assignments and
test (examination) problems to all the universities in the “consortium”.

Each of the other four universities would assign a faculty to be the supervisor of the course locally. The faculty does not have to be in the class (long distance studio class). But he/she would be responsible for collecting and grading the homework assignments and exam papers. Of course, he/she can use a TA to help doing the job.

In this way, each university in the “consortium” needs only to “teach” the course for two years in every ten years!

I think it would be a tremendous saving for the overall faculty time!

Furthermore, since all the universities in the “consortium” have about equal number of students, the expense is a wash. There is no cash flow from one university to the other. It would simplify the deal a lot.

**Other possibilities**

The long distance classroom can be used for many other purposes. Other long distance courses can be developed and delivered to any place in the World. That includes regular courses and short courses. New degree and non-degree programs can be established.

You don’t have to install the expensive satellite video conferencing facility to receive your continuing education. Technology is evolving quickly. You may just need a PC in your office (or at home) and the inexpensive electronics to “attend” the class.

There seem to have endless opportunities for both “students”
and “teachers”.

The technology also allows us to attend a conference without going to the conference site.

Professor Leng had delivered a lecture for a conference held in Hong Kong sometime ago from his office using his desktop PC through an ISDN line.

Currently I help managing a large interdisciplinary research center (as Co-director) supported by industries and the Government on IC (integrated circuit) technology. It is a virtual center involving 10 major universities, 30 faculty, and about 50 graduate students. Geographically these universities are located all over the Country, from California, to Texas, to the East Coast. We run review meetings (student presentations) through video conferencing. We just held a seminar using this mode.

It is such an exciting venture......

The change of academic programs

We have discussed the possibility of a continuous teaching pedagogy change in higher education due to the impact of the information technology. What about the academic programs (perhaps the most important part of our “products”)? Are they going to remain static?

It is difficult to see how they can remain static.

There are already strong signs that some of the academic degree (Bachelor of Sciences) programs are having a harder and harder time to recruit students. One very clear example is the basic science degree programs. That include Math, Physics, and Chemistry.
These programs change very little over the past decades. Recently, the enrollment continues to decline.

“A 17 year old student finds these subjects more difficult to relate to their future. Programs that have to do with computer, biotech, and medicine are more likely to generate resonance in their minds.” Our Admission Office told us.

A more dramatic change in content seems to have occurred in the degree programs offered by the engineers over the years. For example, the Mineral and Metallurgy program had been changed to Materials Sciences and Engineering, Electric Power to Microelectronics and Electronic Communication, Mechanical Engineering to Micro Machining. All these changes were shifting towards more information technology related education.

The word engineering was used to describe a new phenomenon in the industrial revolution where the agriculture society was transformed into the industrial society. In my opinion engineering should become obsolete in the information age. But because of the self-transformation of the focuses of many of these programs, they give themselves new lives in the new era.

Perhaps a more marketable university is the one which would include a School of Information Technology and a School of Biotechnology.

Under the School of Information technology, one would perhaps have a Department of Natural Sciences, Department of Computer Science and Engineering, Department of Electronics Media, Department of Microelectronics Sciences and Technology, Department of Photonic Sciences and Technology, Department of Micro Machinery, etc. Math, Physics, and Chemistry would all be under the Department of Natural Sciences.
Recently our Institute decided to form an institute wide thrust called “Information Technology” thrust. This is not a new School. It is a cross-disciplinary thrust that includes all five major Schools on campus. The main theme is to create new programs and promote existing programs which are related to the application of new information technologies.

One of the outcomes of this thrust is the creation of a Bachelor Degree in Information Technology. Our Department is keenly interested in offering courses related to the information technology for the curriculum of the new degree program. This is a great opportunity for us to grow.

The demand on soft science increases tremendously in recent years. The manpower needed in the society to apply the information technology grows unexpectedly fast. One possible strategy for the Department likes ours might be: if you can't beat them, join them. We do have basic strength in microelectronics and photonics research which are the foundation of the hardware used in information technology. But it is not quite exactly what we want for the Bachelor Degree in Information Technology. The degree requires a softer tone (may be a mixture of soft and hard sciences and engineering). However, I think we can certainly offer quite a bit, if we want to, in the teaching of information technology. Courses such as Physical Modeling and Science of Information Technology are examples that were suggested by our Department. We can certainly grow our business in that direction.

In fact, this semester we are offering a course called "Science of Information Technology". The response of the students and the faculty on campus to the course was extremely encouraging. The main theme of the course was the study of the fundamentals of information generation, storage, and transmission. However, if you look at the content, it is a combination our Introduction Physics II and Physics III courses, i.e., electromagnetism and modern physics. We
teach students how the basic principles in physics are applied to information technology. Put it in another way, we still teach the basic physics principles but with a language that is more acceptable to the audience. That makes the students and the faculty (ourselves) more excited about what we are doing! The students would learn the basic principles of electromagnetism and build their foundation in science without even knowing it!

We used to say to the students, "Come and take our Introductory Physics courses. These basic introductory courses (Physics II and III) will provide you the general knowledge of physics and it is very important for you in your career as a scientist or an engineer." We now say, "Come and take this course and you will see how your PC works." Or, "Come and take this course and you will see how information is generated, stored, and transmitted." Students are much more excited by this approach because it can relate to their life more readily and intimately.

Another opportunity for our Department is in the area of biotechnology. Many people, including our faculty members feel strongly that biotechnology is going to be a shining star in the next century. We do have a unique strength in this area. For example, we have many renowned workers in our Department in the area of imaging, including X-ray tomography and terahertz imaging. Combined with the bio-informatics program in the Biology Department, it may be another direction to grow.

By this time, you definitely would say, “You must be crazy. Long distance learning programs, information technology, biotechnology…… You can’t do all that!”

You are absolutely right. In business, spreading too thin is a route to destruction. We probably can’t do all that. Not with a small Department likes ours. But if this is for our School, or for the whole Institute, is it spreading too thin?
Well, probably not. Our Institute probably is large enough to take on these directions. (These directions are greatly intertwined.) If that is so, why not work with the rest of the folks on campus and grow wherever appears to be appropriate?

Lose the identity of our Department?

Well, so?

Instead of panicking, may be we should think it differently: we (physicists) are launching a massive invasion to new and exciting territories where the grass is green and water is plentiful!

It is so fortunate that we have such an agile ability.

_Are we obsolete?_

But even if we change our teaching pedagogy and degree programs (products), are we sure that we would still have business in the long run?

Is there a limit to the change? Put it in another words, if knowledge becomes more and more of a commodity, is it possible that one day higher education becomes obsolete? Why do people want to send their kids to higher education institutions?

The market is full of “knowledge for sale”.

Techniques are CD-ROMs, videos, WWW, long distance courses,........

When the information superhighway becomes common, you will have more stuff coming to wherever you are. You want to learn
mechanics? You just have to request a program that you like to buy and begin your lesson instantly through the superhighway. The program will be delivered by a star Professor who is well known for his/her teaching on mechanics.

You want to learn C++, or networking? Sign on to a long distance learning program.

(At the present time, we have 900+ students attending our Continuing Education/Long Distance Teaching Programs, mostly in the area of management/business.)

In the future, do we really have to send our kids to universities?

Here is what I have to think about.

I have a 14 year old boy. About four years from now he will be a college age young man. Imagine that he would want to learn physics (which, at this point, does not look likely). It may appear that he can get all the knowledge and techniques he needs to know on this subject through all kinds of information channels, WWW, PC Video Conferencing….. May be even through the information superhighway, or wireless communication, or whatever.

So, should I just ask him to stay home, (or rent an apartment equipped with the state of the art information technology) for him to study physics for a few years after he graduates from the high school?

Well, I would say no!

There is something that everybody needs besides knowledge.

That is emotion. Daniel Goleman called it "emotional intelligence" in his recent book entitled “Emotional Intelligence”. (I
bought the book sometime ago at an airport, but was able to read only the first Chapter so far.)

My son’s emotional intelligence needs to grow and to get mature.

I would like him to grow emotionally with a group of sophisticated young people like himself. I believe that emotion plus knowledge define the quality of a human being. I would like him to grow his emotion while pursuing high level of knowledge with other youngsters.

It is very difficult to have a complete menu of human contact through Internet, teleconferencing, etc. Many feelings of happiness, anxiety, anger…. can be shared most effectively if it is face to face. You can have a combination of eye contact, body language, voice, and smell to convey your feeling.

Technology can serve part of it, but it would never be complete, I think.

Information technology will not likely advance to a point where people can kiss or make love to each other at a distance. At least not at a foreseeable future.

So, my son needs to work and play with other youngsters to grow up. He has to fall in love, has to be jilted, and has to experience joy, bitterness, jealousy…. He needs to learn how to give and take. He needs to relate and to team with his friends. He has to learn how to enjoy his successes and overcome his failures with his friends and his sweethearts.

Also, I would like him to have opportunities to meet and talk to professors, a highly creative group of people on Earth. I would like him to be inspired and stimulated by these minds.
I will be willing to pay a good price for my son to achieve and to get all that.

If many other parents have similar goals like mine, universities will still exist for long time to come.

However, the profile of the universities is probably going to be quite different compared to what we have now in order to satisfy the needs of the youngsters in the next generations to come.
Chapter 19. More Than a Business

Obviously the turmoil isn't over.

In fact, it is probably just the beginning.

The rocky road may be even rockier.

However, it seems that the passion for higher education has never been stronger.

Every time when I see the reaction of our alumni or trustees on our new teaching initiatives or research, it is clear to me that greater excitements are yet to come.

But will the faculty be happy working in this new "business-like" environment?
We can learn

Not many of us (faculty) like business.

I remember when I graduated from high school, my Dad said to me, “Son, like to try some business with me?” I said to him, “Nay, I probably like to read more and wait until next year to see if I can get in a college.”

After I got my college degree, my Dad said the same thing again, “Son, like to try some business with me?” “Nay”, I said to him, “I will wait to see if I can get to a graduate school.”

Meaning: unless I am forced to, I won’t consider doing business (or working for a corporation) as a career.

But it seems that any enterprise requires a market and customers to survive. The only way, it seems, for our enterprise (institute of higher education) to survive and to excel is to bring in the law of business in addition to the law of Newton.

An important part of the law of business is not to get into deficit, at least when applied to us.

The faculty, administrators, and the staff, all have to learn the law of business.

I could be wrong, of course. But the chance of not changing and hope to remain in business is not very high, I think.

Well, if I believe that being business-like must be part of the profile of the higher education, would we, the faculty, who are the soul of the industry, still be happy?
I certainly hope so.

I think we can learn and we can change our culture.

I think when we see that we can serve our customers better, we would be very happy.

**Enjoyable career**

Actually more than that. Much more than that.

In our profession, we have the opportunity to push our intellectual development to the extreme. Scholarly, all of us have to be one of the few best individuals in our chosen fields in order to be where we are.

But that is not all. Let me tell you the most important secret.

The secret is that we have the opportunity to interact with so many incredible young brains due to the nature of our work. Very often the interaction becomes lifelong. You are with the development of the souls of so many individuals.

They look up to you. They adore you. (Doesn’t that satisfied our endless ego!?)

Once they are your students, they are your students forever.

I am always thrilled to talk to them and see their ventures in life after they left school. Intellectually I learn so much from them, either in technology or in life.

They are such a group of unique and intriguing customers!
Can you tell me any other group of customers who are as valuable and as enjoyable to deal with?

The rewards from the lifetime feedback are unmeasurable! The enrichment they provide you in life is unmeasurable!

There is no business in the world with the gain and lifetime reward like this business, the business of higher education.

With this, I say:

“Back up man, I am a Professor!” *

_Farewell note_

To this end, I cannot help thinking how fortunate we are, living in this incredibly fast changing world, in technology and in education. This environment provides everyone, including faculty, students, and staff, with endless opportunities to create and to excel.....

I wrote a farewell note (e-mail) to our faculty the summer of 1997 that concludes my five plus years of service as the Chair of the Department:

“As the celebration of July 1 in Hong Kong reaches its peak, I cannot help wondering in my mind that it is also the conclusion of my service as the Department Chair and the day of my “promotion” back to Full Professor from the Chair position!

The 5.5 years of my life has been full of thrills and intrigues. The experience has fundamentally changed my thoughts/belief on the value of work, career, and human relationship. You are the ones who stirred up my soul and brought upon the changes. You will see
images of yourselves in what I will be doing the rest of my career......

We are thrilled that Leonard is willing to serve as our next Chair. We know that this has been a struggle for him, particularly this happens in the middle of his peak research career. But I am sure that Leonard will find his period of time as the Chair at least as intriguing and stimulating as I have experienced!”

As we are tumbling into the next Century, the story continues to unfold....

* From the movie *Ghost Busters*: “Back up man, I am a scientist!”
“Summer Dance”
Appendix A. The Response

The following was the response of the faculty after the meeting with me regarding the term and philosophy of running the Department if I took the job. There were 16 faculty who responded. I use “……” to omit some names and statements which are directly related to the previous Chair.

This faculty member is fully confident of your potential as chairman. It is well known that US universities in standing just below the top tier of about ten are presently under extreme pressure. Your outlook both practical and idealistic makes you uniquely qualified to lead our department at this juncture, and to secure for us the success to which we aspire. I sincerely hope you will accept.

I support Lu's candidacy for chairman completely. He is clearly in touch with other constituencies at Rensselaer and understands our problems and opportunities. I understand that we have difficult issues and hard work ahead and I am willing to contribute as much as possible to move the school forward and to make Lu's job bearable. I am concerned that the demands of the chairmanship will damage Lu's research excellence and I will attempt to carry my share of the burden.

It is a relief to deal with a person who thinks collaboratively not confrontational.

I very strongly favor the appointment of Prof. TM Lu as chairman of the Physics Department.

The present time - winter 1992 - is not the best of all times for the U.S. or for Rensselaer and future of the latter is irrevocably interwoven with that of the former. The economic plight of our nation is reflected in the economic plight of our university. Of even more concern, the low esteem of science and technology in our country manifests itself in our difficulty in recruiting and maintaining a first class student body. The solution to Rensselaer's problems cannot be found without some movement in solving the national crisis. The best we can hope for in the near future is symptomatic relief to our difficulties - not a cure for all that ails us. Dr. Lu's concern with defining our "market", while not the way I would phrase it, has a sense of reality. I do not envy him, however, the task of identifying the markets of the future.

A.1
I found Dr. Lu’s comments open and frank. I do not agree with all of his priorities (markets); I do agree with most of them. I do not expect to agree with all of his decisions as chairman but I shall respect them as the product of deep thought and commitment.

I am most concerned about the morale of our department which has deteriorated greatly over the past year. The faculty of the Physics Department have for nearly all of my 35 years here operated by consensus. We may argue, but we have stood together to work for common goals. We have always reacted more positively to appeals to our intellects than to threats and demands. The first job of any new Chairman will be to restore our self esteem and our spirit. In his two hour “conversation” with the faculty, Dr. Lu made enormous strides in this direction. This strongly helped me in reaching my positive attitude. It is imperative that he as chairman continue this approach. Just as important, he must reach out to the non faculty members of the physics staff to offset over a year of lack of caring.

I would suggest one consideration - don’t make staff evaluation a numerical exercise. More than any other factor this lead to my discontent as well as that of most of the others who spoke with me. If anyone characteristic of the former chairman made me angry, it was his reducing people to robots - to non-human machines who can be rated by wattage.

I wholly support the suggestion to make TM Lu chairman of the Physics Department and pledge to do everything possible to help him achieve success for himself and for our department.

It is my view that TM is best qualified and best situated at the present time to take over the leadership position of the Department. However, I understand his reluctance to do so. Rensselaer and the School of Science in particular, is under tremendous economic pressure. Unfortunately, our problems need to be considered in light of a national trend for the number of undergraduates in Science (and in Physics) to decrease. Thus, I do not expect there to be any "easy" fix but I do feel that there is room for significant improvement in what we are doing.

As a young faculty member, I take both a short term and a long term point of view. In the short term we need to improve, innovate, and rationalize our undergraduate courses. The freshmen courses in particular are our biggest window to the institute for recruiting (which, in the short term, must primarily come from students who have already decided to come to
Rensselaer) and for Institute service. To do this well, more faculty commitment is needed and this will require that more recognition be given for this effort.

Longer term, we must be able to keep up faculty hiring and continue to improve the graduate program. This is important to me for my own career goals. However, it is also crucial to the long term success of the Physics Dept. and to Rensselaer. The long term success of attracting top undergraduate students to Rensselaer depends greatly (perhaps overly much) on the reputation the school develops in research which primarily happens at the graduate level. We will also not succeed in attracting the best faculty (which we need) or in keeping the best of our existing faculty if the graduate program is allowed to suffer because of our short term needs. Thus, success is going to require the commitment of all the Physics faculty, all the innovation we can master, and maybe a little luck. It is also going to require the support and innovative actions of our administration and cooperation of other departments and centers on campus.

I feel that TM has a good feel for these problems and knows how to work with people to get commitment. I think his connections on campus to other departments will be a great asset. I have developed substantial trust of his instincts for what is realistically possible and, thus, stand ready to work very hard with him on projects for the Department because I know they will be appreciated and likely to be successful.

Of course, I worry about TM’s research effort which is an important asset to the Department. I hope the school will supply some resources to help TM to maintain his effort but I also believe some erosion is inevitable (this comes from my gut, I wish I could say something different). I suspect the best approach is to maintain current research directions and make a decision 3-5 years down the road about what future career direction to take. TM is aware, any active research effort requires starting new research directions and I think that this is the part that is impossible to maintain while acting as Department Chair (from what I have seen at other places). I also consider TM a very fair person and feel that he is also perceived that way by others. This is again crucial in obtaining the kind of collegiality which will be crucial for our success.

One other concern I should mention is the commitment on the part of the Dean. I think these times will require tough choices and fast action. Over, the last year, I have been somewhat discouraged by the dean on
these matters. Thus, I find TM's statements that the dean has been supportive and seems to be in sync with his own thinking to be an encouraging sign.

I am sorry for the somewhat disjointed nature of this response. The time is short so it is somewhat a stream of consciousness. However, I wish to emphasize my commitment to support TM and to develop further thoughts and actions about the problems discussed above.

TM Lu would do a great job as chair of the Physics Department and he has my unqualified support. My only concern is the impact this appointment may have on his research productivity.

I thought the department meeting yesterday went very well, and I congratulate you for the open way you chaired it. Your success in raising our morale at this meeting promises similar excellent results during your three years as chair of the physics department.

I know this letter is supposed to be anonymous - but I don't like to write anonymous letters, and in any case certain specifics would identify me so I'm signing it. I'll retire at the end of the term, so I'll be directly involved rather little. But I've spent more than half of my professional life here (28 years at RPI) so I feel a strong identification with our department, and look forward to the boost of morale that will come (and has already started). It's comparable to the change of faculty moral when Gunton 'left' and Low became President of RPI. Also, I expect to continue research, come to some seminars and colloquia, frequent lunches, give an occasional seminar, etc. after I retire - and my pleasure in doing this (and the amount I will do at RPI) are directly dependent on the atmosphere here. So I am strongly involved.

I'm not happy with your emphasis on 'the market'; but I don't know what to substitute at a time of national recession/depression combined with disenchantment with science. One alternative (that could be used on its own, or combined with finding a market) is to "get by with less". Take my example - I haven't had a summer salary for many years, but I haven't needed one since my kids are old enough to be independent. I'm happy to get the department to pay between 1/4 and 1/4 of my travel expenses to U.S. meetings where I present a paper and/or chair a session. (For instance, I've sent in a paper for the Washington APS meeting this April; and am now requesting a little support.) On the other hand, my graduate students for many years were supported by their work as TA's (as I was
1946-48 and a grad. student at Cornell). And I don’t have to buy equipment or supplies, as experimentalist do. Though I do need a modest budget for computing. If I were 10 years (or 20 or 30 years) younger I might well search for a market. Congratulations and Happy New Year.

Dr. Lu sounds so serious about this new job. He is already so much overloaded. I worry about his health and his own research.

TM, I was very pleased at your willingness to speak so openly and in such detail at yesterday’s meeting about your views of the chairmanship. After the chaos of the last several years, it was most refreshing to have such a frank discussion. I welcomed your forthrightness and your openness to our views. I thought it was a very good meeting.

I reacted very positively to most of the positions your took. I liked your willingness to delegate. For example, it’s very good that you’re willing to have committee chairmen lead the work of their committees without your close supervision.

In my view, the department is very fortunate that you are willing to step forward at this point. It will truly be a new beginning for us. We can begin to put behind us the bad times of the last few years.

Now let me turn to a few things that concerned me a little bit in the meeting yesterday. However, I emphasize that none of what I will say from now on changes my overall view, already expressed, that your taking on the chairmanship is a very positive development for all of us.

I was concerned about your total emphasis on marketability as a criterion for deciding on department directions. I understand how the current economic and demographic situation in the nation (and at Rensselaer) is driving decisions around here. But things are not going to be like this forever. I agree with Paul Kern - we need to take a long view in our planning. And there are other considerations we need to keep in front of us besides marketability. A university is not just a business. Physics is an intellectual activity, and there are intellectual considerations in determining the directions of a physics department. For example, if we were only concerned with marketability, we’d never hire another theorist as a faculty member, even in condensed matter. And that would be a shame.

I thought your use of the term “non-democratic” was unfortunate and not
accurate. I take it you don’t want to put important decisions to a faculty vote. Fine. But I also take it you’re willing to consult with us about major decisions. That’s very good. I was concerned, though, that you have already decided there shall not be a nuclear theory appointment. I’m sure that appointment would indeed have a very tough time right now. But it does seem that you have not yet consulted with anyone about the merits of this case. I’d like to see some consultation and discussion before you make decisions like that, even if your decisions are the right ones.

I share Paul Stone’s concern about your own loading. Do not let the chairmanship duties prevent you from continuing an active research program! Keep the time you spend on the chairmanship down to 40%. Be ruthless about that! Don’t spend all your time in the chairman’s office........ Delegate everything you can. I know there are some things you can’t delegate. I’d expect these include providing intellectual leadership of the department, department planning, overall management of the department budget, promotion and tenure cases, new faculty hiring, interacting with dean and provost, keeping an eye on faculty research efforts, prodding and encouraging them, and encouraging fund-raising. But surely you delegate nearly everything else, including teaching assignments and loading, operation of department office, budget details, proposal and grant monitoring, space assignments, graduate program operation etc........

Finally, TM, I want to say how pleased I am that you’re willing to take on this dreadful chairman’s job. You certainly have my support and my willingness to do all I can to push things forward for the department.

I feel strongly that you should accept the position of chairman. You will bring a degree of honesty, trust, and openness to the job that is sorely needed. Also, I think you will be more sensitive to the diversity that exists in the department........ Overall, I like the approach that was outlined yesterday but I feel obligated to mention a few cautionary notes:

1) Many (but not all) of the faculty are working at maximum capacity. It is not reasonable to expect increased numbers of proposals or increased teaching from them. They understand the system very well and have optimized performance. Increased pressure is counterproductive.

2) One time that was mentioned in the meeting I feel is critical. To the faculty it seems that the chair has been the channel by which
pressure was channeled to them from the administration. We did not get a sense of the institution's problems nor did we have the opportunity to offer solutions. Everyone should understand that we all want Rensselaer to thrive. I suspect that the administration does not acknowledge that the Physics Department has value. If we fall back to "third rate" status by shrinking too small or becoming an engineering department, Rensselaer will be the worse for it. I feel the chairman plays a crucial role in this two-way exchange.

3) In the marketing language you used, one item that was omitted is prestige. Every engineering school that Rensselaer like to compare itself to recognizes that strong physics departments help attract students into their non-physics programs. I don't know how to quantify it, but clearly we should be "selling" prestige both internally and externally.

4) Please don't become too enamored with..... formulas. They have a function, but in the end it will be your responsibility to make a (subjective) judgment of the value of our work. Counting PRL papers is not good comparator. In the end you will be comparing the "good points" for each faculty member. For some that will be PRL papers, but for others it will be teaching initiative or commitment to developing new research.

5) Minor point - If at all possible I think you should let...... ruling on secretarial support stand. He (previous Chair) worked hard to get that concession and I think it is fair. We really don't get much for the money. .......spent two years.....poking.......into our budgets trying to extract what to the department are small amounts of money. It is much better to let individual researchers decide how that money is best spent. It is not "extra" money. Most of us have very tight limits on our budgets.

There should be fairness in loading, evaluation, raises in salary. Present formulas are inadequate in distinguishing among achievements in different areas.

Loading should be such that no research-active person with funding gets driven out of research. Various formulas have been proposed, but one course per semester or its equivalent is the best one, keeping in mind the outside research competition.
Recalling that the last addition to the nuclear theory faculty was more than ten years ago, and this addition has been a success in funding, it would be a pity if another appointment in hadron theory is not made in the next three years. Market value, present and future, dictates its necessity.

I appreciated the open discussion provided by yesterday's meeting. ...... this "openness" is welcome and it should be encouraged as the basis of chairman - faculty interactions in the future.

Delegation of certain administrative responsibilities to the appropriate committees - e.g. recruiting graduate students and T.A. awards to the graduate committee - is also in the right direction.

My main concern in surrounding the pet word used by Lu frequently during the discussion "marketability" and "products". In spite of his explanation, it is not clear what he means by these words on how he is going to decide what "product" is "marketable". Also I am somewhat dismayed by the statements like "I am not going to be democratic". While I expect the chair to exert his leadership in setting up the priorities within the given boundary conditions (financial and otherwise) I hope he will consult fully with the concerned faculty before reaching decisions.

With this clear understanding, and the attitude of openness prevailing last night's meeting, I will endorse TM Lu for the chairmanship.

After yesterday's meeting, I have the following thoughts on your becoming Department Chair: (These are in no particular order.)

I appreciate the open discussion.

I think that the mode of operation that you outlined will work, and should allow you to approach a situation in which the job is not overwhelming you timewise. I think that your philosophy about delegating certain responsibilities will work.

From the perspective of the Graduate Program Committee, I think the proposed division of responsibilities between the Department Chair and the Committee is good.
As a number of people mentioned in the meeting, one of my biggest concerns about your taking this position is that we will lose part of your contribution to the research and graduate student supervision in the department. It is important for you to structure your responsibilities to minimize the impact. You might also need to add a post-doc or equivalent to help.

I understand your philosophy about change and market, and I agree that we must be poised to be leaders when new opportunities arise. However, one can also get into trouble by simply following the latest trend. It is also the chair's responsibility to see that we don't lose our basic character as a Physics department. I do agree that the department must be open to looking at how we teach things from the lowest level to the highest.

I think that you have correctly identified the short-term hiring goals for the department. You have also correctly stated the importance of upcoming promotion cases.

I realize that the time for doing evaluations is short. However, it is important for you to think further about the ways of measuring quality in various areas and disciplines.

You have said that you want to create an environment in which people are happy to work hard. I believe that is the most important thing an administrator can do.

I am willing to do anything I can to make your term as chair a success. I wish you well.

I am very glad you are (I hope still) willing to take on the difficult job of chairman of the department. As for questions to raise, or advice, I'd prefer to leave all that for when specific things need to be settled. My only concern is that overall there be a balance of short- and long-range planning and foresight. It is not enough to pass off the long-range problem by saying no-one can foresee. "He who does not learn from history is doomed to repeat it". There is a lot of history in the academic field. Furthermore, 18-year-olds are not produced in a moment. All of the students of RPI for the year 2010 are already alive! (There is also a lot of history in the RPI academic situation, much of which IS relevant. Also in this department. I may provide some comments on this at a later time.)
A lesson learned by good managers and leaders, and not learned by bad ones, is that to get enthusiastic cooperation of those being managed and led, they must have a real sense of "ownership" of the decisions. This takes a bit more effort, but in the long run reduces the eventual effort by getting those who have to do the work to do it more effectively, and with a lot less direction from above. There are many "tricks" to achieving this. An obvious one is to ask people what should be done, but lead the discussion (by preplanning) in such a way that the "right" choice will appear as the only possible one in the end.

Best wishes on your journey....

As a professor emeritus who has survived through several crises of the physics department I can see the situation from a somewhat more detached standpoint, because whatever happens does not affect me directly. I was impressed by your openness and wish you good luck and much success for the next three years.

Keep in mind that the country is presently in a recession and that better times will come again. This does not imply that we should revert to all the old ways. However, a long-range outlook is most important; otherwise we may "miss the boat".

Marketability: Using this as the main guiding principle may be dangerous, if it goes so far that the physics faculty could just as well be accommodated in the material science department of the engineering physics department. We then would have a faculty that would publish in journals like Vacuum Research, Fiber Optics, Surface Science and Technology, Transactions of the IEEE (those titles are made up by me!), and not anymore in Physics Review. Such a faculty will not enhance the reputation of the department in the physics community. The administration of RPI has to be taught that physics per se is not marketable as engineering, or even chemistry. (There exists a chemical industry, but not a physical industry!) The Arts Department, the History Department, or the Physical Education Department are also not marketable.

Furthermore, it is important that the chairman of a department should feel as a member of the department and be its spokesman. He should act somewhat as an impedance matching device between faculty and administration.
Salaries: It is a grand illusion to believe that the quality of a professor and the raise of his salary can be expressed in a formula consisting of an arithmetic sum. My guess is that the salary distribution within the department presently is not at all reasonable. However, as an emeritus I do not have to suffer from it.

I very much believe that you have the skill to navigate the boat through the present stormy weather! Good luck!
Appendix B. The Reply

The following was my reply to the faculty’s response given in Appendix A. A final acceptance statement is also attached.

“I scanned through quickly your comments (see attached). If my interpretation is correct, I do have your understanding (not necessary agreement) of my philosophy and the motive behind. Many faculty don’t agree with the wordings I use, particularly the term “market” (and perhaps the implications behind). I have no problem with that. My intention was to ask for “understanding”, meaning: when I made certain decisions in the next few years, I hope you would say “I understand why he does that”, rather than “I don’t understand why he does that”.

I also see a strong commitment from you to work together to fight for the department’s future.

For that, I am now willing to accept the Chairman position and will work as quickly as possible with the Dean to make this happen.

In addition, I would like to make the following quick response to some of the comments at this time:

1. I will try (and I think I can) to boost the morale of our physics staff members in a very short time.

2. Many faculty don’t like a numerical evaluation. I have not thought about this much, but will try to come up with a more agreeable way to do this in the future. I need some time to study this.

3. For the retired people, you are most welcome to continue your activities here in the department. If you are interested in participating the committee work, please do so. I am sure that you have a lot of creative things that you like to do. Any degree of participation are all very welcome. If you don’t like to do any specific job, fine, just “hang around” an enjoy some reading and may be a lunch with us, and chit-chat a bit.

I share a lot of common interests with you “old timers”. Hill inspired and encourages my “painting career” (I was touched to see him come to the
faculty meeting last Wednesday), Joe taught me to make wine, Willy taught me how to invest, Walter inspires me the art of administration, I share the same thrills with the Sternstein's each spring when flowers blossom, the Kissinger's and my family are greedy animals - like to eat good food........ In the process of this "take over", in additional to the advices I got from the present faculty, I have numerous consultations with Walter and Gery to formulate my thoughts.

In exactly the same spirit, the retired staff members are most welcome to visit us, to chit-chat a bit with the faculty and with the staff, and to participate our departmental events.

Just to remind you, I "grew" up from and was nurtured by this department. I am a "product" of this department (like it or not). We share a lot of common "characteristics".

4. I agree that the term "non-democratic" was a bad choice. A better description would be "for some items, I would not like to put it to a faculty vote". I will certainly consult with the faculty on major decisions. I will try to bring the departmental and administration viewpoints closer instead of further away, so that in a few years the number of these items be minimized, or totally eliminated. At the present time, realistically, because of the lack of communication between the administration and the department, a vote of certain items might mean a direct clash between the department and the administration. I simply cannot handle that. I ask your "understanding" of this point.

I have to add that I think you are absolutely right on the issue of communication: "We did not get the sense of the institutional problems nor did we have the opportunity to offer solutions". Our department is not unique when we come to this issue. What leads to this? In my opinion, this is a result of the lack of leadership at the present time at our institution. We see accounting, but we don't see where we go. Blame them? Yes, to a certain extent, to us too. Curse them? Should not, at least not me. There aren't many George Lows on the Earth.

5. Yes, the decision of not going for a hadron theorist was done only with limited consultations. I have not even consulted with the most relevant people involved. There is no excuse. I apologize for that.

6. I thank and appreciate your concern about my loading and at the same time the maintaining my own research activities. 40% sounds an ideal
goal. I will try to reach that, with help from all of you.

7. Yes, I think my approach will be a mixture of both realistic and idealistic. I would set a firm footing on the ground and share George Low’s “Imagine the Impossible”.

8. I agree totally with you that selling prestige internally and externally is very important. This has been in my mind for quite a while now. I have some thoughts too. We will discuss this more.

9. Yes, we should deal with the loading issue. We should come up with an acceptable load distribution scheme before the assignments of the next Fall teaching duty. We should try our best not to increase our teaching load such that it will affect our research badly, but one course/semester for all research active faculty sounds a little unrealistic given the boundaries that we have at the moment. However, I believe there are creative ways to reduce the teaching load and to deal with the issue.

10. I am aware that there has been quite a bit of concern of the nature of the department that we are building. I myself am very positive about the direction we have gone so far and I have already seen a very significant impact in the scientific world on the concept of such a department with multidiscipline activities. We are pioneering in such a direction. The direction of our department is an extremely important one and I have planned to create an opportunity and atmosphere to fully discuss this issue in a retreat sometime in the future.

    I have not told anything to my large group of students yet. It will be hard for me to do that and I don’t know yet how to start at this point. Some of them will not be happy, especially the ones who need more help. I hope to win their understanding, at least partially at the beginning, (in the next few weeks time).

    Finally, and most importantly, I thank Winnie for her understanding of the whole situation and her “understanding” of my decision to take the job (even though I myself don’t understand and am still confused why I would take the job)! As for Victor, well, I guess he doesn’t have much choice. But I look forward to cheering his baseball game when I step down as the Chairman a few years later. Fortunately at this point he is still too young to play baseball in a team. I am sure that I should have times to continue playing games with him at home.
I thank everybody for your quick response. Wish me good luck for the new job and I wish you good luck to have me as your chairman.”

(Note: George Low was a former President of the Institute who transformed the Institute into a research oriented university in the 70's.)

Acceptance letter to the faculty

“As you know from the last week Dean’s memo, I now formally take over the responsibility of the Chair’s job. I then will not have a second thought of my decision to do so.............

I look forward to working with you all in the next few years. My slogan:

CHANGE, ADOPTION, AND CREATION!

Let’s all work together to create the most exciting and enjoyable period of life in this most difficult period of time in our lifetime!”
Appendix C. First Year Review

The following is the review of the Chair’s performance by the faculty after the first year. (Each bullet refers to the comments of a faculty member.)

Question 1 -- Indicate your overall impression of Professor Lu's performance as Chair, Department of Physics using a single descriptive word.

- super
- superb!
- excellent
- excellent
- excellent
- vigorous
- terrific
- great
- brilliant
- outstanding
- excellent
- different
- outstanding
- outstanding !!!!
- enabling

Question 2 -- Comment on key strengths and weaknesses which are noteworthy.

- Strengths: (1) energetic and innovative; (2) good person-to-person skills; (3) vision for an improved department. Weaknesses: Is sometimes hard to understand.

- (a) He speaks too softly -- both at meetings and in person. Perhaps he can try to compensate for this if he’s conscious of it. Also, compounding the problem, his “accent” is more difficult to understand than the speech of other Chinese-born faculty. Often people don’t reply at all, or reply to misunderstood comments of his. It really would make him even more effective if this natural understandable situation could be corrected somehow.

(b) His honesty and openness are laudable. He is fully trustworthy. He works very hard. He consults with interested and relevant persons on all issues, yet makes up his own mind. His judgment seems excellent. There
is a basic humanness that comes through in all his dealings. The example he sets - work habits, productivity, personal consideration, etc. - leads to a more productive and happier set of members of the department - faculty, staff, grad students, etc. Nothing like a combination of talent and hard work! It can't be beat.

- Commands respect; personal warmth and friendliness; integrity; flexibility; gets the most with a minimum of friction; knows what's important; can delegate responsibility

- Strengths: (1) open to suggestions, opinions, etc. which contradict his own views; (2) energetic; (3) delegates authority (vast improvement over predecessor); (4) balanced view of education and research. Weaknesses: none.

- Strengths: (1) good at delegating; (2) very conscientious; (3) good at seeing what should be the 'long range' goals. Weaknesses: (1) occasional difficulty in summarizing a thought clearly when talking to people.

- I have not been impacted directly by his administration and so my impressions are second-hand, but he appears to have: (a) a clear set of goals; (2) the ability to enlist people to accomplish those goals. His possible (and actual) limitations in communication -- as a non-native speaker -- do not appear serious. His good will shines through.

- Strengths: (1) enthusiastic; (2) very positive attitude; (3) encourages initiative; (4) willing to take a chance; (5) a real gentleman.

- TM has done tremendously in pulling us back together. These are difficult times and many sacrifices must be made but TM has gotten everyone to share the burden and work together. His strong focus on applications and relevance to Rensselaer appears to irritate some faculty but there is no question that he's doing what he feels is best for the department and for the institute. There are no hidden agendas, no manipulation -- just straight talk. He communicates his impressions of the institute and department to us regularly. The pain of the transition........was well worth it to get someone of TM's caliber.

- Strengths: (a) ability to motivate others; (b) openness and honesty; (c)
commitment to best interests of department; (d) interpersonal skills; (e) leadership by example. He has completely transformed this department!

Weaknesses: none.

• Lu has no trouble making decisions and very quickly identifies his goals. He communicates very well with the faculty and earns our respect.

• Works hard; deals well with people; good perspective.

• Strengths: Good leadership, made the department a cohesive unit again, understands the existing fiscal problems and tries to remedy these problems for the betterment of the department, very fair. Weaknesses: Does not realize the value of the support staff for the faculty - by eliminating secretarial support to the faculty, the chair has made it more difficult to produce publications, proposals, reports, etc. - more time is spent by faculty doing secretarial work - which is usually done in an inefficient matter.

• Key Strength: focusing on the productive, making all of us more productive. I am grateful to Professor Lu for his agreeing to serve in the midst of his productive research career. I hope he will continue. Key Weaknesses: There is a long academic tradition in physics in the United States, which had led to world leadership. This needs reinforcement at RPI; it is the chairman's responsibility to continuously educate the administration on such matters. I am not sure any of this has happened since the chairmanship of the late Hill Huntington. Perhaps, probably, Lu is doing all what is practical in the RPI of today. I think the change in Washington will help us all.

• Dr. Lu has the ability to grasp key issues and take necessary steps to carry out things. He also knows how to bring out the best quality of a person and to get the person to contribute to the Department. The Department has transformed into an alive and working Department after he became the Chair. We need more capable secretaries and staff to help out with the details of the work initiated by him and others in the Department. Also, he and the Department need financial resources to make things continuously happen.

Dr. Lu drives himself too hard and this may hurt his health and his own research in the near future. I also feel that Dr. Lu is an outstanding physicist with great physical intuition and the service as the Department Chair is wasting his talent in physics.
Strengths: (1) Has created environment that allows us to be maximally productive; (2) has challenged faculty to think in non-traditional ways; (3) uses e-mail to effectively communicate what is going on and to solicit feedback. Weaknesses: (1) Has not yet figured out what he is looking for in the evaluation process.
Appendix D. Third Year Review

The following is the review of the Chair’s performance by the faculty after the third year. (Each bullet refers to the comments of a faculty member.)

**Question 1. Indicate your overall impression of Professor Lu's performance as Chair, Department of Physics using a single descriptive word.**

- an exceptional leader!
- great
- excellent!
- dedicated
- excellent!
- enthusiastic
- good
- performance: disappointing
- parochial
- My feelings about TM's chairmanship are very mixed, therefore I cannot come up with a single word.
- very good
- leadership
- innovative
- good
- brilliant
- super. Amplification: TM Lu is a tremendous asset to Rensselaer particularly during these difficult times.

**Question 2. Comment on key strengths and weaknesses which are noteworthy.**

- Lu has the ability to sense the changes in the physics community and sets decisive strategies to response to the changes. He also delegates responsibilities to capable professors in our department so that important initiatives can be executed effectively. He works hard on administrative, teaching and research related work. He is also highly respected by his peers.

Lu's weak point is that he is too nice to the "rotten apples" in our department.
- STRENGTHS: Creative, Activist, Solid Research Program, Solid Teaching Program, Decisive

WEAKNESSES: Not a great speaker.

- STRENGTHS:
  - Very quick response to faculty's e-mails, memos, and suggests
  - Can make decision without an unnecessary delay
  - Balance teaching, research, and service loads among faculty well (fair to faculty)
  - Excellent listener and very open mind
  - Always encourage every faculty
  - Very friendly and supportive of students and faculty
  - Professor Lu showed his excellent leadership during the last three years

- Works hard and has good ideas
  - Good working relation with the Dean
  - Needs to work on communication a bit, for example, at faculty evaluation time

- TM Lu has been a very fortunate choice as chairman of the Physics Department. During prosperous times when funds are readily available and the department is expanding it is easy to be a good chairman. During difficult times, when resources are scarce and the department contracts while the workload and stress per faculty increases it is very difficult to be thought of as a good chairman. However, given these very difficult circumstances in which Lu has had to work he has shown himself to be remarkably resourceful and enthusiastic while not shirking the tough unpopular decisions. Although he is always friendly, and often apparently mild manner, he is at the same time a non-nonsense administrator who can be quite tough when necessary. Remarkably, during these difficult times I personally have found him to continuously encourages my new initiatives, and is very supportive of them. I also get the impression that he is a very effective spokesperson and advocate for the department in his dealing with other administrators.

I believe the department has been, and continues to be extremely well served by Lu. I do not understand how he can play the extremely active chairman role which he does, and still maintain one of the best research programs in the department.
You might get to hear some personal grousing and dissatisfaction because of the extra burdens necessitated by our changing culture, but I have not heard a single person complain specifically about Lu as chairman. Overall, I think it is essential to retain Lu as Chairman of the Physics Department at this time.

- good communicator with the faculty

- Lu maintains a clear idea of the physics departments goals and directions. He is also good at seeing that details are followed that are consistent with these goals. He is not afraid to make decisions and to take the heat for unpopular ones.

- Lu shies away from confrontation. In tough times (like now), the chair will frequently encounter opposition, and Lu takes these episodes too personally. This has not prevented him from doing his job well, but I feel it is taking its toll on him. I encourage him to persevere and remain chair.

- I have served under 7 different Chairs as a member of the Physics Department. At no time have conditions been gloomy and prospects for the (immediate) future so dark as they are today. Recent years have seen as serious erosion in the size (faculty, undergraduate and graduate students) in the Department and School and a significant increase in the loading of the faculty and staff. This is a situation that TM Lu inherited, not one for which he is responsible. Yet despite conditions that not too many years ago would have touched off a major degree of discontent within the department, has managed to keep morale high for most of the Faculty and staff. His graciousness, his openness, his willingness to listen and, when appropriate, act on our behalf, his eternal optimism, good spirit and cheerfulness, all these contribute to the positive feelings he helps to generate.

I am sure TM has ruffled a few feathers. I have witnessed a few confrontations between him and a member of the faculty. In each case the dispute arose because the faculty member resented being asked to change his mode of operation. TM, from the beginning of his tenure as Chair, has seen the need for change, for increased loading and responsibilities, for looking ahead. From the beginning he has counseled us on this. Indeed at least twice he has had you speak to us on these matters. In every instance, I have found myself siding with TM and at least once had great admiration for his restraint.
Personally, he has treated me very warmly and with friendship and respect. I always come out of a meeting with him in good spirits even when he had bad news to tell me. His value of education and his warm feeling for students coupled with his excellence in research give him a full and sound view of the problems facing us today.

In short, I have served under 7 different Chairs during my 38 years at Rensselaer. I view TM Lu to be the best and will feel a deep sense of loss should he not continue as Chair.

- Lu is smart and has many good ideas.

Management style is becoming increasingly autocratic.

Lu sometimes proposes a course of action which does not have broad-based support among the faculty. On these occasions, he apparently does not feel the need to persuade us of the desirability of his proposal. Moreover, he responds to disagreement as though it is a personal attack on him and therefore unacceptable.

Lu is completely inaccessible to discuss issues with any emotional content (e.g., annual evaluation and salary adjustments, teaching load). The end result is an atmosphere which discourages the creative contributions for which we are paid.

- **KEY STRENGTH:** Has fostered interactive learning; undergraduate enrollment has recovered; represents the department well with the upper management; has increased department funding for the past three years; has excellent research and funding record.

**KEY WEAKNESSES:** No long-term vision for the department; leads by decree not by example; is not aware or does not care about the research of some of the faculty; no difference of opinion tolerated; lack of communication; does not make effective use of his faculty; rude and vocal on occasion; punitive and vindictive.

- **TM Lu** has been a dedicated, energetic, and forward-looking department chairman. He has served the department and the university well. Unfortunately, there is a key flaw in the nature of his departmental leadership which troubles me. If we can resolve these problems, I would be happy to support TM through to the next century.
My key problem with TM's current leadership methodology is his antipathy to critical discussion of issues which are important to the department. Most troubling is the appearance that TM takes criticism of decisions and policies personally.

I feel that one of the chairman's roles is to enable the faculty to make good decisions. As chairman, he is more informed than most faculty, he is expected to have opinions, and he should be able to convince most of the faculty that his opinion is correct. TM has made several decisions and commitments which are important for the future of the department with relatively little input from members of the department who will be responsible for implementing and supporting the implementation of those decisions. An example of such a decision is the level of support for development of new teaching methods (such as Studio Physics). Another is the way in which we share the load of teaching (graduate and undergraduate). In order to get the department to take up and share in a new venture we must have a clear idea of: What we and/or the students will gain, what the venture will cost, and how we will pay for it in the short term and in the long term. I believe that critical discussion will lead to consensus on a path similar to that along which TM is proceeding.

My advice is to: Open up the discussion (Bring your best arguments and information to the table.) Let us argue. Listen to the good and bad points. Guide the discussion to fruitful conclusion. Don't take disagreement with ideas personally.

- Dr. Lu has considerable strength as chair. I would like him to remain in this position for at least two more years. His strength is due to his caring for and supporting of the faculty. He listens and is helpful. He solves day to day problems very well. Coming from a pure research background he developed an appreciation and understanding of education. He appreciates the importance of curriculum reform and is helpful in implementing the much needed reforms. He understands that, in principle, there should be a happy medium between teaching and research in a university. He also knows what good research is. All this reflects his considerable strength as chair. However, there is one important weakness. This is related to the teaching load. This load is divided in a very uneven way. Those of us who are overloaded must clearly reduce their research activity. However, despite good evaluations which they get from him they are penalized when it come to
salary adjustment. This is not a just procedure. The department should discuss its goal and evaluate its members accordingly. I hope that this issue will be resolved soon. Clearly his strength out weighs his weakness considerably, hence I am giving him very high marks as chair.

- **POSITIVE ACCOMPLISHMENTS:** He has spear headed education reforms in the Department and allocated funds and resources to achieve that goal. He made available funds for computer facilities and gave faculty members time to develop new courses.

He has made tough decisions to meet budgetary cuts in the Department. The decisions were sound and within the constraints demanded, it was the only realistic choice.

TM is an accomplished researcher and has a good reputation in his field. He has been honored by Fellowship in the American Physical Society.

- **WEAKNESSES:** TM does not have a command of the English language, either written or spoken. His choice of words in a discussion or written communication with the faculty is often poor and has led to misunderstandings. He does not communicate his motivations well to others in the Department and important decisions are often made without sufficient consultation with the faculty. Since he is one of the first persons to meet with outside persons and prospective students; this can lead to loss of prestige.

He does not know the students nor the alumni nor the student organizations. Except to a few students with whom he closely works, he is often distant and aloof. TM is unaware of the research capabilities and accomplishments of his faculty members. This means that he cannot adequately promote the Department when he has an opportunity to discuss with colleagues, company representatives or faculty members within the institute.

- **Leadership means bringing out the best in everyone.** In good times this may not be so hard to do, but our physics department has done outstandingly well at a time of drastic cut back. Lu does it so well that it looks easy, tempting other to, perhaps, also try. But my advice is do not change boats in a storm; wait for better times before taking a chance on a change.
• **KEY STRENGTHS:**
  1. Open in his decisions, taking faculty into confidence.
  2. Many new initiatives, generally successful, such as the studio physics, Resnick Center, room for graduate students etc.
  3. Record performance by the Department Faculty, during his term as the Chair, in terms of funding, publication, and external visibility.

**KEY WEAKNESS:** None

I would like to see improvements in the following areas in Prof. Lu's next term [I realize he must get Dean's help and support in these matters -- he cannot do these things on his own.]:

(a) Equitable treatment of the theorists on the Faculty, in terms of salary increases and loading. [I realize that theorists generally do not bring as much money as experimentalist, but they do not cost as much either, in terms of facilities etc.!]
(b) At least one-to-one replacement of the sabbatical Faculty vacancies by young temporary Faculty or postdocs so that the quality of teaching and research does not suffer in the Dept.
(c) Enhancement of the Graduate program.
(d) Modest, but non-zero, increase in the number of Faculty members in the Dept.

• **Strength:** He continues to give the department a sure sense of purpose and direction. His judgment is almost always sound and his example exemplary.

**Weakness:** I do think it was a mistake to promote a junior office person to be assistant to the Chair without consulting the faculty. (I have the highest regard for the person concerned.)

• Lu has done a remarkable job despite considerable financial and other difficulties. Our department is now widely perceived (with good reason) to be a leading force in the campus-wide effort to restructure undergraduate education. We are getting an enormous amount of attention on- and off-campus for the Studio Physics program and other educational experiments. We have a vigorous program to recruit undergraduates that seems to be working well. Faculty and student morale have improved tremendously.
Lu delegates authority wisely and works hard to find the resources to support good initiatives. He deals straightforwardly with faculty and staff. He listens well and leads by consensus.

- **Key Strengths:**
  1. Ability to realistically evaluate current situation and future opportunities and to make good plans based on these assessments.
  2. An ability to convey enthusiasm and confidence that a good solution can be and will be found (if only we don’t give up!)
  3. Ability to ignore (or at least to appear to ignore) slights and hastily spoken words. Our department has some people who can be very annoying; TM seems to take them in stride.

**Key Weakness:**

Speaking ability. His enthusiasm always comes across but his meaning is not always clear particularly to those not familiar with him. I realize this is not a very fair complaint to make about someone who has learned English later in life. However, (as an example) I know Giaever made this a priority and has become a beautiful speaker; Esak never worried about it and got worse. Of being Esak: is not so bad?
Dr. Toh-Ming Lu, the Ray Palmer Baker Distinguished Professor of physics, was the former Chairman of the Department of Physics, Applied Physics, and Astronomy (http://www.rpi.edu/dept/phys/physics.html), at Rensselaer Polytechnic Institute from 1992 to 1997. Currently he is the Co-director of the Semiconductor Research Corporation Center for Advanced Interconnect Science and Technology where 30 faculty (from 10 universities) and 50 graduate students are involved in computer chip research (http://www.academy.rpi.edu/caist/).

During his tenure as the Physics Chair, Dr. Lu had been a major driving force for education reform in the Department. This memoir describes insights of what he saw and felt as a Department Chair during the turmoil of higher education in the 90’s and his view on how an academic institution may survive and excel in the new era of information age.