

Notes on working group G

Navigators vs planners- navigators have advantage because they can navigate novelty.

Some people push levers of change. Change culture, change symbols, rewards, policies, in a planned leverage way. You might come into process part way thru change and figure out where you are and figure out what to do. Maybe you “slide into” these changes. You might start out thinking you are going in one direction or need certain groups but end up doing something else.

Rogue change- no real intention for change. Global warming for example as an example. Unanticipated events. Sputnik. Women’s movement. Something from outside your community that impacts. When physicists got converted change in education it changed everything. It was this one test – Hestnes Halloon test - that changed physics educators believed about what their students know. Some of this is competing paradigms, and based on experimental evidence. Researchers did not really expect what change would be. All of these generated a certain amount of discomfort.

Is sustainability one of these levers? Students will need to know how to live in this kind of world. Combined with global warming and high gas prices this is big change that is coming.

This may lead to more distance learning, and to more students living closer to school.

World future society. Maybe we could take those predictions and extropolate back to STEM.

If you look at these historical events happened change happened, how? Not all them have been successful. Some of these are scattered reforms. How do you define successful change. How do you research this? How do you do intervention? There is strong literature change and industry is not that different from academe. Do these models work in navigating rather planning? Yes they are nuanced models that allow one to make change in complex situations. Truth is that every problem is complex and answers are complex.

Force concept inventory converted a group of very powerful leaders then there was room for this topic to be aired. Part of this change is getting to power holders, such as leaders and congress. STEM education is a major concern for congress and they view that K-12 is the problem. Perception is that the work force is broken now and needs to be fixed. Higher ed has not yet been impacted by globalization, but K-12 and community college are on urgent agenda. Acknowleging problem is only very first step. Having courage to do what is needed to change this is real problem. There are intransigence that are in need of change.

We need a system that has flexibibility to respond. Can you figure out the characteristics of these events? Getting to leaders is one? What happens in group that change versus groups that do no change in response to changing event.

Are we looking to improve STEM education.

What is lever? Planned use of lever, or can best try to navigate change, or hit with it?

How do you best use lever to frame and effect change?

Why has it taken so long for graduate faculty been so slow to get to improved undergrad education? Foreign students fill their labs and they do not need worry about our own undergrads. They are not really concerned about US competitiveness.

How can we be lever of change? How could we identify what these levers of change and how to respond to them?

The leadership of higher education is indifferent to all this? Except where there is money, as in grants? The silo effect is also there. Even with in one discipline there are silos, such as different areas of engineering. There is no real STEM in academia. How could networking be a lever? Breaking down communication barriers may be of value.

K-12 example of lever is the charter school movement. It's a threat to public schools. Another example there is huge K-12.com in florida is a virtual classroom. If we could get into such a system to improve STEM that would be used a lever. Would have to get to persons of power here.

Work force pressures are also a lever. They may not want to wait for us to get better results and the business community may step in to get a workforce with job skills. But our goal is to produce full people, not just to produce widget workers. American public actually has more confidence in more vocational or job centered schools like Univ Phoenix.

Some states are requiring these high school vocational program to produce at least some graduates go to either workforce or to university.

Accountability is a factor and is one lever. How do we measure accountability? What are they learning? Depends on whether there is external accountability? If we develop our own accountability we may avoid external accountability?

We are the most lax country in terms of individual accountability, in terms of declaring a major and one that is useful.

How would get into virtual school movement?

We could have an effect on high school if colleges change their admissions requirements. Make science a requirement for admission. ? But most jobs do not require STEM. Europe divides students early on, but we want our students to be broadly based educated. If we add to high school admissions requirements the high school curriculum would be too thin, and not deep. And we can move toward critical thinking and use science without taking a particular topic or subject.

We need people in certain positions who really can understand scientific thinking to make decisions. Technical literacy is an important part and the T in STEM.

So, threads are:
Interdisciplinary
Technology literacy
Faculty development

Critique of British system is that students are pigeon holed too early but maybe not true. Does our system taught many people to dislike STEM? Maybe not, but there is an attitude in the American culture to devalue STEM. In Britain it seems uncultured to do something applied.

Why do we end up with so many people to disdain science. Educated people who devalue science. This happens for scientists with humanities as well. The exams are one of the problems. The humanities do not draw that same sort of fire and ire as STEM.

Can we use this as a lever? Do we need a PR campaign? Can we encourage parents as well as students to value science? Can we convince them that science is part of the problem?

The outcome we are looking for is that students WANT to take another science course. Get them to understand this will be useful for this in the long run, in their lives as citizens. Broad based literacy. How is this actionable? The outside world may get hit by the lever.

Prediction: Google model: everything they get into has a huge impact on the world. Example google docs, they stealthfully develop things that will take over the world. Google has recently made a major financial investment in renewable energy and will have an impact. Google may build an online university. Lots of content is already on web, people are already learning stuff online. This could completely sideline universities. Students do it because they want to. Google contracts out and folks take what they want. Who will “certify and sort” in this kind of world? If universities don’t then employers will.

What though are actually actionable actions?

One might be lobbying congress, leveraging our prestige and respect in congress. There are things we can actually DO things to impact the change. For example Noah went to representative and may have been a factor in getting more STEM money.

How about ***forming a formal network to disseminate ideas*** and change and try to get action done. Maybe organize ourselves and getting into politics. Because we have knowledge we have information set that average citizen does not have. But this may give us something others don’t. Usually lobbying is in terms of more research. But maybe we could lobby for STEM and education. Some groups are doing this already.

One action item could be for us in STEM to ***join action coalitions***? Could we develop a social group if you already belong to another STEM group. This group would get involved in lobby as one large group.

The top leaders of the field are often involved in national issues in STEM but the rank and file are not. This kind of ***list serve or information***.

How much of what is already going is similar to WEB2.0?

What are we going to ask Congress to do? Spend more money? NSF has already spent a lot of money but its in the exploration mode?

Another idea- *professional societies organizations* would publicize institutions that do really good educational programs. This has been done with “female friendly” programs in physics. You could let people / programs what they are doing tthat is great. This is a bit like PR and could put social pressure. Professional societies could get a list of questions that programs and post answers.

Accreditation requirements are also a lever. Many accreditation organizations demand certain outcomes and demand posting of goals and outcomes. For example ABET requires ability to work in groups.

What if we come up with a *document that asks departments to self evaluate* on certain issues. Got organizational buy in from professional organizations, and post answers to website? This may open up conversations. Problem here is faculty may think they are being interactive etc when they are really not.

How about students answering these questions? Maybe, maybe not.

Need key people – leaders in field – to talk to the professional societies. Some of this is already being done.

If you make the *website self correcting like wiki's* it could solve the problem that faculty are not really doing what they say. This would also allows us to put out our failures. A wiki might get round this.

Faculty on their own webpages should post their own classroom strategies. Some of this is happening between students already but not on the web. Students walk with their feet to take courses at some locations. But if we let students be the arbiters we will end up with easy courses. Although studetns will go for hard courses that have good teachers. Most students are non-majors. You can reach non-majors.

What is our goal? There are some data that show that problem based learning actually improves performance in upper level courses.

How about online vs in class? The important factor is whether the instructor is watching and monitoring of learning then students learn.

Leveraging accreditation processes to improve learning.

Leveraging the new technology use by students and virtual schools.

Get the professional organizations to do provide a venue for some sort of voluntary questionnaire of best practices that programs, depts, can publicize what they do.

Develop a social network of STEM educators and resarchers that will allow rapid dissemination of these unexpected levers.

Leadership is a lever of change. Individuals become huge levers of change. For example would election of Obama have an impact on minority education?

Where do the elite go in all this? What does history tell us about this? Will they gravitate to where the rewards are? Example of Spanish in south America? The best and brightest are moved toward science? What do the smart kids want to do? Pharmacy provides

stable.

Electronic forms of education, both organized as virtual classrooms and more informal learning through the internet will be on us. It is possible industry may get into the education game. For example Google could conceivably get in the business of education.

We have no idea how but this is one big external phenomenon STEM will have to be aware of and leverage.