

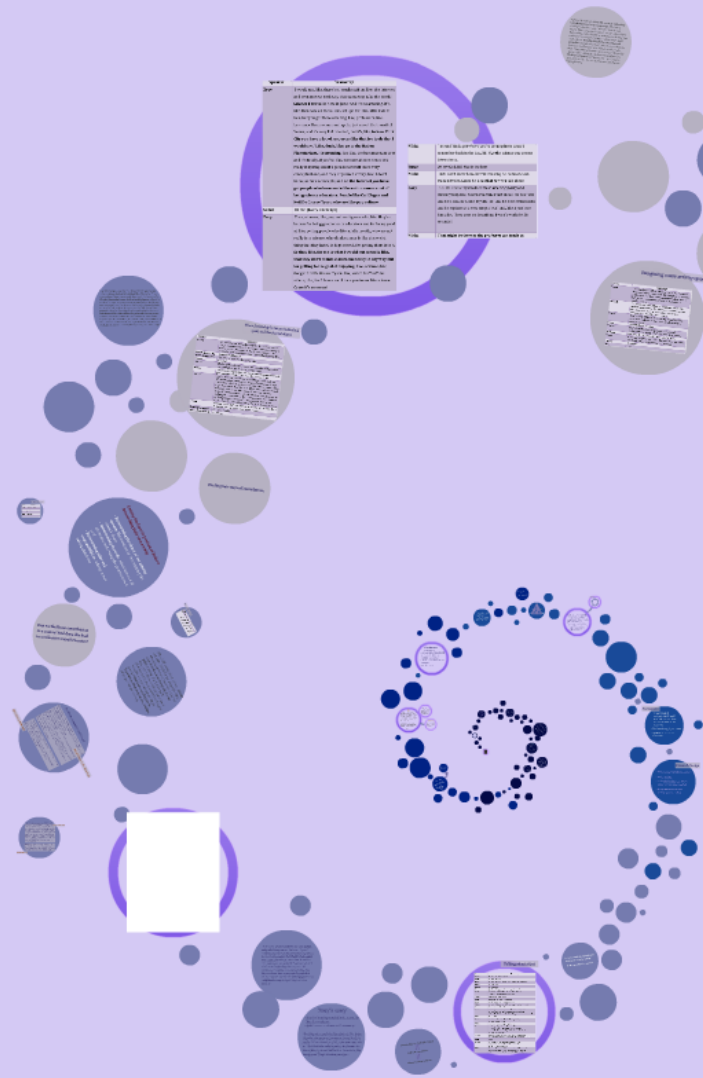
- So, What is possible?**
- pursuing a shared object and building a real collective
 - cultivating a personal sense (Leontiev, 1978)
 - organizing teaching and learning toward expansive transformation
 - Taking students' agency in learning seriously

contribution to activity: A lens for understanding and promoting students' agency in learning physics

Sanaz Farhangi

ISCAR Summer University

June 2016



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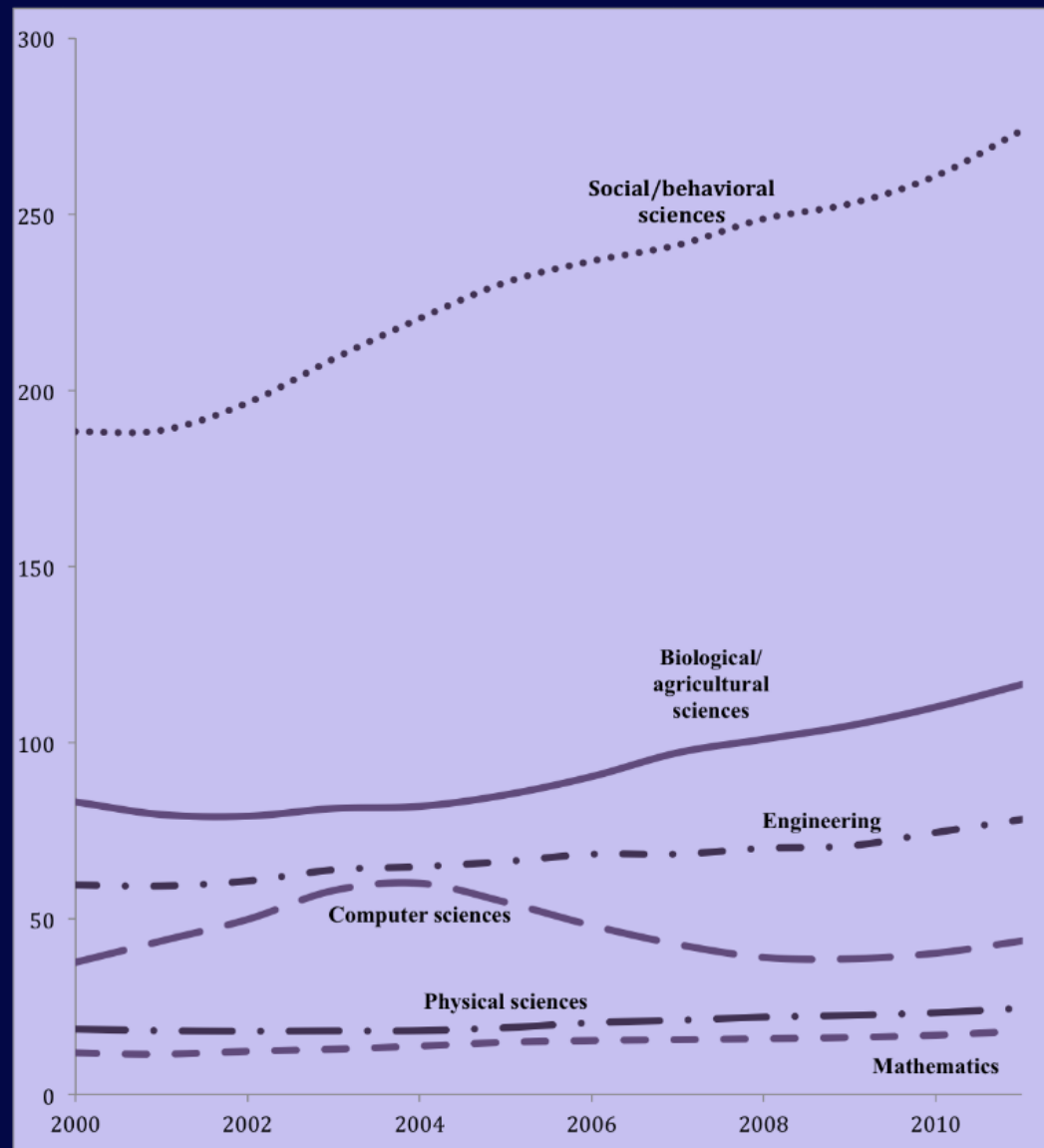
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Where did my story begin?



Science and Engineering Bachelor degrees, 2000-2011



SOURCES: Science and Engineering Indicators 2014
<http://webcaspar.nsf.gov>

- How the low engagement problem has been studied from Socio-cultural perspective?
What is missing?
- What are my ideas and arguments?
- Proposing **contribution to activity** as the needed lens
- My research questions: is **student contribution** possible in a physics course?
how can it help us?
- Future directions

What is studied from socio-cultural perspective:

- The importance of **relevance of science** to students' lives
- **Participation:** how students' identities are formed, transformed or acquired to **fit into** a science-related **community** or to take up the **discourse** of that community.

- *Tan and Barton (2007): Identity formation in community of practice*
- *Brown (2006): classroom science discourse*
- *Basu, Barton, Clairmont and Lock (2009): agency and structure*

What is missing?

- There's something paradoxical about "making" something relevant!
- Relevant to whom and to do what?

Karen Barad (2012)

What is missing?

- **Reciprocity of change** between Science and students (Barton, 1998)
- **Adaptation** versus **Transformation** (Stetsenko, 2010)
- A Genuine **collective** (Roth & Lee, 2006)

- Why and how does someone feel engaged in a human activity?
- Does science, as a practice or a discipline let diverse learners in?
- Is a collective change in way we learn science needed or possible?
- How can this change and transformation in science learning be started?

I argue for using the concept of contribution to activity instead of participation for understanding learning and engagement in formal settings from a sociocultural perspective.

I argue that using this lens we can identify the ways students use their agency in learning as well as helping them realize how agentive and transformative they can be.



collective
transformation
needs a
transformative
Framework

Cultural -Historical Activity Theory

Transformative Activist Stance

TAS

TAS suggests that "it is directly through and in the process (rather than in addition to) of **people constantly transforming and creating their social world** that people simultaneously create and constantly transform their very life, therefore also changing themselves in fundamental ways while, in the process, coming to form their own ways of being, doing and knowing".

Thus, TAS places collaborative transformative practice carried out through **unique individual contributions** to this practice at the very core of human development and social dynamics.

Stetsenko (2014)

Every student: "pro...
in everything that i...
the way he or she m...
constitutes develop...
for the formation o...
which, therefore, is...
ineluctably social a...
individual" (Stetsen...

Contribution to activity

The process through which the unique individual visions become a part of the collective goals of an activity is called **contribution** (Stetsenko, 2008)

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Stetsenko (2014)

Every student: "profoundly matters in everything that is going on...[and] the way he or she matters is what constitutes development and allows for the formation of one's identity which, therefore, is at once ineluctably social and deeply individual" (Stetsenko, 2013, p.16).

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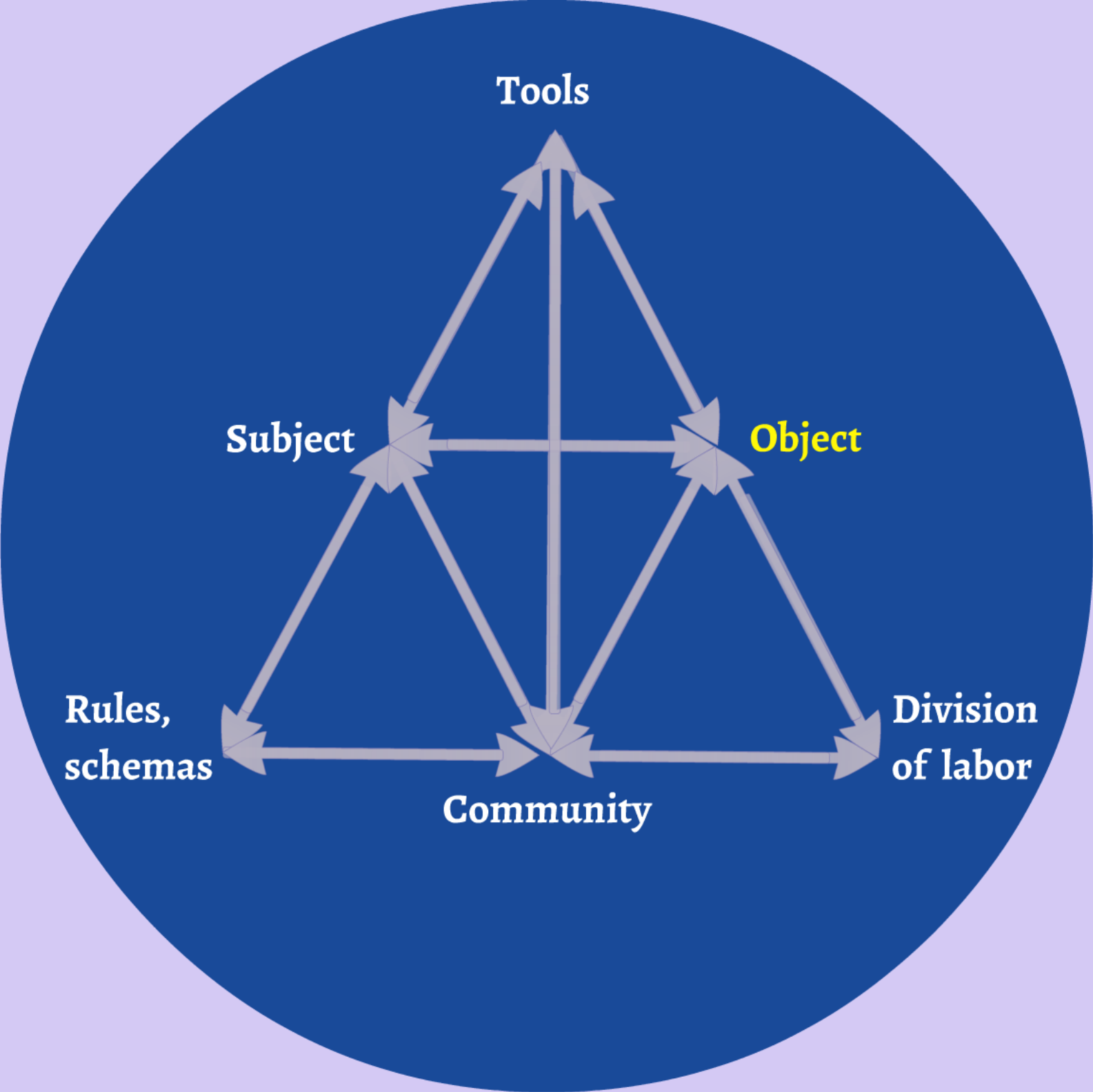
Contribution vs. participation

- struggles toward “what should be” versus fitting in the structures of practices.
- collective and relational versus individual
- critical activist

- **Is such contribution possible for students in a science learning course?**
- **Can we facilitate contribution in a course? And does this lead to a collective transformation?**

How to make contribution to
activity visible?

Cultural -Historical Activity Theory



How to Make Contribution Visible

Expansive Transformation as Contribution

expansive transformation is defined as inventing and constructing new forms, structures, tools, models and patterns of activity (Engeström 1987).

Transformations starts around contradictions.

The underlying contradictions are not easily visible but they are manifested in failures, disturbances, conflicts and unexpected innovations (Engeström 1999b).

Change Lab



Change Lab



How to Make Contribution Visible

Expansive Transformation as Contribution

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Participants

- **4-year research** university (61% female / 3.6% and 9.7% of African American and Hispanic students)
- Two **introductory physics** courses
- 15 liberal studies students (9 females)

Research Design

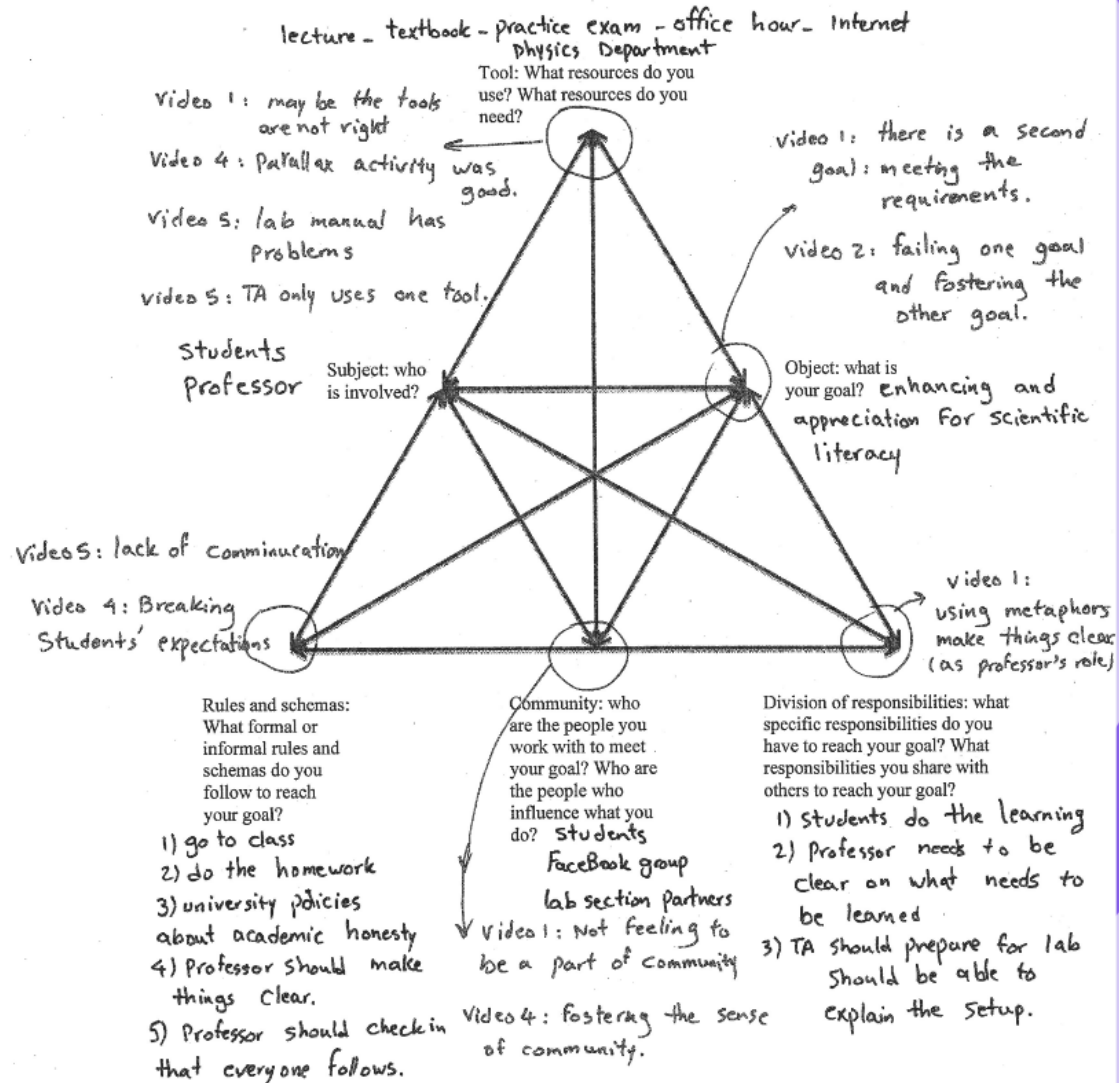
- Video taping the lectures and labs
- Video analysis
- Individual student interviews using activity system models
- Group conversation and activity system analysis

Your name: ~~XXXXXXXXXX~~

Date: 11-30-2012

This model is adopted from:

Yamagata-Lynch, L., & Smaldino, S. (2007). Using activity theory to evaluate and improve K-12 school and university partnerships. *Evaluation and Program Planning*, 30(4), 364-380.



Talking about object

Speaker	Transcript
Sanaz	What is the shared object? ...
Larry	to learn physics.
Sanaz	to learn physics? Do you have anything to add to it?
Nikka	pass the class
vivian	get the credit.
Sanaz	(while writing) pass the class, get the credit...
Zoey	getting an appreciation for scientific literacy [chuckle, silent laugh from others]
Sanaz	oh! Do you agree or no?
Larry	I guess in my mind I object that
Zoey	no! It's not ... the whole object but
Nikka	yeah it's different for different people. [mixed voices]
Sanaz	it should be included?
Susan	it's a object that like you want to mark it to people. It's like, and they see that you are impressed but internally it's like nah [loud laugh] I just wanna get the credit.
Nikka	I second that!
Sanaz	so it seems that the object is learn physics, pass and get the credit,
Nikka	and those things can go together so
Sanaz	and be, yeah you know all three of them can be achieved at once or just part of them and be scientifically literate. Right? Good! So what kind of tools we are using?..
Vivian	I think like add just increasing interest like getting students in taking, like it's an intro physics course ⁵⁵⁷³⁴⁰
sanaz	right
Vivian	so idea is not like "oh, I'm gonna walk away a physicist" .it's like I know I am in media while I'm studying physics.
Nikka	is it our objective or is it the objective of the course? Because the objective of the course I'll be agreeing with her but our objective could be different like,

Is such contribution possible for students in a science course?

How it can affect the course?

Personal stance - Individual vision



collective enactment



Change in activity's elements

Zoey's story

- A senior in acting enrolled in the course for liberal art students.
- double minor in physics and astronomy.

“The thing about grad school for physics is, like, Brian May who's the guitarist from Queen [music band], he got his PhD in astrophysics, like, a few years ago, so to me I find that to be really inspiring story because it's kind of like physics will still be there for me in in, like, twenty years” (Zoey's interview, 00:05:44).

*“As far as, like, **feminism and, like, race and equality, and gender binary issues** or whatever, so, I guess I would say that it has been, like, a kind of priority of mine because it's also something that **I feel like I have control over**. ‘Cause, a lot of things, as far as how the world is run, as far as economics and stuff, there is not that much that I can do. But for things that are, like, social construct and social, like, issues, they are things that, like, exist because they are propagated by people that are, um, ignorant. And I feel like **not being ignorant is a really hands-on way to stop it**” (Zoey’s interview, 00:04:25).*

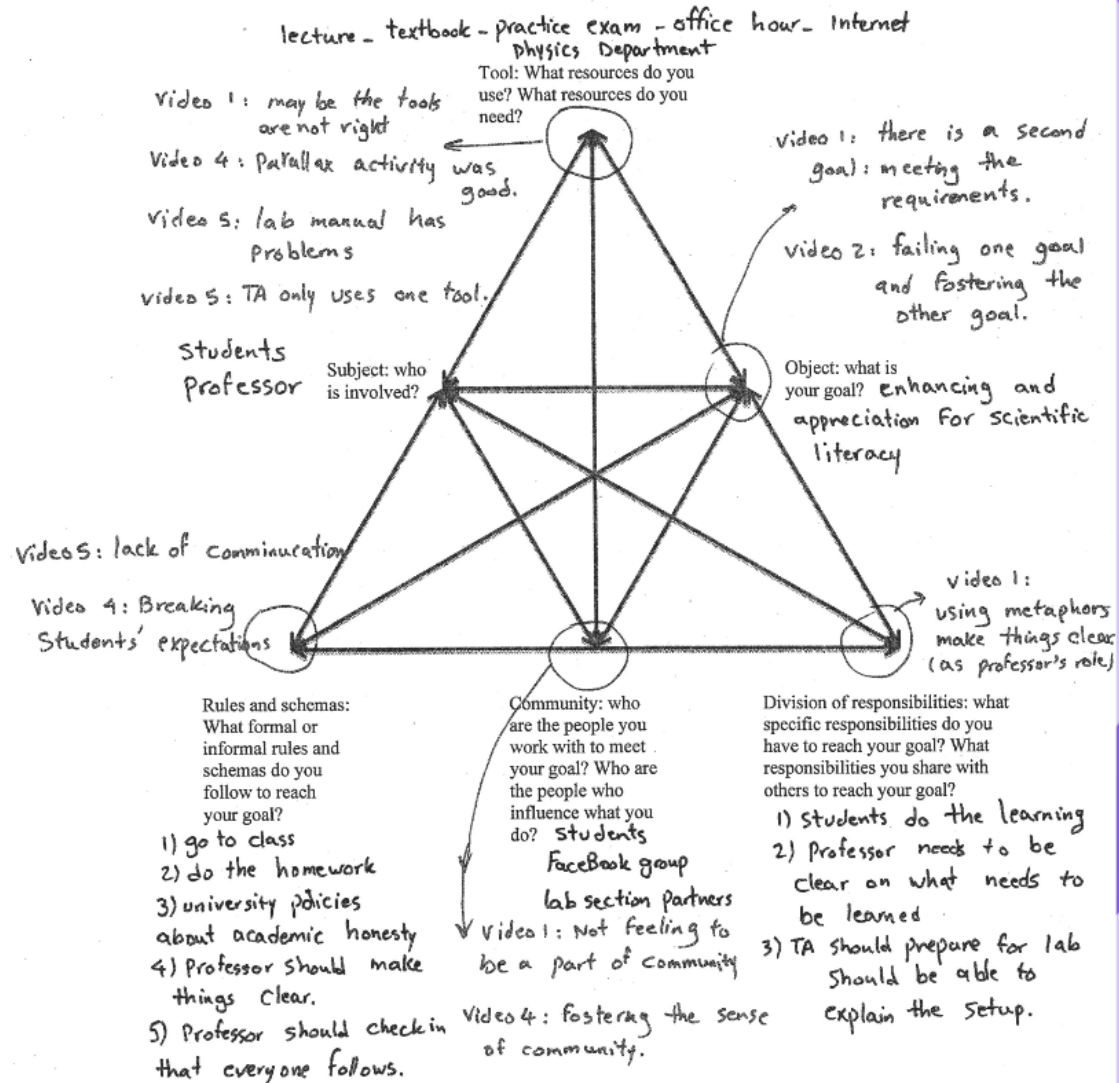
*“Ahh... gosh! Contribution to science... **I think I can.** Cause I think that goes along with what I was saying earlier about how so much of science is that **it needs to be a scientifically literate public,** [...]things, like, that like public democratic decisions on what get's funded and what doesn't as far as science which tends to, you know, like, not be as well understood by the general. **I think that's something that is important and that everyone can contribute to**” (Zoey's interview, 00:30:52).*

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Facebook as community builder tool

Zoey: Hold your ground, hold your ground! Students of Physics, of CAS! My brothers! I see in your eyes the same fear that would take the heart of me. A day may come when the late-night studying of students fails, when we forsake our friends and break all bonds of this facebook group, but it is not this day. An hour of woes and shattered GPAs, when Meyer comes crashing down! But it is not this day! This day we fight! By all that you hold dear on this good Earth, I bid you stand, STUDENTS of Q!!! December 17, 2012 at 5:58pm Seen by 47

Sense of community

Melanie (pseudonym) uploaded a file. Here is my study guide. It just has basic concepts and some equations of everything that has been on practice exams/problems. Good luck! :) December 18, 2012 at 11:15am **Seen by 47**

Helping with Study

Facebook as community builder tool

Perma: *this is probably a stupid question, but #5 on the practice problems?*

Uranium-238 decays to Th-234 and an alpha particle, how much energy is released?

I'm totally just forgetting how to do this...

December 16, 2012 at 9:15pm Seen by 47

Kriti: *subtract the two, and for the leftover amu convert it to kg and then plug that into $E=mc^2$. i think thats the way*

Zoey: *Add up the mass of the decayed atom and the alpha particle and subtract that from the mass of the original atom, get .0046 AMU. Convert this to kg, get $7.636E-30$ grams. Put this into $E=mc^2$, I got $6.8724E-13$, this is close enough to the expected answer, $6.84E-13$*

Perma: *i have much love for all of you*

Zoey: *If you ignore the parts of this that don't apply to what we're learning, the stuff that we are learning is very well explained.*

The Standard Model Of Particle Physics 001 : Overview www.youtube.comAn animated introduction to the standard model of particle physics

December 13, 2012 at 3:56pm Seen by 48

Ask and Answer the Question

Introducing New tools

**Can we facilitate contribution
in a course? And does this lead
to a collective transformation?**

Putting Students in position of Subject Researching their own activity

- **Determining the object of our activity system:** The tensions in determining the shared object
- **Determining the tools:** abundant use of electronic and seeing the professor as a tool
- **Determining rules and responsibilities:** asking or not asking questions

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What are the tools?

Speaker	Transcript
Melanie	The professor and the classroom.
Sanaz	So the professor is the tool? What do you say?
Larry	I'd say yeah.
Sanaz	As a resource?
Susan	Just like the course materials.

Putting Students in position of Subject Researching their own activity

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- **Determining the tools:** abundant use of electronic and seeing the professor as a tool
- **Determining rules and responsibilities:** asking or not asking questions

What are the rules?

Speaker	Transcript
Nikka	Oh, ask questions!
Susan	Well, on the other hand people could argue! Don't ask questions because I've seen some of my peers they are like roll their eyes and sigh whenever somebody ask a question, it's like move on already! So?



Finding new ways of contribution

The relationship between individual goals and the shared object

Speaker	Transcript
Larry	It's, I don't mind being challenged. I like, I think one the things about the college is like you're choosing where you wanna go, like, this is what, this is your path and I don't wanna be challenged in science. I wanna be challenged in ...
Susan [jumps in]	Business and finance.
Larry [continues]	Business or whatever I'm going into.
Susan	Exactly!
Nikka	Challenged in what you wanna do. Don't be challenged in something that you've never thought about.
Sanaz	So you're telling me that you are, you have seen science and you are done with it. You know that science is not ...
Nikka	At this point we know what we want to do with our lives. We've already figured out our majors. We've gone through high school where they force us to take science versus taking English, math all that. We know kinda what we're interested in by this point so we, like, being, if, for your business major, if you have to take a tough business class, you can be challenged, you wanna do that. You gonna be more inclined to "I'm gonna get this done". This gonna be the triumph when I pass this class. For science, I'm, it's, it's not the same.
Susan	Because you feel it's not impactive on you. It's like nowhere in finance, are we gonna learn about quarks or....
Larry [jumps in]	So right, exactly!
Susan [continues]	Anything.

Zoey: I was just gonna say, like, I really like just warn you guys, you freshmen **against thinking I already know what I wanna do.** 'Cause every one know things they wanna do when they're freshman in college. **I thought I knew what I wanna do when I was freshman** in college. It's not what I'm doing right now in my senior year of college. So, like, just even, like, regardless of this, pleaaaaase don't think you know that [Other students chuckle] you know what you wanna do. I didn't know I was gonna do a minor in, I like, **I signed up for my first physics class on a total whim and, like, I didn't think I was gonna make a minor out of it.** It was just based on it's interesting to me. And like two classes later I was, like, oh, may be I should do, like, a minor. I, like, switch studios so I can transfer schools, like don't think that you know wanna do because the classes that you take, can and will, like, impact your opinion. Sorry!

Speaker	Transcript
Zoey	I would say, like, there's so much stuff on, like, the Internet and even in New York City that's amazing. Like the World Science Festival is here in June. And it's so amazing. It's, like, there are all these, like, set ups for, like, little kids to talk, but you got these amazing, like, professors, like, Lawrence Krauss came and spoke just about the transit of Venus, and it's very kid oriented, but it's, like, in New York City you have a lot of resources like that for tools that I would say, "Like, dude, like, go to the Haden Planetarium. It's amazing. It's, like, the best museum ever and it's totally, if you're, like, not sure about science it's really inspiring and it's got a lot of stuff that's very conceptual and, and they organized it very, like, I don't know, as far as concepts, and on the Internet you have got people who have made like entire careers out of being science educators. People like Carl Sagan and Neil De Grasse Tyson who are like pop culture.
Sanaz	Or me! [Every one laugh]
Zoey	Yeah, who are, like, pop culture figures who, like, they're known for being good science educators and for being good at, like, getting people who like adults mostly, who are not really into science, who think science is like this weird thing that they hated in high school, for getting them into it. So that, like, for me is what I would put as tools, like, that they don't fit into classroom neatly in any way but for getting to the goal of enjoying, like, science, like, Google Neil De Grasse Tyson, like, watch his YouTube videos, like, for 5 hours and I dare you to not like science. Cause it's awesome!

Nikka	I mean I kinda get where you're coming from cause I remember back in the day, Bill Nye the science guy got me into science.
Susan	Oh my God, Bill Nye is the best
Nikka	But I don't know how, how interesting he, someone can make physics. Cause he, does that guy you talk about
Zoey	Neil De Grasse Tyson does these amazing [Larry and Susan: yeah], like, hours of lectures that are all on YouTube and he's, like, he's, like, my life idol and he is so enthusiastic and he explains at a very simple level and, like, I just love him a lot. [Zoey goes on describing Tyson's work for 58 seconds]
Nikka	That might be the way the professor can teach us.

Melanie: I don't know, **I think, like, no matter what class you take you can relate it to your major.** Like, I am a childhood education major. I will never have to teach science. That's not gonna be my job. I'm gonna be teaching basic reading and math but I can go to the class looking how professor Carter teaches and try to evaluate how I would teach it better. **[To Nikka] You do the same thing with journalism.** You take what people are telling you about the class and you tell us about that. That's journalism right there. That's, without writing it down, you are taking what other people are telling you and presenting information. **[To Larry and Susan]** With finance, like, one day you're gonna have to, like, do some weird math things that are looking like this.

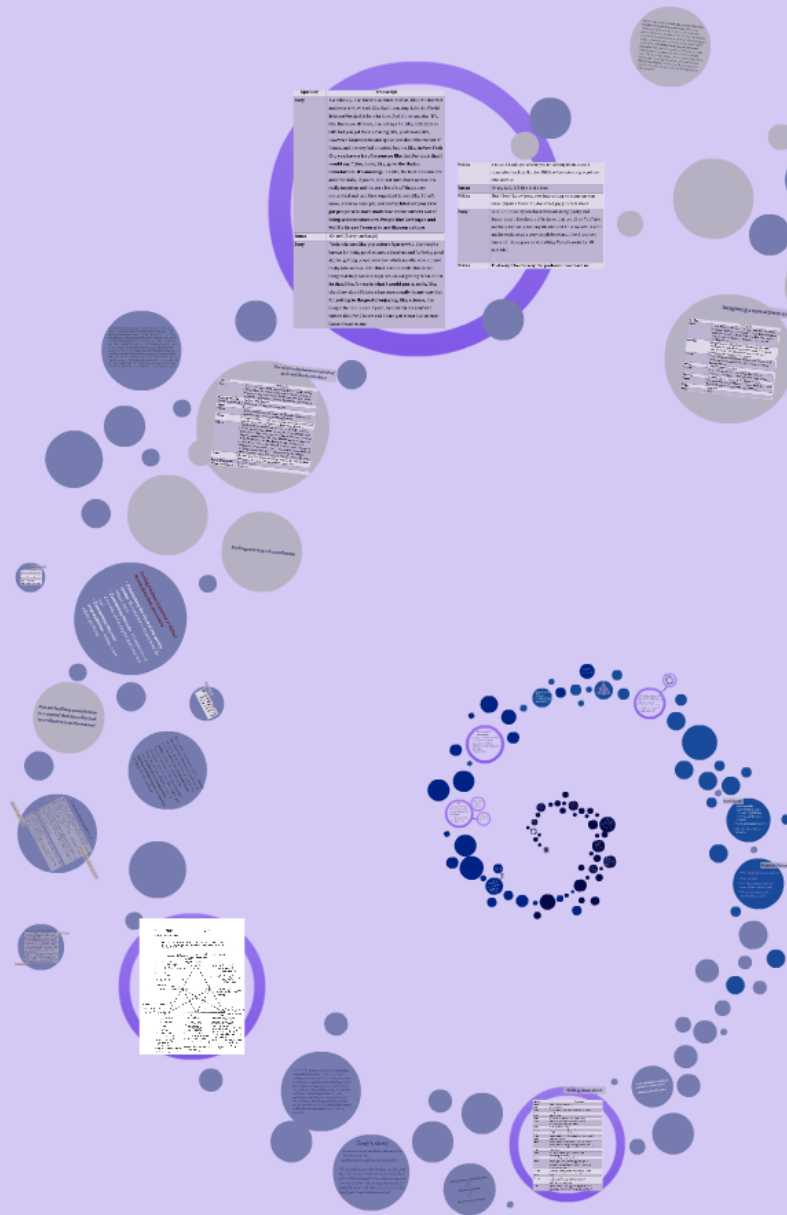
Imagining a new activity system

Speaker	Transcript
Sanaz	I was thinking that how this, you know, this Facebook thing can happen sooner and, this thing that we students get together and do good things together, find ways to help us, so I am thinking of may be that could be another way of ...
Melanie	He [professor] should have a blog thing, where like students can just ask, like, questions, and then he can, like, he doesn't have to answer them every time someone asks but, like, once a week
Vivian	That's really different from making it an obligation. I have been in classes that are, like, you have to pose three questions.
Sanaz	Yeah! Nobody does that.
Vivian	That's just like I have to generate, like, even if I understand everything. That's different from asking.
Melanie	But then, like, if you really need help? It helps.
Sanaz	It's something that you know, the good thing about that Facebook was, it is something you initiated.
Nikka	Good job
Zoey	Yay!

**An actual change in number and
pattern of question asking**

So, What is possible?

- pursuing a shared object and building a real collective
- cultivating a personal sense (Leontiev, 1978)
- organizing teaching and learning toward expansive transformation
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