

Northwestern University Feinberg School of Medicine



Social Science Theories for Natural Scientists Part 2: A Workshop on Applying Social Science Theories to Design and Assessment of STEM Interventions

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Scientific Careers Research & Development Group

Understanding Interventions 2012





Most of you don't have time to become experts in the social sciences, but...

Why should you want to?

Interventions take place in 'social' environments with multiple contexts, not just learning or doing science.

How can you use this information?

By knowing social science theories, you can better understand student behavior, interventions and the workings of research groups and mentors.

Any other use for theories?

With more experience, you can begin to prospectively design interventions to achieve developmental purposes and/or assess their impacts from theories.

How much do I need to learn?

That is one of the questions we are asking – how much we need to teach you for you to be able to have new insights and apply this information effectively.



Last year we introduced 'de-coders'. This year we focus on application of theories

Where do we start from today?

We will introduce 4 social science theories/principles useful in looking at scientific development, and interventions promoting interest and development.

Example: applied to an intervention

The theories are the basis of our Pathfinder Award: The Academy for Future Science Faculty, an example of how to apply theory to designing an intervention.

Practice applying

You will remember little unless you get to construct meaning. We will break into smaller groups to practice applying theory to your current or potential intervention (facilitated).

Can also be used for assessment

If you have an intervention you would like to assess/evaluate more deeply, you can also reverse-engineer practice to begin recognizing where theories inform.

Teaching SS theories to scientists and students is easier than we expected



Experience with teaching theories

To date, we have introduced 100 beginning PhD students and 15 'coaches' to SS theories – everyone seems to 'get it' pretty easily.

Students saw them as useful

Even spending 15-20 minutes on each theory at the Academy meeting, students indicated they felt they understood and saw them as useful.

What is different today?

Today we focus on you applying them to your situations, programs and objectives.

What if you want more?

We would be happy to schedule phone or Skype conferences to assist you.



Think of theories as a set of tools

Communities of Practice

- Social learning
- Inclusion based on perceived competence

How do group processes such as shared norms, inclusion and exclusion affect the integration of young scientists into laboratories and other groups?

Identity

- Multiple senses of “self” based on interactions with the social world
- Contingencies including discrimination and stereotypes

How do students develop an identity as an academic scientist? How does a scientist identity interact with racial, ethnic, and gender identities? How do young scientists deal with stereotypes and discrimination?

Cultural Capital

- Social reproduction by dominant groups
- Focus on promotion and fit based on perceptions of knowledge and skills

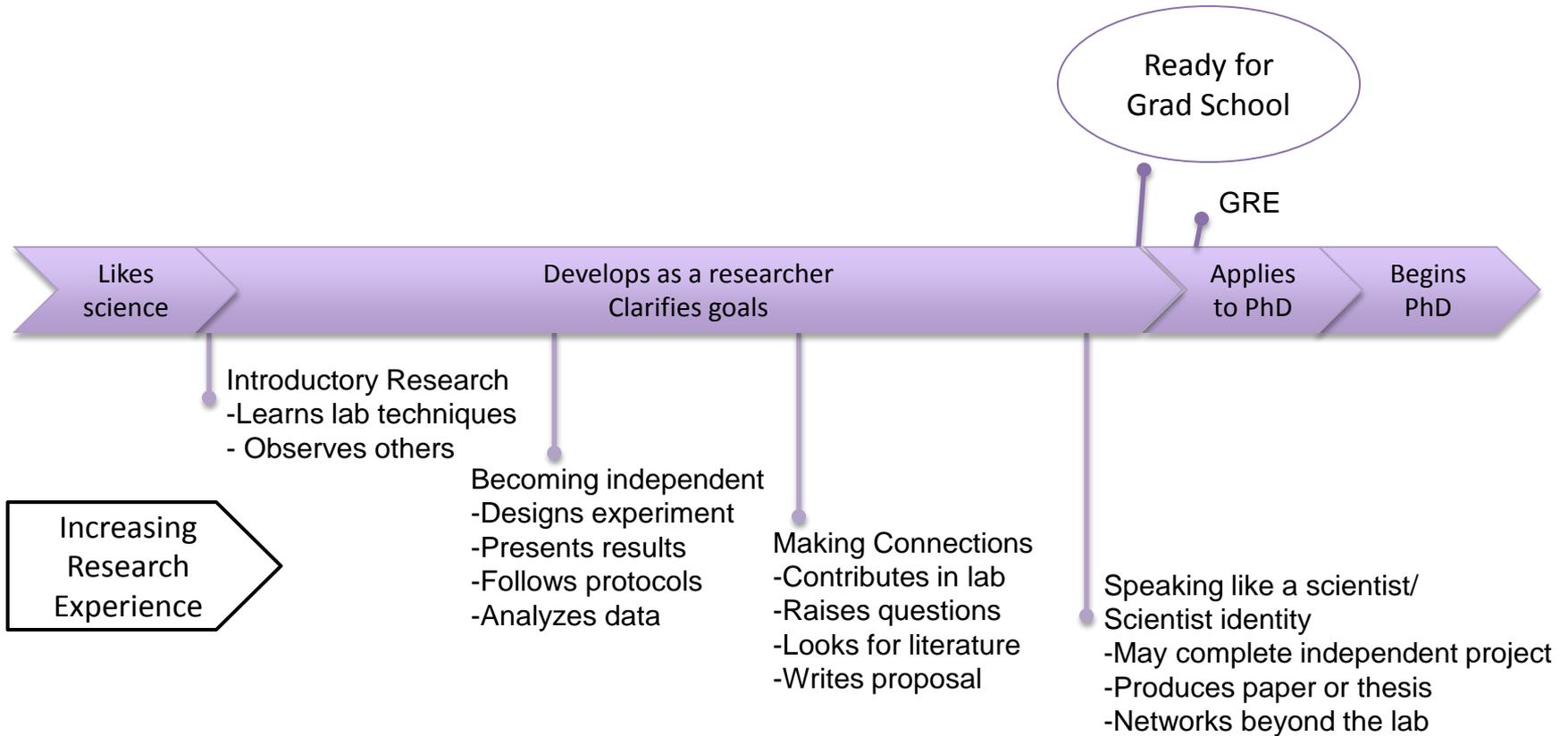
What skills, knowledge, attitudes and values do young scientists need to “fit” with the culture of science? How are students differently evaluated based on gender, race, and ethnicity?

How do experiences translate into science self-efficacy and a goal as an academic scientist? How are students moved toward, or away from, academic science careers?

Social Cognitive Career Theory

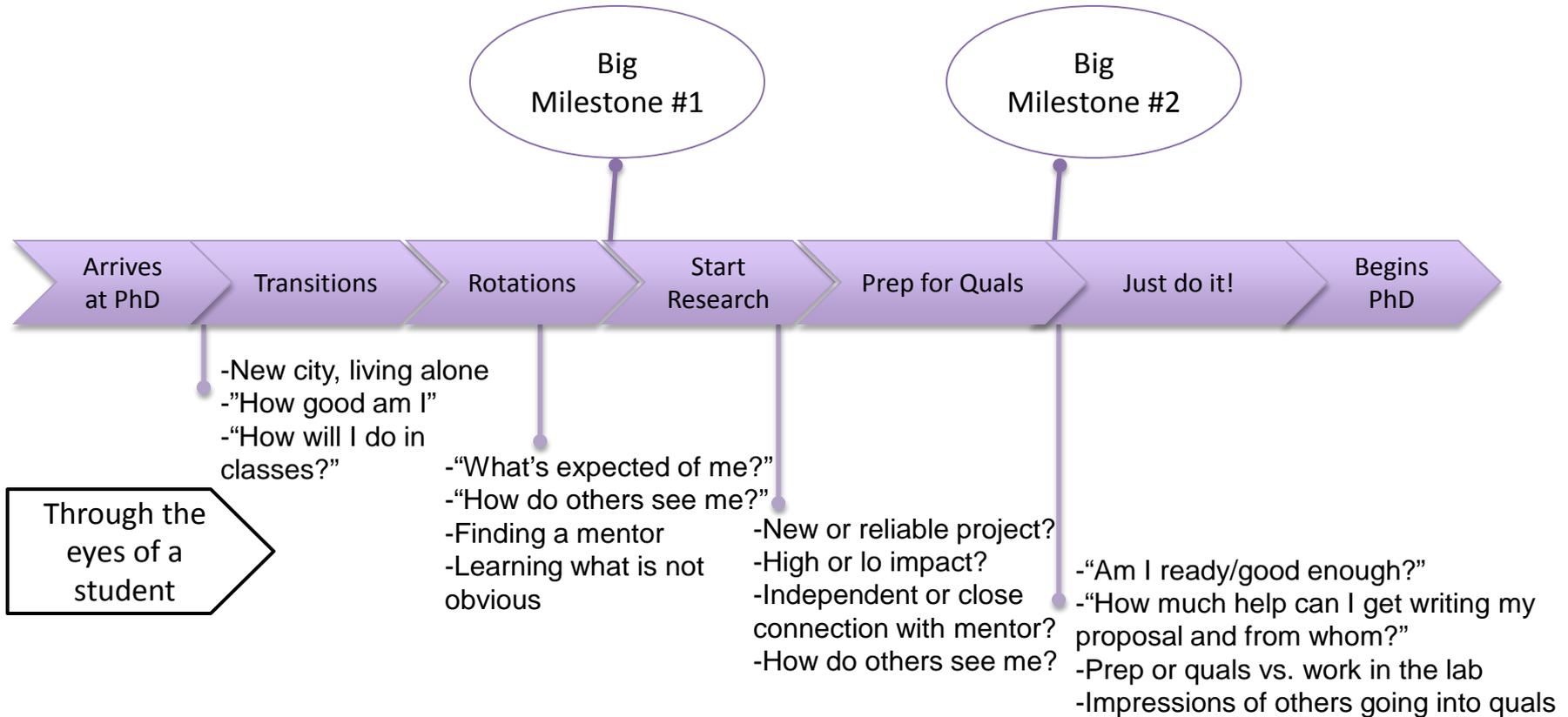
- Individuals move toward particular careers based on experiences, interests, self-efficacy and goals

Trajectory Toward the PhD



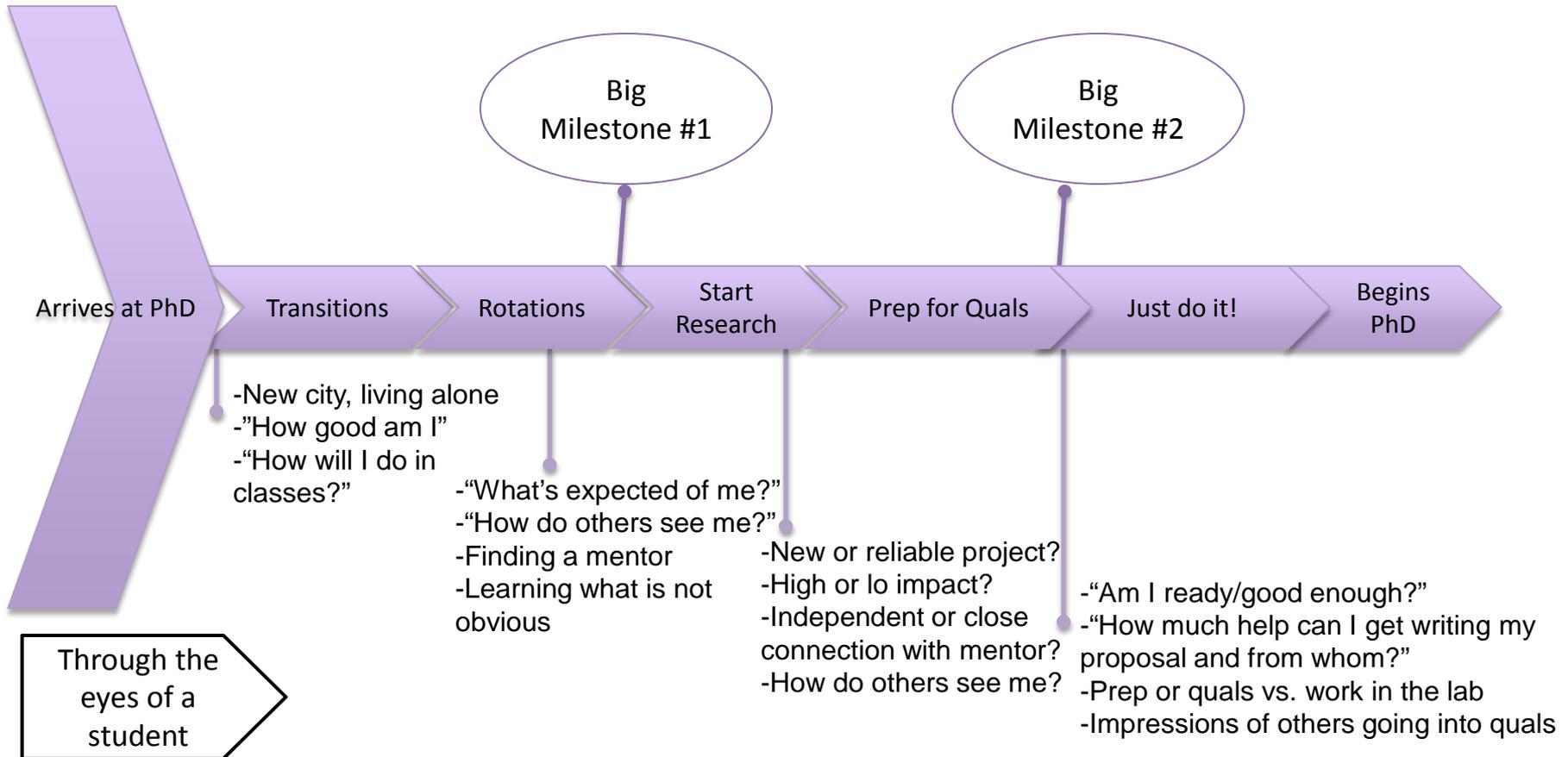


Trajectory During PhD Training





Trajectory During PhD Training





What determines what a student arrives with at the starting line of the PhD?

The obvious things:

- Depth and mastery of science and math knowledge
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 - Almost impossible to truly catch up during 4 years of college if starting from far behind
- Amount and depth of prior research experience
 - Technical skills mastered and/or ability to learn new ones quickly
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- Clarity of research interests

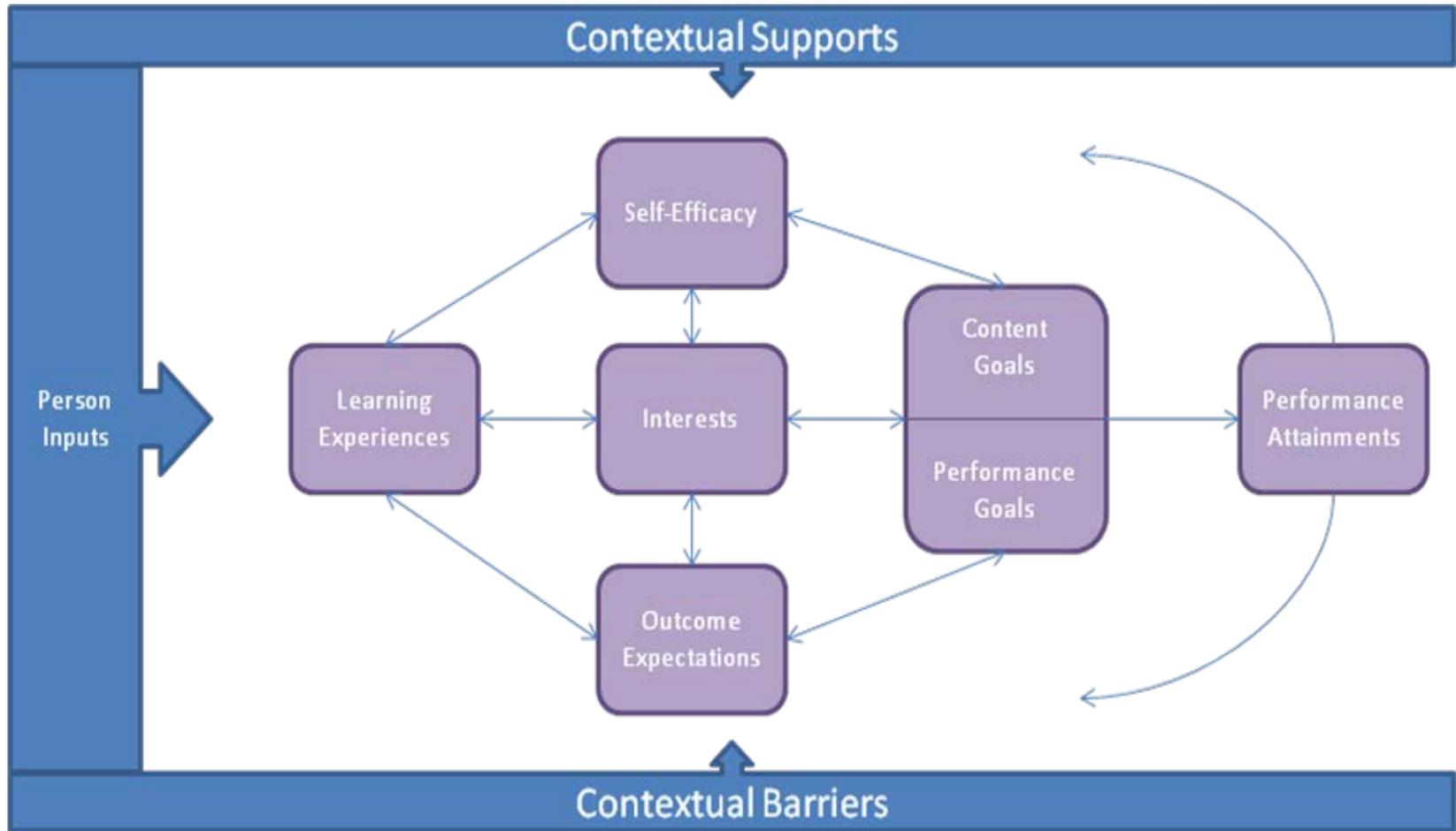


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- Degree to which others have treated them like a scientist, a member of the club
- Level of 'passion' for doing research vs. PhD as a route to teaching or other use of the PhD
- Overall maturity and breadth of life experiences

Social Cognitive Career Theory





Arrival at the PhD seen through theories: Social Cognitive Career Theory (SCCT)

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Experiences

Science Self-
efficacy

Interests

Outcome
Expectations

Goals

Performance
Attainment

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Arrival at the PhD seen through theories: Cultural Capital



Underlying Principles:

- Social reproduction by dominant groups
- Promotion and fit based on perceptions of knowledge and skills

Impacts on Students and Interventions:

- What skills, knowledge, attitudes and values do young scientists need to “fit” with the culture of science?
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“Resources” to use within a given setting

Knowledge, skills, credentials

Being seen as a scientist

Habitus – habits, behaviors of scientists

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Contingencies

Stereotype
Threat

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Recognition by
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Arrival at the PhD seen through theories: Communities of Practice



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Arrival at the PhD seen through theories: Communities of Practice – think lab group

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Social environment
of people with
common interests

Situated learning

Domain of
expertise

Shared repertoire
of practices

Legitimate peripheral
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Newcomers
become insiders
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Communities of Practice takes center stage beginning in PhD and beyond

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Enter mentoring as the central dogma for PhD training and beyond...

Shift in approach to learning

Within 1-2 years shift from structured to unstructured learning and skill development – emphasis on independence

From teaching to mentoring

“Teaching” disappears, replaced by mentoring and independent learning – including evaluation

Presumptions of mentoring

Mentoring highly variable and idiosyncratic process with purposeful maximum latitude for mentors’ judgments and stylistic preferences

Challenges/risks for outsiders

Informal learning architecture typically more difficult for anyone starting as an ‘outsider’ to navigate



Now integrate social science theories with mentoring as the central process

Starting point of PhD matters

Real and perceived differences in cultural capital and SCCT variables affect internal and external perceptions

Critical to be seen as scientist

Informal assessments by others take on central role for determination of competence as scientist

Communities of Practice - labs

Each lab group a C of P which students have to navigate to acquire tacit knowledge essential to performance and development as a scientist

High risk for system failures

Really challenging for even well-intended, skilled mentors to craft a learning environment able to support new members entering C of P continuously



What does this mean for interventions at the PhD level?

Likely essential if we want change

Most interventions focus on inputs to the PhD

- more diversity and better preparation
- assume mentoring will take it from there or believe Darwin was right – flawed assumptions

System issues as much as people

Need to look beyond practices and idiosyncrasies of individual mentors - impossible to control

Systematizing more

Think about what we hope mentors will provide, assume they often won't, and fill in the critical gaps

Early phases critical

Early phases of PhD training high risk of system failure for those coming from 'atypical' backgrounds



Applying Theories to Interventions - An Example at the PhD student level

Start from theories

From theories, in what ways could URM students be starting from 'behind' other PhD students, be at risk of marginalization and/or not be positioned to excel toward an academic career?

Design the intervention

Designed consciously to mitigate disadvantages and proactively provide what may be limiting/hard to get

From mentoring to coaching

The Academy for Future Science Faculty

- Funded by NIH Director's Pathfinder Award
- Several talks and poster will describe more
- Testing adding structured coaching to mentoring

Gather data to test hypotheses

Consider any and all interventions as experiments with explicit hypotheses and assumptions to test

Cultural Capital may be Different for URM and low SES students



How will PhD be different from BS?

Explicitly describe how the PhD works, especially the first year to promote successful start

How do you choose rotations?

Walk through considerations, self-assessment to be aware of areas of needed development

Afraid to ask for help – look stupid

Purposeful provision of safe, skilled Coach separate from environment where evaluation taking place
Peer network, others with same questions

Unknown skills & competencies

Self-assessment exercise to sensitive to range of skills and competences needed and begin calibration
Naming of Cultural Capital

Scientific identity may be less developed and identity conflicts greater for URM and low SES students

Self-recognition

Academy as a safe-space to get to know peers, often realizing similarities and common identities – and meet others *'like themselves'*

Recognition by others

Establishment of Academy and Coaching Group identities in a highly positive, supportive environment

Identity Contingencies

Coaches trained and especially sensitive to recognizing and counteracting prior negative feedback from mentors and others

Identity Conflicts

Academy sessions openly, acknowledge, talk about and develop strategies for working with competing and conflicting identities including cultural biases associated with them



URM and low SES students more likely to be marginalized in lab Communities of Practice

C of P Principles revealed

Before the implications and impact of C of P can be discussed and addressed students must understand them

Entry to C of P more at risk

Active discussion of the social and operational idiosyncrasies of lab group, how to engage, how to acquire tacit or hidden knowledge

Importance of early impressions

Emphasis on impact of early impressions, perceptions of legitimacy, oral communication skills critical

Unconscious and conscious bias

Active discussion of realities of unconscious and conscious bias towards newcomers unlike the group, tools and approaches to cope and excel



Now it's YOUR turn!

Where do you want to start?

A new program or activity within a program you are thinking about creating?

An existing activity you want to improve with a theory-based approach?

Existing activities to reverse engineer to see how they fit with theories and student needs?

Focus on specific activity

Hard to do this at the level of a program – need to do for an activity or discrete objective of that activity

For a new activity or improvement

What objective do you want to accomplish? Or
What theory-based challenge or barrier are you addressing?

For reverse engineering

Why are you doing the activity? What do you hope to accomplish? What theories apply to its purpose?



Now it's YOUR turn!

Map the theories
to the students

Think of activities as linking students and theories

It may help to pick a theory and how it might apply to your students first, then map activity, student, theory

Based on theories
do you see holes?

Another approach can be to consider the theories and key student needs you may not be addressing

Repeat

Ideally you do this mapping and analysis for every component of an intervention

What if it does
not map?

You may need to consider why you are doing it and perhaps stop



To Contact Us...

Scientific Careers Research and Development Group

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The Scientific Careers Research and Development Group

Practice = Things we do in research training

- Classes
- Mentoring
- Doing research

Theories = Underlying principles explaining social experiences

- 'Theory' has different convention in social science
- Can underpin Practice or Research



Research = What gets done in the lab

- Expand to research on our practices
- Hypothesis testing or generating
- First level 'try it and see what happens'