Navigating the New NIGMS Training Guidelines

AAMC Learning Center

February 12, 2018
“Navigating” was not a grant-writing workshop, nor a consensus conference. Rather, the purpose was to stimulate discussion and self-reflection on

1) the state of one’s training program, and

2) how it could be improved in line with the requirements in the NIGMS Funding Opportunity.
Who participated?

The 60 participants and 10 facilitators encompassed all levels of deans and professors, and programmatic staff. They represented 39 universities/institutions—public and private, large and small, from all regions of the United States—and six professional organizations. There were no NIGMS or NIH staff in attendance.
Planning Committee

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& Vice President-Elect for Science Policy, FASEB

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Kenneth Gibbs,
Program Director, TWD, NIGMS
Navigating the New NIGMS Training Guidelines

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Jointly organized and sponsored by FASEB, AAMC, HHMI, & CGS
Session 1: Training Culture

How do we create a culture that maximizes trainees’ abilities and experiences and helps them realize their full potential?
Imagine the Perfect Training Environment!
The Perfect Training Program

• How is it structured? What are some of the guiding principles that make it successful?

• What are some of the qualities or characteristics of the faculty, students, administrators, and the home institution?

• How do you promote the importance of mentorship and maximize the mentoring skills of faculty and administrators in this program?
What Barriers Stand in the Way?

• What cultural barriers within your program and institution could prevent you from achieving the ideal training environment?

• For each barrier, come up with two strategies by which to overcome it.
Facilitators share examples of interesting/incisive ideas and comments from their groups for discussion in the larger group.
Session 2: Skills for Success

What key knowledge and skills do trainees need to thrive in the biomedical workforce?

How do we evaluate mastery of those skills and knowledge?
Skills and Competencies

What’s the difference? Are they synonyms?
Skills vs. Competencies

**Skill:** the ability to perform tasks; a learned ability to bring about a desired result.

**Competency:** The combination of observable and measurable knowledge, *skills*, abilities, and behaviors that are needed by trainees/scientists to be successful.
Skills vs. Competencies: Examples

**Problem Solving** (*competency*) involves demonstrating the ability to

- define the problem (*skill*),
- identify potential solutions (*knowledge*),
- evaluate those solutions (*skill*), and
- try them out (*behavior*)
T32 FOA Classification of Skills

“...training opportunities that equip trainees with the technical (e.g., appropriate methods, technologies, and quantitative/computational approaches), operational (e.g., independent knowledge acquisition, rigorous experimental design, and interpretation of data) and professional (e.g. management, leadership, communication, and teamwork) skills required for careers in the biomedical research workforce.”

“Skill” appears 33X
Activity

Lists of skills developed that should be addressed in an ideal training environment.
Skill Ranking Exercise

★ 5 most important skills for trainees to master in order to succeed in biomedical workforce careers.

😊 5 skills you are struggling the most to understand and/or incorporate into your training program
**Perfect Training Environment**

<table>
<thead>
<tr>
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Emerging and Boundary-Crossing Skills

• What new or emerging skills should trainees be expected to master, or at least understand, for future success?
• Which skills are discipline- or career-specific and which are broadly applicable to a range of disciplines/careers?
Emerging and Boundary Crossing Skills

*Skills identified as important by all tables included:*

- Working with large datasets, bioinformatics, and other quantitative approaches to research
- Working in and leading teams. Many identified components of team work, such as collaboration across disciplines, interpersonal communication skills, and cultural sensitivity. The importance of being able to work in multidisciplinary and multicultural teams was raised by a few tables
Defining and Measuring Mastery

• How do we define and assess mastery of ________ skill?
• How do we integrate that skill into existing training curricula and program elements?
• How do we identify and take advantage of existing resources to provide trainees access to expert thinking and instruction in this area?
Activity

Specific skills assigned to groups for development.
Example of Product of Groups

Oral Communications:

- **Defining mastery**: the ability to communicate key (scientific) ideas succinctly and in a way a specific audience can understand; trainee can do this for research talks, poster presentations, and elevator pitches, among other situations

- **Assessment**: audience evaluation and feedback; feedback from (mentor’s) collaborators on trainee’s presentation; develop rubric(s) to assess trainee’s ability to communicate effectively by
  - identifying audience and purpose of talk, and tailoring presentation accordingly
  - identifying storyline (historical context) of research and tying research to “big picture”
  - being sensitive to audience cues and adjusting in real-time in response to feedback
  - varying tone for emphasis

- **Integration**: integrate rubric assessment into courses, journal clubs, program talks, etc.; create opportunities to practice oral communications and get feedback in low-stakes environment; expose trainees to popular science media, i.e., podcasts, TED talks, iBiology lectures; maximize opportunities for trainees to talk to each other about their research in interdisciplinary settings and symposia

- **Resources to facilitate acquisition**: Toastmasters; outreach through professional societies; 3 Minute Thesis; speakers/experts from outside the scientific community (could be from other departments on campus); training workshop from Alan Alda Center for Communicating Science
Evaluating Trainee Development:
One Approach to Competency-Based Assessment

Victoria Freedman and Wayne McCormack
Evaluating Trainee Development: One Approach to Competency-Based Assessment

- Broad Conceptual Knowledge of a Scientific Discipline
- Deep Knowledge of a Specific Field
- Critical Thinking Skills
- Experimental Skills
- Computational Skills
- Collaboration and Team Science Skills
- Responsible Conduct of Research and Ethics
- Communication Skills
- Leadership Skills
- Survival Skills

Michael Verderame, Penn State University
Victoria Freedman, Albert Einstein College of Medicine
Lisa Kozlowski, Thomas Jefferson University
Wayne T. McCormack, University of Florida College of Medicine
# Sample Assessment Rubric

<table>
<thead>
<tr>
<th>Dreyfus &amp; Dreyfus Levels of Skill Acquisition</th>
<th>Novice</th>
<th>Advanced Beginner</th>
<th>Competent</th>
<th>Proficient</th>
<th>Expert</th>
</tr>
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<tbody>
<tr>
<td>Rule-based behavior, limited, inflexible</td>
<td></td>
<td>Incorporates aspects of the situation</td>
<td>Acts consciously from long-term goals and plans</td>
<td>Sees situation as a whole and acts from personal conviction</td>
<td>Has intuitive understanding of situations, zooms in on central aspects</td>
</tr>
<tr>
<td>Biomedical Science PhD Training Stages</td>
<td><strong>Beginning PhD Student</strong></td>
<td><strong>Advanced PhD Student</strong></td>
<td><strong>Defending PhD Student / Beginning Postdoctoral</strong></td>
<td><strong>Advanced Postdoctoral Scholar</strong></td>
<td>Science Professional</td>
</tr>
<tr>
<td>CRITICAL THINKING SKILLS B. Design a single experiment (answer questions, controls, etc.)</td>
<td>Follow experimental protocols, seek help as needed, describe critical role of controls</td>
<td>Plan experimental protocols; include relevant controls; choose appropriate methods; troubleshoot experimental problems</td>
<td>Design &amp; execute hypothesis-based experiments independently; evaluate protocols of others; imagine range of experimental outcomes</td>
<td>Consistently design &amp; execute experiments with appropriate controls; assess next steps; critique experiments of others</td>
<td>Teach experimental design; guide others doing experiments</td>
</tr>
</tbody>
</table>

Verderame, Freedman, Kozlowski, McCormack. 2018
Competencies & Subcompetencies

1. Broad Conceptual Knowledge of Biology and Human
   A. Knowledge base for multiple disciplines
   B. Broad scientific approaches

2. Deep Knowledge of Specific Field
   A. Historical context of a specific area
   B. Current content expertise in the specific area
   C. Tools and approaches for a specific area

3. Critical Thinking Skills and the Scientific Method
   A. Recognize important questions
   B. Design a single experiment
   C. Interpret data
   D. Design a research program

4. Experimental Skills for Conducting Research
   A. Identify appropriate experimental protocols
   B. Design and execute experimental protocols
   C. Identify and troubleshoot technical issues
   D. Lab safety & regulatory issues
   E. Research records and data storage
   F. Recognition of data ownership

5. Computational Skills
   A. Basic Statistical Analysis
   B. Bioinformatics literacy

6. Collaboration & Team Science
   A. Openness to collaboration
   B. Self-awareness
   C. Disciplinary awareness
   D. Integration
   E. Team skills

7. Responsible Conduct of Research & Research Ethics
   A. Knowledge about RCR
   B. Ethical decision making in RCR
   C. Moral Courage
   D. Integrity

8. Communication Skills
   A. Informal Oral Presentation Skills
   B. Formal Oral Presentation Skills
   C. Written Communication - Scientific Manuscript
   D. Written Communication - Grant Proposals
   E. Written Communication – Meeting Poster
   F. Communication with the Public

9. Leadership Skills
   A. Vision
   B. Integrity
   C. Group dynamics and interpersonal skills
   D. Organization and planning
   E. Decision-making
   F. Problem-solving
   G. Managing Conflicts

10. Survival Skills
    A. Motivation
    B. Perseverance
    C. Adaptability
    D. Professional Development
    E. Networking

Verderame, Freedman, Kozlowski, McCormack. 2018
Session 3: Navigating from “Promising” to “Evidence-Based” Practices

What existing approaches have been developed to provide instruction on these skills?
How do we know they are effective?
From the T32 FOA (Appears 9x)

• “...this funding opportunity announcement (FOA) provides support ...to develop and implement effective, evidence-based approaches to biomedical graduate training and mentoring ...”

• “...adequate, evidence-based retention plan to ensure the well-being and success of all trainees throughout their graduate training...”

• “...implement evidence-based training activities that are grounded in the literature and from evaluations of existing relevant graduate programs.”

• “...employ modern, evidence-based approaches to training, mentorship, inclusion and professional development?”
The Rise of Evidence-Based Practices

- Movement away from practices based upon belief
- Focuses on rigorous research that informs “what works”
- Confidence in the evidence
  - Have the results been published in referee journals?
  - Have the findings been replicated by independent researchers?
  - Is there consensus within the research community about the reliability and validity of the results?
Best Practices
Common Practices
Standard Practices
Promising Practices
Conventional Practices

Evidence-Based Practices
What Works?

• What courses, activities, or interventions in your programs address your assigned skill?

• What **evidence** do you have that they are effective (i.e., achieving desired outcomes)?

• What additional supporting evidence or data would you need to demonstrate they are “evidence-based?”
Activity

Top three most important skills assigned to groups for development.
Perfect Training Environment

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Three highest, each discussed by three tables
Perfect Training Environment

*Critical and Independent Thinking:*
  - Existing courses or approaches
    - Case studies
    - Journal clubs/Paper meetings in a lab
    - Analyzing paper reviews
    - Problem-based learning
    - Experimental design discussion/courses
    - Qualifying exams
    - Annual thesis committee meetings
    - Workshops
    - Rigor and reproducibility
    - Critical thinking questions in foundational course exams
    - Grant writing courses
    - Engaging in the research itself

*Evidence of effectiveness*
  - Improved quality of papers when junior students are involved in paper critiques.
  - Papers are being accepted
  - Course evaluations
  - Assessments
  - Longitudinal surveys
  - Increasing grant application numbers and funding
  - We need to seek advice from experts in educational research to determine how can we evaluate current approaches to make them evidence based

*Additional supporting evidence/data*
  - Design experiments to provide empirical evidence of effectiveness, e.g. pre/post-tests, comparing groups of students that get/don’t get training
Using Logic Models for Program Design and Evaluation

A VERY Brief Overview!

See W.K. Kellogg Foundation Logic Model Development Guide for a more complete description (with permission)
What’s a Logic Model?

- Graphic representation of how your program will work.
- Illustrates the relationship (if..., then) between the resources, activities, desired outcomes, and the long-term impacts.
- Expresses your “theory of action” or “theory of change”
How to Read a Logic Model

**Resources/Inputs**: Certain resources are needed to operate the program.

**Activities/Strategies**: If we have these resources, then we can implement these activities or strategies.

**Outputs**: If we accomplish these activities, then we will deliver the services or products we intended.

**Outcomes**: If we accomplish these activities to the extent or level we intended, then we expect these results or benefits.

**Impact**: If these benefits to participants are achieved, then certain changes in the organization or system might be expected to occur.
W.K. Kellogg Foundation
Logic Model Development Guide

Session 4: Outputs, Outcomes, and Evidence of Programmatic Success

How do we measure and track the success of a training program?
Activity

Working in pairs, develop lists of short-term outcomes of an ideal program. Use examples to populate a Logic Model.
# Activity

## Logic Model “Backward” Design

<table>
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<tr>
<th>Logic Model Design Template</th>
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<tbody>
<tr>
<td><strong>Resources/Inputs</strong></td>
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<td>What resources (new and existing) are required to run the program and are essential to conduct the planned activities?</td>
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</table>

Start Here

Move Backwards
Activity

What are some of the short-term outcomes of your idealized training program?

Changes in

- Awareness
- Knowledge
- Attitudes
- Skills

- Opinion
- Aspirations
- Motivation
### Logic Model Design Template

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<td>What resources (new and existing) are required to run the program and are essential to conduct the planned activities?</td>
<td>What will you do? What specific activities, strategies, services, and events will be part of the planned program?</td>
<td>What are the measurable and tangible results or outcomes of the program's activities? What is the size and/or scope of the project's activities or strategies?</td>
<td>What specific changes in attitudes, behaviors, knowledge, or skills are expected to result from the program's activities within 1-3 years?</td>
<td>What additional changes in attitudes, behaviors, knowledge, or skills are expected to result from the program's activities within 4-5 years?</td>
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**What are some of the likely or expected short-term outcomes?**
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What are some activities or strategies that could be used to achieve the outcomes?
## Activity

**Logic Model Design Template**

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What are some measurable outputs—tangible, observable results of the activities?
### Logic Model Design Template

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**What resources (existing or new) will be needed to implement the program**
Activity

Mid- and Long-term Outcomes

• Thinking beyond outputs and short-term outcomes, identify one or two longer-term outcomes or achievements for the program.

• Identify possible indicators you could use as evidence of your short- and long-term outcomes.
# Example Logic Model

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<td>Money</td>
<td>Faculty mentor training program</td>
<td># faculty completing training program</td>
<td>Improved mentor-mentee communications and expectations</td>
<td>Student career satisfaction</td>
</tr>
<tr>
<td>Time</td>
<td>Presentations to faculty on broad, “21st century” careers and data on PhD employment</td>
<td># and variety of presentations on career tracks</td>
<td>Faculty can mentor students toward a variety of career outcomes</td>
<td>Less attrition</td>
</tr>
<tr>
<td>Speakers and facilitators</td>
<td>Mentor-mentee workshops with case studies, leading to compact</td>
<td># students and faculty in attendance</td>
<td>Faculty can identify and mitigate implicit bias, stereotype threat, and imposter syndrome</td>
<td>Fewer students change labs after qualifying exams</td>
</tr>
<tr>
<td>Literature/data</td>
<td>Workshop/speaker on inclusive mentoring, expert advice</td>
<td># trainee-mentor compacts filed</td>
<td></td>
<td>Shorter time-to-degree</td>
</tr>
<tr>
<td>Partnerships with on- and off-campus collaborators</td>
<td>Mentor and mentee both participate in team-building, get outside comfort zone</td>
<td># workshops; qualitative assessment?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social capital and buy-in from Chair; (e) cahrpion(s)</td>
<td>Incentives/awards for mentoring excellence</td>
<td># mentor-mentee pairs completing exercise; qualitative and reflective component(?)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Great mentors who can mentor faculty</td>
<td>T32 mentors could have to sign an agreement to get a student</td>
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Session 5: Putting It All Together

- Sketch out a diagram of your training program, incorporating aspects/components of the ideal program you described in Session 1.
- Choose one or two short-term outcomes and identify the associated inputs/resources, activities стратегии, and outputs.
- Overlay with assessment tools and measures of success.