

Do you know it when you see it? Competency based assessment to guide mentor-mentee communication

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Biomedical Science Graduate Education



Background

■ PROBLEM

- Historical: PhD education is traditionally an apprenticeship
- When is a graduate student ready? Do you “know it when you see it?”

■ GOALS

- Define the knowledge, skills and attitudes (KSA) required for a scientist to successfully meet the needs of the profession and of society
- Link to formative assessment

Education is a Developmental Process



Model

- Dreyfus and Dreyfus, 1986: model of knowledge and skills acquisition along the continuum of an educational process
 - ***Novice → Advanced Beginner → Competent → Proficient → Expert***
 - Milestones: expectations for the knowledge, skills and attitudes for each competency at each stage

Dreyfus HL, Dreyfus SE. 1986. Mind over machine: The power of human intuition and expertise in the era of the computer. New York, NY: The Free Press.

Sample Assessment Rubric

	Novice	Advanced Beginner	Competent	Proficient	Expert
Dreyfus & Dreyfus Levels of Skill Acquisition	Rule-based behavior, limited, inflexible	Incorporates aspects of the situation	Acts consciously from long-term goals and plans	Sees situation as a whole and acts from personal conviction	Has intuitive understanding of situations, zooms in on central aspects
Science PhD Training Stages	Beginning PhD Student	Advanced PhD Student	Defending PhD Student / Beginning Postdoctoral	Advanced Postdoctoral (in/out of Academia)	Science Professional
	MILESTONES				
Observable Behaviors	discuss, describe, follow	identify, use, explain	design, develop, evaluate	plan, adjust, teach	lead, review, mentor

Core Competencies: Essential Elements Necessary to Earn the PhD Degree

■ **Core competencies**

- Broad conceptual knowledge
- Deep knowledge base
- Critical thinking skills
- Life-long learning skills
- Communication skills
- Quantitative skills
- Team science skills
- Data management
- Leadership
- Ethics and the responsible conduct of research

Professional Competencies: Some Skills Align with Specific Career Pathways



not included

- **Professional Competencies**
 - Teaching
 - Mentoring
 - Management
 - Entrepreneurship

Competency-Based Assessment

■ Purposes

- Focus mentoring conversations on research competencies
- Help trainees and mentors identify an individual's progress in each competency
- Support productive mentor-mentee conversations

■ Development of an assessment tool

- Focus on **core competencies**
- **Milestones:** specific expectations (observable behaviors) for the knowledge, skills and attitudes for each core competency
- Specific **milestones mapped to stages of PhD educational development** (predoctoral – postdoctoral) for each competency

10 Competencies with 44 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

3. CRITICAL THINKING SKILLS	MILESTONES				
A. Identify important questions	Describe background information; explain rationale for an hypothesis	Identify important questions and hypotheses in a paper or experimental design	Evaluate results and generate new hypotheses based on historical and current context; determine next important questions	Independently formulate hypotheses and experimental approaches using the scientific method	Independently generate new hypotheses; prioritize research questions; teach the scientific method

observed on a consistent basis

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observed sometimes,
still developing

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Mentor and trainee would each do this independently to assess the trainee's progress

Reporting of Self-Assessment & Mentor Assessment

3. Critical Thinking Skills

- A. Identify important questions
- B. Design an experiment
- C. Interpret data
- D. Design a research plan

4. Experimental Skills

- A. Identify appropriate experimental protocols
- B. Design & execute experimental protocols
- C. Identify & troubleshoot technical issues
- D. Lab safety & regulatory issues
- E. Research records & data storage
- F. Recognition of data ownership

Trainee Faculty Match

Use of Competencies & Milestones

- Inform applicants and new trainees about expectations
- Tool for trainee self-assessment and self-directed learning
- Tool for faculty to assess a trainee progress and **support effective mentoring**
- Tool for program directors to harmonize learning objectives, expected outcomes, and program assessment

Pilot Testing

- Questions:
 - ❑ Calibration of observable behaviors to stages of training
 - ❑ Concordance between mentor assessment and trainee self-assessment
 - ❑ Support for improved mentor-mentee communication
 - ❑ Usefulness for advisory committee members
 - ❑ Usefulness of aggregate data for program evaluation

Workshop

- You're invited to participate in a workshop with role play activity to demonstrate the experience of using this assessment
- Workshop TBA at our mutual convenience
- Email mccormac@ufl.edu