Research Mentor Training

The selections you have chosen for your customized curricula are drawn from materials based on *Entering Mentoring* (Pfund, Branchaw, and Handelsman, 2014).
The Entering Mentoring-based materials have been developed and tested by many partners across the country. Individual acknowledgements can be found in footers of each page.
A full listing of partners and funders can be found at CIMERProject.org.

Assessing understanding

1. He Should Know That
2. Reasons for Lack of Understanding: Follow-up to 'He Should Know That'
3. Identifying Strategies to Enhance Understanding
4. Excerpt on How People Learn
5. Assessing Understanding Full Session
6. Reasons for Lack of Understanding
7. Identifying Strategies to Enhance Understanding
8. Strategies to Assess Understanding
9. Reflective Listening
10. Excerpt on How People Learn

Learning Objective:

Mentors will learn to assess their mentees understanding of core concepts and processes

Case Study

He Should Know That

Dr. Richard Smith started his mentored research in your lab after completing his MD and residency. His professional goals include performing both clinical and translational research as an independent investigator. Dr. Smith has been working in your lab for six months, performing basic science and early-stage translational research, and his research appears to be going well. In a regular meeting with him, you discover that Dr. Smith cannot answer a fundamental question regarding the background and motivation for his current work. In probing further, you find that Dr. Smith appears to be unfamiliar with some core biological concepts that drive many of the projects in the lab, including his own. You often expect such issues to arise when mentoring a graduate student, but are shocked to be in this situation when mentoring someone with Dr. Smith's education and experience. You wonder if you missed other indicators of Dr. Smith's lack of understanding in previous months. Moreover, you are not sure how to proceed to assess Dr. Smith's current understanding and identify the gaps.

Guiding Questions for Discussion:

1. What are the main themes raised in this case study?
2. What could have been done to avoid this situation? What should the mentor do now?
3. How can mentors balance promoting independence with confirming understanding?

Learning Objective:

Mentors will learn to identify various reasons for a lack of understanding, including expert-novice differences

Activity **Follow-Up Discussion (Case #1: He Should Know That)**

Distribute the Understanding Case: *He Should Know That* and let participants read the case individually for two to three minutes.

DISCUSS (5 min): the questions below with the entire group. You may want to record the ideas generated in this discussion on a whiteboard or flip chart.

1. What could explain a mentee having difficulty understanding?
2. We all unconsciously make assumptions about ability and level of understanding based on other cues and factors such as race, ethnicity, gender, English fluency, prior experience and background, types of questions someone asks, etc. How can you acknowledge those assumptions and remain open-minded?

NOTE: Some of the reasons that may arise include differing backgrounds, e.g., clinical expertise versus research training, different modes of communication, misunderstandings regarding the level of understanding that is expected, cultural differences, disciplinary differences, etc.

NOTE: You may want to ask mentors to consider the difference between an expert and novice perspective. As an expert, there are many steps in an explanation that you may leave out because they are second nature, or because it is hard to remember what it was like to be a novice. For example, when you see a master chef cooking, it looks easy; however, when you try the same recipe yourself, you realize that there are many steps that have been left out of the explanation. See included summary for more information.

From Pfund, Christine et al. (2012) Mentor Training for Clinical and Translational Researchers. New York, NY: W.H. Freeman & Co.

For additional resources and complete curriculum—including information on competencies and facilitator notes—visit: CIMERProject.org

Learning Objective:

Mentors will learn to use multiple strategies to enhance mentee understanding across diverse disciplinary perspectives

Activity

Identifying Strategies to Enhance Understanding

- DISCUSS: Ask mentors to share one strategy they use to promote understanding. You may want to record the ideas generated in this discussion on a whiteboard or flip chart.

- NOTE: Strategies you can add to the list include:
  1. Taking a minute to consider any assumptions made about what my mentee knows or does not know.
  2. Taking time to remember what it was like to not understand something before I became an expert.
  3. Writing out an explanation and asking a colleague from outside the discipline to identify all of the terms they do not understand.
  4. Asking my mentee to explain something back to me so I can assess their understanding.
  5. Asking my mentee to explain something to another scholar or trainee.
  6. Asking my mentee to organize information with a flowchart, diagram, or concept map.
  7. Asking my mentee to come up with an analogy that relates to our research.

- NOTE: How do you know when you are qualified to assess a mentee's understanding? Be sure to include a discussion of what to do if you are not an expert in all aspects of a mentee's research program, such as when you are a secondary mentor.

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For additional resources and complete curriculum—including information on competencies and facilitator notes—visit: CIMERProject.org

Learning Objective:

Mentors will learn to identify various reasons for a lack of understanding, including expert-novice differences

Activity

Excerpt on How People Learn

Have mentors read a summary of how people learn, paying particular attention to the results from expert/novice studies (see “Brief Summary & Implications for Teaching” based on How People Learn: Brain, Mind, Experience, and School). Have mentors discuss how they could better help their mentee understand one aspect of their research if they considered it from a novice point of view.

CHAPTER 6

Assessing Understanding

OVERVIEW, LEARNING OBJECTIVES, AND ACTIVITIES

Introduction

Determining if someone understands the content and process of their discipline is not easy, yet critical in a productive mentoring relationship. Developing strategies to assess understanding, especially of core research concepts, is an important part of becoming an effective mentor. Moreover, it is important for mentors to be able to identify the causes for a lack of understanding and strategies to address such misunderstandings.

Learning Objectives

Mentors will have the knowledge and skills to:

1. Assess their mentees' understanding of core concepts and processes
2. Identify various reasons for a lack of understanding, including expert-novice differences
3. Use multiple strategies to enhance mentee understanding across diverse disciplinary perspectives

From Pfund, et al. Mentor Training for Clinical and Translational Researchers (2012). New York, NY: W.H. Freeman & Co.

Overview of Activities for the Understanding Session: Please note that a core activity is listed for each learning objective. We encourage you to engage the mentors in your group in this activity. There is a list of additional activities that can be used if you have extra time in the session or if the core activity is not working well for the mentors in your group.

	Learning Objectives	Core Activities	Additional Activities
1	Assess their mentees' understanding of core concepts and processes	Mentors read and discuss Case #1: *He Should Know That* and then create a list of ideas they expect their mentee to understand (Activity #1)	Mentors generate a list of strategies for assessing understanding in face-to-face meetings, over email, through written reports, etc. (Activity #4)
2	Identify various reasons for a lack of understanding, including expert-novice differences	Mentors brainstorm reasons behind a lack of understanding (Activity #2)	Mentors read an excerpt from an expert-novice study and discuss the implications for understanding (Activity #5)
3	Use multiple strategies to enhance mentee understanding across diverse disciplinary perspectives	Mentors share strategies to enhance understanding (Activity #3)	Mentors read and discuss Case #2: *Should I Know That?* (Activity #6)

FACILITATION GUIDE

Recommended Session on Assessing Understanding (30 minutes)

Materials Needed for the Session

- Table tents and markers
- Chalkboard, whiteboard, or flip chart
- Handouts:
  - Copies of introduction and learning objectives for *Assessing Understanding* (page 49)
  - Copies of *Understanding* Case #1: *He Should Know That* (page 53) and the additional case if desired (page 54)
  - Copies of "Summary & Implications for Teaching" based on *How People Learn: Brain, Mind, Experience, and School* (pages 55–57)

Overview (3 min)

- TELL: Review the introduction and learning objectives for the session. Be clear that this session is about assessing a mentee's understanding of research concepts and processes. While understanding other factors that affect your mentor/mentee relationships is important, keep the focus on research.

Objectives 1 and 2: Assess their mentee's understanding of core concepts and processes and Identify various reasons for a lack of understanding (17 min)

- ACTIVITY #1
  - Distribute the *Understanding* Case #1: *He Should Know That* and let participants read the case individually for two to three minutes.
  - DISCUSS (12 min) with entire group. You may want to record the ideas generated in this discussion on a whiteboard or flip chart. Use the guiding questions following the case study. Additional questions are listed below:
    1. How do you know if your mentee understands something?
    2. How can you help your mentee accurately assess his/her own understanding?
    3. How can you explain something in more detail without sounding condescending?
    4. How would you know if a mentee is in need of alternative communication modes to understand the research, e.g., written instructions to augment verbal ones? Is it the mentee's responsibility to let you know their needs in this area?
    5. Is it possible that the mentor is the one who is mistaken—that the mentee simply explained it poorly or in terms unfamiliar to the mentor? How can you tell the difference between a miscommunication and a true lack of understanding?
- ACTIVITY #2: Follow-Up Discussion
  - DISCUSS (5 min) the questions below with the entire group. You may want to record the ideas generated in this discussion on a whiteboard or flip chart.
    1. What could explain a mentee having difficulty understanding?
    2. We all unconsciously make assumptions about ability and level of understanding based on other cues and factors such as race, ethnicity, gender, English fluency, prior experience and background, types of questions someone asks, etc. How can you acknowledge those assumptions and remain open-minded?
       - NOTE: Some of the reasons that may arise include differing backgrounds, e.g., clinical expertise versus research training, different modes of communication, misunderstandings regarding the level of understanding that is expected, cultural differences, disciplinary differences, etc.
  - NOTE: You may want to ask mentors to consider the difference between an expert and novice perspective. As an expert, there are many steps in an explanation that you may leave out because they are second nature, or because it is hard to remember what it was like to be a novice. For example, when you see a master chef cooking, it looks easy; however, when you try the same recipe yourself, you realize that there are many steps that have been left out of the explanation. See included summary on pages 55–57 for more information.

Objective 3: Use multiple strategies to enhance mentee understanding across diverse disciplinary perspectives (10 min)

- ACTIVITY #3: Identifying Strategies to Enhance Understanding
  - DISCUSS: Ask mentors to share one strategy they use to promote understanding. You may want to record the ideas generated in this discussion on a whiteboard or flip chart.

- ▷ NOTE: Strategies you can add to the list include:
  1. Taking a minute to consider any assumptions made about what my mentee knows or does not know.
  2. Taking time to remember what it was like to not understand something before I became an expert.
  3. Writing out an explanation and asking a colleague from outside the discipline to identify all of the terms they do not understand.
  4. Asking my mentee to explain something back to me so I can assess their understanding.
  5. Asking my mentee to explain something to another scholar or trainee.
  6. Asking my mentee to organize information with a flowchart, diagram, or concept map.
  7. Asking my mentee to come up with an analogy that relates to our research.
- ▷ NOTE: How do you know when you are qualified to assess a mentee's understanding? Be sure to include a discussion of what to do if you are not an expert in all aspects of a mentee's research program, such as when you are a secondary mentor.

Assessing Understanding

Case #1: He Should Know That

Dr. Richard Smith started his mentored research in your lab after completing his MD and residency. His professional goals include performing both clinical and translational research as an independent investigator. Dr. Smith has been working in your lab for six months, performing basic science and early-stage translational research, and his research appears to be going well. In a regular meeting with him, you discover that Dr. Smith cannot answer a fundamental question regarding the background and motivation for his current work. In probing further, you find that Dr. Smith appears to be unfamiliar with some core biological concepts that drive many of the projects in the lab, including his own. You often expect such issues to arise when mentoring a graduate student, but are shocked to be in this situation when mentoring someone with Dr. Smith's education and experience. You wonder if you missed other indicators of Dr. Smith's lack of understanding in previous months. Moreover, you are not sure how to proceed to assess Dr. Smith's current understanding and identify the gaps.

Guiding Questions for Discussion

1. What are the main themes raised in this case study?
2. What could have been done to avoid this situation? What should the mentor do now?
3. How can mentors balance promoting independence with confirming understanding?

From Pfund, et al. Mentor Training for Clinical and Translational Researchers (2012). New York, NY: W.H. Freeman & Co.

Additional Activities (if time allows)

Objective 1; Activity #4

Have mentors generate a list of strategies that can be used to assess their mentee's understanding. Ask mentors to consider strategies that can be used in face-to-face meetings, over email, through written reports, etc. You may want to record the ideas generated in this discussion on a whiteboard or flip chart.

Objective 2; Activity #5

Have mentors read a summary of how people learn, paying particular attention to the results from expert/novice studies (see "Brief Summary & Implications for Teaching" based on *How People Learn: Brain, Mind, Experience, and School*[3]). Have mentors discuss how they could better help their mentee understand one aspect of their research if they considered it from a novice point of view.

Objective 3; Activity #6

Case #2: Should I Know That?

Dr. Saldaña (MD, PhD) is a new assistant professor in Population Health with a focus on pediatric asthma treatment. He has recently made contacts within the local Hmong community who would like to work with him to improve treatment adherence in Hmong children with asthma. He is very excited about the possibility of this potential partnership having a direct impact on children's health and wants to apply for a grant to pursue a community-based participatory research (CBPR) project. He approaches Dr. Hunter as a potential mentor on the award. Dr. Hunter is very reluctant to accept, letting him know that she has never done community-based participatory research and doesn't know if she could guide him adequately. Dr. Saldaña assures her that this is not necessary, that he has identified a mentor in another university with CBPR expertise who can fill that role. He further points out that there is no one in the department who has this expertise and reminds her that his community contacts will be able to help guide and mentor him in this area. Dr. Hunter is still uncertain how well she can assess his study design and progress and wonders how well this other mentor can fill that role at a distance. She is also feeling uncomfortable because she has no experience treating Hmong asthma patients.

Guiding Questions for Discussion

1. As a mentor, how do you know if you are qualified to assess a mentee's understanding? What should Dr. Hunter's next steps be?
2. What can mentors do to improve their ability to work with mentees whose professional background and research differ from their own?
3. How can you help your mentees accurately assess their own understanding?

[3] Bransford, J., Brown, A., Cocking, R., Eds. (1999). *How People Learn: Brain, Mind, Experience, and School.* National Academy Press: Washington, D.C. <info from http://www.nap.edu/openbook.php?isbn=0309065577>

How People Learn: Brain, Mind, Experience, and School
Brief Summary & Implications for Teaching

Developing Expertise

Experts have acquired extensive knowledge that affects what they notice and how they organize, represent, and interpret information.

Key Findings

Experts have a great deal of content knowledge that is highly organized; this organization reflects a deep understanding of the subject matter, and allows them to retrieve information quickly with relatively little attentional effort.

- Experts' knowledge is linked to contexts for applying that knowledge.
- Experts notice features and meaningful patterns that are not noticed by novices.
- Expertise in one domain does not transfer to other domains, e.g., being a chess master does not mean the master is good at solving crossword puzzles or complex math problems.
- Even experts have varying degrees of flexibility in applying their knowledge in new situations.

Implications for Teaching

- Being an expert on a topic does not imply ability to instruct others effectively on the topic.
- Equally important to teaching the content of a discipline (facts, definitions, and concepts) is helping trainees organize this knowledge and apply it flexibly across many contexts.

Transferring Knowledge Flexibly Across Different Contexts

Transferring knowledge learned in one context to another context is difficult.

Key Findings

- Skills and knowledge must be extended beyond the narrow contexts in which they are initially learned.
- Learning should be linked to conditions of applicability, i.e., learning *what* should be linked to learning *when* the *what* can be applied.
- All new learning depends on previous learning. Students come to the classroom with preconceptions, and if their preconceptions are not engaged, students may fail to grasp new concepts and information that are being taught. Engaging in this context means identifying preconceptions, and, when preconceptions are misconceptions, actively helping students construct appropriate understanding based on scientific principles.
- Learning by rote rarely transfers; learning in the context of tying material to underlying principles is more effective.
- The more you know about a topic, the easier it is to learn more about that topic.

Implications for Teaching

- Help students identify appropriate contexts and conditions for application of different concepts and strategies.
- Probe often for students' preconceptions during instruction. When misconceptions that interfere with understanding scientific concepts are identified, engage the student to help her or him reconstruct appropriate understanding. Providing the right answer does not suffice in helping students overcome misconceptions.
- Link all teaching and learning to major concepts or principles in the discipline.

Designing Learning Environments

The design of learning environments is linked to issues that are important in the processes of learning, transfer, and competent performance. Those processes, in turn, are affected by the degree to which learning environments are *learner-centered*, *knowledge-centered*, *assessment-centered*, and *community-centered*.

Learner-Centered

- Learners use their current knowledge to construct new knowledge. Thus, what they know or believe at the moment affects how they interpret new information; sometimes learners' current knowledge hampers new learning, sometimes it supports learning. Effective instruction must take into account what learners bring with them. Active engagement in learning supports the construction of knowledge.
- Learners should be assisted in developing *metacognitive* strategies. Metacognition refers to people's abilities to monitor their own level of understanding and decide when it is not adequate. Transfer can be improved by helping students become more aware of themselves as learners who actively monitor their learning and performance strategies.
- Learners learn more efficiently and effectively when they are provided with feedback to help them monitor progress. *Deliberate practice* refers to engagement in educational activities that include active monitoring of one's learning. For example, when left on their own to do homework in the physical sciences, students often practice the wrong habits (e.g., equation-finding and -manipulating), thereby reinforcing such habits. Instead, students need to be given opportunities to practice skilled problem solving and provided with both feedback and support to ensure progress.

Knowledge-Centered

- Instruction should begin with students' current knowledge and skills, rather than assuming students are blank slates ready to absorb knowledge. Emphasis on how knowledge is organized will help to promote this goal.
- Instruction should help students organize knowledge in ways that are efficient for recall and for application in solving problems.
- Instruction should focus on helping students gain deep understanding of the major concepts and principles, rather than acquisition of disconnected facts and skills.

Assessment-Centered

- Formative assessment (assessment done during the course of instruction to monitor students' progress and to help shape instruction) is pivotal for providing feedback to students so that they can revise and improve the quality of their thinking. This should be done continuously, but not intrusively, as a part of instruction.
- Formative assessment strategies should be developed to make students' thinking visible to the instructor, the learner, and classmates.
- Summative assessments (assessment performed at the end of instruction for such purposes as assigning grades or evaluating competence) should reflect the knowledge, concepts, principles, and problem-solving and lab skills of the discipline considered crucial by experts.
- Students should learn how to assess their own work and that of peers.

Community-Centered

- Learners are embedded in social contexts. If they are going to make effective use of their prior knowledge, they need to be encouraged to relate the origins of their learning to school-based concepts.
- Students spend only 14 percent of their time in school, and 53 percent of their waking hours out of school. It is important to help students see the relevance of their school-based learning to non-school contexts and problem solving.
- Communities of practice need to be encouraged. Local leaders and practitioners can facilitate community-centered learning through internships, class participation, and site visits to illustrate learning and problem solving in the workplace.

Prepared by Jose Mestre (2008). Departments of Physics & Educational Psychology, University of Illinois at Urbana/Champaign, mestre@illinois.edu

Learning Objective:

Mentors will learn to identify various reasons for a lack of understanding, including expert-novice differences.

Activity

Reasons for Lack of Understanding (5 min)

- DISCUSS the questions below with entire group. You may want to record the ideas generated in this discussion on a white board or flip chart.

  1. What reasons can you think of that would explain a mentee having difficulty understanding?

  2. We all unconsciously make assumptions about ability and level of understanding on the basis of other cues and factors such as race, ethnicity, gender, English fluency, prior experience and background, the types of questions someone asks, etc. How can you acknowledge those assumptions and remain open-minded?

- NOTE: Some of the reasons that may arise include differing backgrounds, (e.g., clinical expertise versus research training), different modes of communication, misunderstandings regarding the level of understanding that is expected, cultural differences, disciplinary differences, etc.

- NOTE: You may want to ask mentors to consider the differences between the perspectives of a novice and an expert. As an expert, there are many steps in an explanation that you may leave out because they are second nature, or because it is hard to remember what it was like to be a novice. For example, when you see a master chef cooking, it looks easy; however, when you try the same recipe yourself, you realize that many steps have been left out of the explanation.

Learning Objective:

Mentors will learn to use multiple strategies to enhance mentee understanding across diverse disciplinary perspectives.

Activity

Identifying Strategies to Enhance Understanding (15 min)

- ASK: Ask mentors to share one strategy they use to promote understanding. You may want to record the ideas generated in this discussion on a white board or flip chart.
- NOTE: Strategies you can add to the list include:

    1. Taking a minute to consider any assumptions made about what mentees know or do not know.
    2. Taking time to remember what it was like to not understand something before I became an expert.
    3. Writing out an explanation and asking one of my peers from outside the discipline to identify all of the terms they do not understand.
    4. Asking my mentees to explain something back to me so I can assess potential gaps in their knowledge and suggest areas in which their understanding could be enhanced.
    5. Asking my mentee to explain something to another scholar or trainee.
    6. Asking my mentee to organize information with a flowchart, diagram, or concept-map.
    7. Asking my mentee to come up with an analogy from their own work that relates to our research

- NOTE: How do you know when you are qualified to assess a mentee's understanding? Be sure to include a discussion about what to do if you are not an expert in all aspects of a mentee's research program, such as when you are a secondary mentor.

Learning Objective:

Mentors will learn to assess their mentees understanding of core concepts and processes

Activity

Strategies to Assess Understanding

Have mentors generate a list of strategies that can be used to assess their mentee's understanding. Ask mentors to consider strategies that can be used in face-to-face meetings, over email, through written reports, etc. You may want to record the ideas generated in this discussion on a white board or flip chart.

Learning Objective:

Mentors will learn to use multiple strategies to enhance mentee understanding across diverse disciplinary perspectives

Activity

Reflective Listening

Mentors get in pairs or small groups and practice one strategy. One option could be having them write out, or verbally describe their research topic or study design and then ask one of the mentors from a different discipline to identify all of the terms they do not understand. They could also incorporate strategies from the handout from the *Maintaining Effective Communication* session, such as reflective listening, paraphrasing, and summarizing.

Learning Objective:

Mentors will learn to identify various reasons for a lack of understanding, including expert-novice differences

Activity

Excerpt on How People Learn

Have mentors read a summary of how people learn, paying particular attention to the results from expert-novice studies (Mestre, Jose, 2008. Brief Summary and Implications for Teaching from "How People Learn: Brain, Mind, Experience, and School."[1]). Have mentors discuss how they could better help their mentee understand one aspect of their research if they considered it from a novice point of view. Be sure to discuss how expert is defined in the context of community engaged research.

[1] National Research Council. 1999a. How People Learn: Brain, Mind Experience, and School. Commission on Behavioral and Social Sciences and Education, National Academies Press.