

TECHNICAL BULLETIN

Peer-reviewed research findings and practical strategies for facilitating effective agricultural education



Photos by (from left): Ajay Nair, Iowa State University; Aaron Ristow, American Farmland Trust; Lance Cheung, USDA

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Sustainable Agriculture Through Sustainable Learning

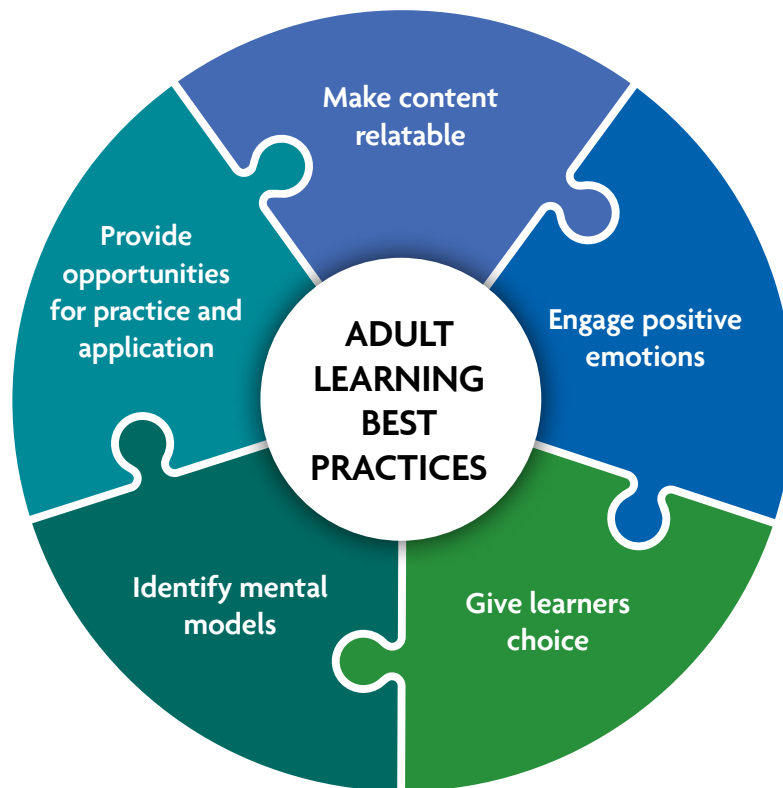
An Educator's Guide to Best Practices for Adult Learning

Learning empowers farmers to make sound decisions and beneficial changes to enhance the sustainability of their farms. The purpose of this guide is to help educators and farm advisors effectively facilitate learning for farmers, agricultural service providers and others working to improve agricultural sustainability.

In this guide we introduce **five best practices for adult learning** you can use to enhance learning in your educational programs. The five best practices are:

1. Make content relatable
2. Engage positive emotions
3. Give learners choice
4. Identify mental models
5. Provide opportunities for practice and application

These best practices are grounded in adult cognitive psychology and neuroscience research. Because the practices are based in human biology, they are applicable to all adult learners. The guide is intended to complement, not replace, other resources you may have on adult education and learning. Its value lies in its singular focus on the application of adult learning research to agricultural education contexts, and it is chock full of examples you can relate to.

FIGURE 1. The Five Adult Learning Best Practices

Tracy Robillard, Oregon NRCS

The examples we use to illustrate applications of the best practices come primarily from Extension educators and specialists in the Northeast SARE region, because most of our experience is based on working with educators from this region. As you read this guide, we encourage you to think about your work and the work of colleagues and to identify your own examples that illustrate these practices in use.

In this guide we describe how and why these practices work, and we share applications across multiple learning contexts, including workshops, on-farm field days, online courses and one-on-one instruction. Employing these best practices can improve both learning outcomes for participants and your satisfaction as an educator. Our hope is that with practice you will become confident in trying new things and that your skills as an educator will continuously grow.

In the following sections we cover each best practice in detail. First, we describe the science behind the practice. This allows you to enhance your curriculum and activities for your setting, to understand why an activity did not turn out as you planned and rework your approach, and to modify your instruction “on the fly” to adapt to unpredictable situations. Then we provide strategies and examples for how to apply the best practice. To wrap up, we provide a set of prompts to help you review the content and reflect on how you can apply it to your own educational contexts. We recommend spending time on these review sections while the content is still fresh in your mind.

We present the best practices in an order we believe facilitates learning them. However, when you apply the practices you will most likely emphasize some practices over others at different stages of the learning process. And you may use a few practices simultaneously depending on learning goals. Later in this guide, we devote a section to how you can apply the practices before, during and after learning interactions to ensure you are providing optimal support to the adult learners with whom you work.

No. 1. Make Content Relatable

Provide Opportunities for Learners to Link the Content to Their Prior Experiences and Knowledge

One of the most powerful ways to help adult learners retain new information is by making it relatable to their past experiences or existing knowledge.

The Science Behind the Practice

As an agricultural educator you may already be using this best practice on a regular basis. When you introduce a new topic, do you ask participants, “How many of you have had experience with ...?” or “What do you know about ...?” Do you find that farmers first rely on their own experiences to make sense of new concepts? Or that farmers tend to make comparisons between what they have done in the past with the new method or technology you are helping them learn? Do you use their comparisons to adjust your teaching? If yes, then you appreciate the powerful impact that linking new content with prior experiences and knowledge has on learning.

This tendency for adults to make sense of new information or experiences by making comparisons to what they already know or have done can be explained by how the human brain learns. Learning creates long-term memories that physically change the brain (Lindenberger and Lövdén 2018). To efficiently manage the multitude of long-term memories that it creates, the brain organizes them into neural networks and

Learning creates long-term memories that physically change the brain.

establishes patterns among these networks (Sloan and Norrgran 2016). When your brain processes a new experience or encounters new information it creates neural patterns that capture the attributes of the experience or information. These neural networks are located in different parts of the brain, depending on which attributes of the experience they capture. For example,



Ron Daines

consider your favorite song. The lyrics are stored in verbal regions of the brain, and vocalization of the lyrics are in the motor regions. The melody is stored in regions responsible for music, and the emotions you attach to the song are stored in emotion centers. The complete pattern of these various networks is what constitutes a memory, in this case the memory of your favorite song. When you recall the song, all the interconnected networks join up as you start singing.

As you accumulate experiences, knowledge and skills, the brain compares new patterns of neural networks (or memories) with existing ones, and it builds connections between memory networks that have similar attributes. This first happens unconsciously. When there is an overlap or matching of patterns, the pre-existing memories are reactivated (Schlichting and Preston 2014). This is why you may hear a new song and recognize that the melody

of its refrain sounds a lot like the refrain in your favorite song. When new connections and expansions of neural networks become strong through recall and practice, learning has occurred.

This phenomenon of how memories are created and associated with each other explains why, when you introduce new content to farmers, they will spontaneously recall prior experiences or knowledge that relate to the content. For example, a discussion of family dynamics and succession planning may prompt some farmers to recall their own experiences of how they inherited the family farm any number of years ago.

Because each farmer has a unique set of prior experiences and knowledge, the connections they make to new content will be unique as well. Although farmers will spontaneously make these connections, you can use a variety of strategies to facilitate this process in ways

PROFILE

Nevin Dawson, Northeast SARE
(University of Maryland Extension)



Courtesy Nevin Dawson, Northeast SARE

Imagine You're Building a House

Nevin Dawson used a simple analogy to convey the implications of excess tillage on soil health during educational programs he ran for farmers and agricultural service providers. Adapting an idea he first heard in a presentation by USDA NRCS staff, Dawson created an animated slide that compared building good soil health to building a strong house. Soil organisms like fungi, bacteria and other micro- and macro-organisms contribute to building a strong, resilient soil structure, akin to a strong “soil house of bricks.” Tillage can undermine and break down soil structure, just as a bulldozer can knock down a solidly built brick house. This simple analogy turns an ordinarily complex concept, soil health, into one that is more easily understood and meaningful.

FOR MORE INFORMATION

SARE project: Building soil health in Maryland through agricultural service provider education (2017)

Read more: https://projects.sare.org/sare_project/neumd17-001/

that benefit learning. Generally, while developing a new curriculum or learning interaction, include opportunities for farmers to share the connections they see between the new content and their existing experiences and knowledge. For both individuals and groups, examine the nature

of these connections to identify gaps in their experiences, knowledge or skills. Identify both commonalities in experience and knowledge levels, and where notable differences exist. With this information you can tailor your content to participants' backgrounds, levels of experience, types of

experience and the nature of knowledge they bring to a learning event.

At times, farmers may lack prior experiences or knowledge that directly relate to the new content, so they might struggle to make meaningful connections. This may be particularly apparent during the initial stages of learning. **You can take advantage of the brain's natural tendency to make comparisons by using analogies to experiences and knowledge in other aspects of learners' lives to help them form links to the content.** For an example of how one educator from University of Maryland Extension uses a relatable, non-agricultural analogy to help farmers appreciate the undesirable effects of excessive soil tillage see the profile “Imagine You're Building a House.”

Wrap Up

As adult learners, farmers enter learning with a wide range of experiences, knowledge and skills. Their brains are full of long-term memories that serve as scaffolding for new learning. This best practice is about taking advantage of the tendency for learners to compare new content with things they have already experienced and know. When you are aware of the connections farmers make between new content and their lives you can make the content more relatable and target the curriculum to address gaps in experience and knowledge.

How to Apply the Best Practice

Strategies for providing opportunities for learners to link the content to their prior experiences and knowledge.

- Before a learning program begins, use a needs assessment or registration survey to ask farmers about their prior experiences, knowledge and skills. For efficiency, use an online form. Information gathered from participants may include their:
 - Level of knowledge about content topics
 - Skill in target activities
 - Level and type of experiences using information or tools related to the content

While this strategy is used by many educators to design more effective and efficient programs, it is also helpful for

learners. In completing the pre-program questions, farmers begin to reflect on their prior experiences, tap into their knowledge and skills, and assess their strengths and weaknesses. This primes them to make new neural connections for learning.

- Before a group learning event, recruit one or more farmers and ask them to be prepared to share their experiences related to the content and to take questions as part of the event.
- During your interactions, ask learners to share their past experiences or current practices related to the content. Hearing the experiences of others has a learning potential as participants mentally compare their experiences to those of others. If the situation does not allow for sharing, ask learners to reflect individually and make notes. Examples of what to ask and when include:
 - Before a field event or tour, or at individual tour stops: “Does anyone have an experience about marketing the crops we’re about to see that they’d like to share?”
 - When a topic or task is introduced: “What’s been your experience calibrating sprayers? What resources do you use? What have you had the most difficulty with? Have you developed any helpful tips others might use?”
 - Before a learning activity begins: “Take a few minutes to think about one enterprise on your farm and make a list of all the inputs needed for that enterprise.”
- Ask participants to identify their best experience, worst experience and lessons learned related to the content and to share with others, either in a small-group or whole-group setting. A similar prompt is, “What worked well and not so well?” Follow with a discussion of commonalities across experiences, notable differences and what contributed to success or failure.
- At meetings or onsite events featuring peer learning among farmers:
 - Provide an opportunity for the host or guest farmer to share their experiences related to the learning objectives. Give the farmer guidance about the information you would like them to convey to help keep their sharing well focused.
- Allow participants to share situations they know of or have experienced that are similar to the host’s or guest farmer’s situation. In some situations, grouping farmers based on experience or knowledge level (e.g., beginner, novice, experienced) may be helpful for such discussions. In others, pair less experienced farmers with more experienced farmers who can serve as mentors or coaches regarding observations.
- Encourage participants to ask the host or guest farmer about the types of connections they made between their own experiences and the new method or technology when they initially started to learn about it. For example, what post-harvest storage and handling challenges were they most concerned about addressing when they began considering new storage technologies?
- Most of the strategies listed above can be adapted for use in online formats. For instance, you can:

PROFILE

Dan Severson, University of Delaware Cooperative Extension

Relatable Analogies When Learners Have Limited Experience

How do you make new information relatable to beginning farmers when many of them are coming from a non-agricultural background? Dan Severson and his colleagues ran into this challenge when they hosted a series of beginning farmer workshops starting in 2017. Many of the new farmers who enrolled in the course did not have a farming background, so their agricultural experiences were limited. To facilitate learning, Severson and his colleagues started out by using analogies to familiar experiences.

One topic that was foreign to many participants was interpretation and implementation of soil analysis reports. The educators made the analogy that interpreting and following soil report recommendations is like reading a recipe and baking a cake. You need the ingredients in the recipe in the right amounts to make a good cake—leaving out the baking powder will result in a deficient cake. Likewise, soil pH at the right level and nutrients in the right amounts are needed to produce good crops; a pH that is too low or inadequate nitrogen will result in less than optimum production.

When teaching about direct marketing, the educators compared the importance of setting up an effective marketing display to staging a house for sale. You want it to be attractive and to invite entry, with the best features up front. Once you get people into the house, you want to maintain their interest so they linger and don’t leave quickly.

FOR MORE INFORMATION

SARE project: Beginning farmer workshops (2017)

Read more: <https://projects.sare.org/project-reports/nede17-001/>

PROFILE

Olivia Saunders, University of New Hampshire
Cooperative Extension

Guided Reflections to Connect New Information and Past Experience



Olivia Saunders, University of New Hampshire Cooperative Extension

When learners come into an event with a high level of existing experience, knowledge and skills, giving them the chance to reflect can be a powerful tool for reinforcing new information and techniques. This was the case for Olivia Saunders when she designed an online education module to help beekeeping school instructors in New Hampshire improve their effectiveness as teachers. The

beekeeping school instructors were not professional educators. Rather, they were expert beekeepers and longtime bee school instructors who volunteered to teach classes and had a considerable amount of experience to draw from. Saunders designed a program that helped participants link new content to their prior experience and knowledge.

After a series of reading and video assignments about how adults learn and effective strategies for facilitating learning, Saunders asked participants to reflect on their experiences teaching bee school and then respond to a series of questions. The questions included:

- Can you think of situations in your own teaching where a strategy you used seemed particularly effective for helping learners “get it”? Using what you have learned in this program, explain why the strategy worked so well.
- Can you think of situations in your teaching where learners struggled and you felt your teaching strategy was not “connecting”? Using what you have learned in this program, why do you think the strategy did not work well?
- What feedback have you received on your teaching style—positive or negative?
- Based on the feedback you have received and what you have learned in this program, what changes do you plan to make in your teaching strategies?

These questions were purposefully designed to prompt the bee school instructors to make connections between their experiences as teachers in the bee schools and new information learned in the online resources. Try this technique for yourself to help make connections between your experiences as an educator and new information you are learning in this guide.

FOR MORE INFORMATION

SARE project: Tech transfer for New England beekeepers (2017)

Read more: <https://projects.sare.org/project-reports/nenh17-001/>

- Recruit farmers in advance to share their experiences as part of a virtual event
- Extend a round-robin invitation to all participants to share experiences or respond to experiences shared by others
- Incorporate mini breaks with quiet or music to give participants a few minutes to reflect on their experiences and make notes
- Organize small-group discussions in breakout sessions if the platform permits. Include a well-defined assignment or discussion prompt that encourages participants to make connections between the content and their own knowledge and experiences. An educator or peer discussion leader for each breakout group will increase comfort and participation.

Review Questions and Reflections

- The human brain spontaneously compares attributes of new experiences with neural network patterns established for prior experiences. In your own words, what is the significance of this for learning?
- Think of something notable you learned within the past year. Is what you learned similar to either experiences, knowledge or skills you already had? If yes, how are they similar? Does your new learning influence how you think about your earlier experiences or the knowledge and skills you already had?
- Think of a future learning event or program you are planning. Describe three specific ways you could provide opportunities for learners to make connections between the new content and their own prior experiences or knowledge.
- Identify one specific topic or skill that learners tend to struggle with. What analogy can you make between that topic or skill and something else in learners’ lives that would help them to grasp the topic or skill?

PROFILE

Jason Challandes, Delaware State University Cooperative Extension



Jason Challandes, Delaware State University Cooperative Extension



Using Small Groups to Make Cover Crop Strategies More Personal

Cover cropping is a recognized way to improve soil health. It is also a strategy that must be customized to each farm's soil, cropping system and management for it to work successfully. This is why, when Jason Challandes coordinated a multi-year education project for farmers and agricultural service providers on cover cropping, he made sure participants had the opportunity to share their experiences in small groups.

First, participants learned concepts and practical advice for application through workshops and field days. At the end of each meeting, Challandes offered small-group discussions that focused on farmer case studies to help participants apply what they were learning to their own situation. The discussion groups usually included a mix of farmers and service providers. In the small groups, participants discussed the cover cropping opportunities and challenges presented by the cases and their suggestions for addressing them. Analyzing cases prompted learners to draw on their existing knowledge and link it to new information to make critical judgments. Discussions often included participants' stories of similar situations they had encountered. Small groups then debriefed with the whole group about their conversations.

This process helped farmers improve their ability to weigh multiple cover crop decision factors and helped service providers develop strategies for better advising farmers in the future. As one service provider said, "So much amazing information. Lots of great research and ideas to incorporate into local operations."

Challandes later adapted this strategy for virtual learning. After a presentation by a content specialist about soil health/cover cropping solutions in various farm settings, participants broke into virtual small groups with a moderator where they discussed case studies and developed questions to help farmers choose cover crops. The whole group then reconvened and moderators shared results from the discussions. Elements that Challandes considered keys for success in the virtual format included:

- Informing participants in advance that there would be breakout discussion groups
- Encouraging participation in breakouts, but allowing participants to listen only if they felt uncomfortable sharing
- Recruiting breakout group moderators in advance
- Providing a well-defined focus, goal or task for the discussion groups
- Including ample time for both the breakouts and reporting back

FOR MORE INFORMATION

SARE project: Cover crops and soil health training for agriculture service providers in Delaware and the Eastern Shore of Maryland (2017)

Read more: <https://projects.sare.org/project-reports/nedsu17-001/>

No. 2. Engage Positive Emotions

Focus on Activities that Engage Positive Emotions

All people share the same set of core emotions. Positive emotions—joy and surprise—keep adult learners motivated and promote creative thinking, whereas negative emotions, such as fear and anger, can limit learning.

The Science Behind the Practice

Humans experience a range of emotions, from sympathy and embarrassment to anticipation and contentment. Emotions serve many purposes. They enable individuals to make sense of their experiences and motivate them to make decisions or take action. The expression of emotions via body language, facial expressions and vocalizations plays an important role in communication among individuals. A small subset of emotions, known as **core emotions**, are especially important in learning.

Core emotions are shared by all humans, and they developed to enhance survival. Debate exists as to the exact number of core emotions, but researchers have found that five core emotions in particular have a strong impact on human learning: joy, surprise, anger, fear and disgust. We will focus on these emotions in this best practice.

Each core emotion has a unique set of automatic physiological and physical responses when triggered (Oh et al. 2020). For example, the heart races with fear or the head recoils with disgust. Distinctive conscious feelings also accompany each core emotion, such as feeling anxious with fear or nauseous with disgust. Each emotion has characteristic facial expressions that are recognized across cultures, so you can usually tell by a person's facial expressions if they are experiencing surprise or disgust, for example. Depending on the perceived significance of the environmental trigger, core emotional responses can range from mild to strong.

Core emotional responses are initially controlled by the limbic system, found deep in the brain, which operates largely without your being conscious of it. Within a few seconds, however, outer layers of the brain in the cortex are activated and you become conscious of the experience. You are then able to “think” about the experience, react to the event in more complex and thoughtful ways, and remember it for



Courtesy Aaron Ristow, American Farmland Trust

the future. In this way, humans are able to learn from experiences that are associated with core emotions (Tyng et al. 2017). **Because events and circumstances that trigger core emotions tend to be remembered for a long time, these emotions are thought to play an essential role in survival, helping to protect individuals from threats, adapt to circumstances and explore new opportunities.**

Core emotions are typically classified as either positive (joy and surprise) or negative (anger, fear and disgust). This distinction is important in education because the types of learning that are associated with positive emotions are quite different from the types of learning associated with negative emotions. In general, negative emotions tend to fix your attention on the things in the environment that triggered the emotion, limit your ability to think through the situation, and lead to impulsive actions (Alia-Klein et al. 2020). Positive emotions, on the other

hand, tend to expand your attention, broaden your sense of what is possible under the circumstances, and motivate you to persist when challenged (Frederickson 2004).

Positive Core Emotions

When your goal is to help farmers learn new information and skills to creatively solve problems, then ensuring they experience positive core emotions when you teach is essential. The core emotion of joy is triggered when you perceive good fortune in your current circumstances. Surprise is triggered when you perceive something novel, yet safe, in your environment. **Studies show that when adults have experiences that trigger joy and surprise they tend to do twice as well thinking of alternate ways to solve problems compared to when they are angry or fearful** (Frederickson 2004). This is likely due to the role positive emotions play in helping learners remember the contextual or peripheral aspects of an

experience and apply their intuitive knowledge to situations (Talarico et al. 2009).

Joy. Joy is associated with expanding awareness and forming social bonds. Social activities enable adults to reap the benefits of social learning, such as being exposed to new perspectives and learning from others' experiences. A great way to support joy among participants is to incorporate activities in which they collaborate on a task in small groups and then present their ideas to the whole group. Encourage peer feedback after presentations that is both supportive and constructive. Even introverted learners get enjoyment from group work when they are given alternative ways of contributing to the group (e.g., as note taker, timekeeper, etc.) and when the task requires successful collaboration among group members (Flanagan and Addy 2019).

The logistics of group activities and sharing will be different in face-to-face versus online educational programs; however, including opportunities for small group work brings positive emotional benefits in both settings. In online forums, designating an educator or peer facilitator in advance will help most learners engage more easily in group activities. The more learners engage in online group activities, the more comfortable and active they become.

Surprise. Surprise is associated with alertness, curiosity and motivation. In fact, the brain has a system, called the dopamine neuron system, that is dedicated to learning when you are surprised either by being exposed to something new or when you make an error.

An innovative way of triggering surprise has been used by pesticide safety educators to help farmers learn about safe handling of pesticides (Galvin et al. 2007). In this method, prior to instruction, each participant performs a mock pesticide application with a non-toxic solution containing a fluorescent tracer. A black light shows participants the extent to which they have contaminated their skin and clothing. Participants respond with surprise and alarm and become highly motivated to learn proper handling methods.

Educators should note that when adults are uncertain about what to expect from a learning event in terms of learning goals, teaching and evaluation methods or social interaction, they are less likely to feel positive emotions. If participants feel a lot of

uncertainty in their interactions with you, then activities you hope will trigger pleasant surprise may instead cause anxiety.

To create an optimal environment to engage positive emotions—both joy and surprise—be sure to:

- Have clear learning goals
- Let participants know what types of peer interactions they will experience
- Provide clear instructions
- Be upfront about how learners will be evaluated

In the “How to Apply the Best Practice” section we describe a variety of activities designed specifically to support farmers in experiencing positive emotions during their learning.

Negative Core Emotions

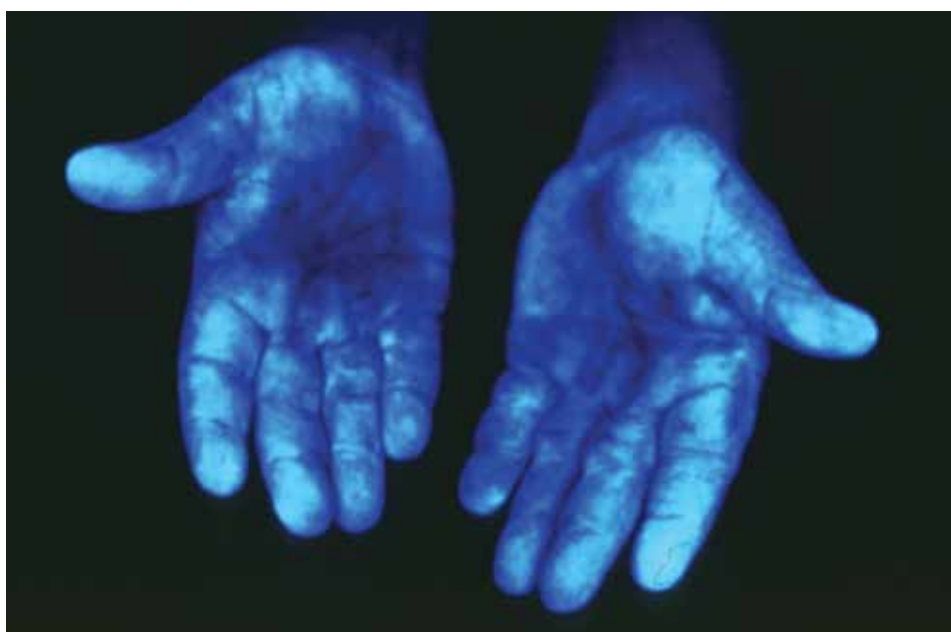
Although the focus of this best practice is engaging positive emotions to promote learning, you may encounter situations in which farmers experience negative core emotions during learning events. In this section we cover some of the science about negative core emotions to give you an understanding of how these emotions can impact learning. We also describe ways you can mitigate the situation if farmers experience negative core emotions while you are teaching.

As mentioned earlier, the human brain is designed to remember events that trigger strong core emotions. After an event

Studies show that when adults experience negative emotions, they make more mistakes in tests and are less successful in activities in which they need to apply their knowledge to solve novel problems.

in which a strong negative emotion was triggered you will likely remember every little detail for a long time. You may even run the event over and over in your head. What you learned from the experience will stay with you, but you may struggle to apply what you learned to new experiences. **Studies show that when adults experience negative emotions, they make more mistakes in tests (Kuhbandner and Pekrun 2013) and are less successful in activities in which they need to apply their knowledge to solve novel problems** (Brand et al. 2007). When negative core emotions like anger, fear and disgust are triggered frequently and for prolonged periods, the physiology of the body and brain change in ways that significantly impede any type of learning.

Anger. Anger is triggered when an individual attributes an adverse experience to someone or something. Anger motivates



Richard Fenske, Pacific Northwest Agricultural Safety and Health Center

Diffusing Anger When Addressing “Hot Topics”

Climate change and pesticide environmental risk assessment are two topics that Mary Halbleib has seen provoke anger among some farmers in Oregon. Halbleib has heard provocative reactions such as, “You’re not here to tell me the climate is changing, are you?” and “Let’s abolish the EPA” in the opening moments of meetings focused on collaboratively exploring new ways to reduce environmental impacts from agriculture. Promptly addressing such reactions is necessary to avoid an early derailment of the meeting’s atmosphere and purpose.

Halbleib offers an effective strategy for diffusing anger and moving the program into productive learning. Calmly and gently, provide an alternative perspective about what the farmers have been experiencing in recent years regarding the weather, or about how the EPA’s role in pesticide approval is key to having a range of products on the market. Following a brief discussion, the group generally agrees that the weather is more erratic now, or that yes, the EPA does play a vital role for agriculture, and participants can then move on to constructively achieve the intended outcome for the meeting. By approaching the topics in this way, words and concepts that some consider provocative and politically charged are less likely to trigger anger.

Educators may find this non-confrontational technique of diffusing anger and redirecting participants towards a productive discussion useful in many contexts.

individuals into action. The action can be reactive and without focus, as in aggression, or it can be targeted and proactive. Educators, who are frequently called upon to provide advice to farmers, should note that when someone is experiencing anger, they are less likely to take advice from others (De Hooge et al. 2014). Farmers are more likely to consider your advice if you wait until their anger dissipates.

Sometimes the content covered in a learning event may be a trigger for anger. For example, a new environmental regulation may come up that some farmers perceive as a threat to their economic viability. There are two ways educators can help farmers channel the drive to “do something” that is associated with anger. First, support farmers in learning as much as they can about the trigger so that their actions can be effectual. Second, help farmers identify others who are affected by the issue. When experiencing anger, if individuals have a reason to act on behalf of others, their responses are more likely to be proactive than reactive. In the example of a contentious new regulation, connect farmers to trusted, credible sources about the environmental rationales behind the regulations and how the regulations will affect farm decisions. Facilitate meetings among farmers who will be affected or who may

have already faced similar regulations to learn what others are doing and generate more positive responses to this change.

You can help diffuse farmers’ anger by making them feel supported and safe in their learning interactions with you, and by both allowing them to express their anger and acknowledging their viewpoints. Guide farmers in finding areas of common agreement regarding the circumstances surrounding the anger to set the stage for productive learning. For an example of how educators from Oregon State University have diffused anger around contentious topics, see the profile “Diffusing Anger When Addressing ‘Hot Topics.’”

Fear. Fear can be triggered by anything an individual perceives as a threat. In group learning settings like workshops, seminars, field days or webinars, fear may be triggered among individuals who perceive they do not “fit in” with the group, they are being singled out or that their perspectives and ideas are not being valued. A feeling of fear can cause an individual to retreat and disengage from activities.

In educational settings, depending on the social context, individuals who may be at risk for experiencing fear include members of minority racial or ethnic groups, recent immigrants, new or beginning farmers, and women farmers. As facilitator, a few

ways you can mitigate the fear of not fitting in include:

- Ensuring each individual has the opportunity to introduce themselves, and if time allows, share something they hope to learn
- Setting “ground rules” for respectful interactions
- Encouraging participants to work with individuals they do not know during group activities

Disgust. Disgust is triggered when an individual perceives something as offensive, contaminated or diseased. It functions to preserve health and safety by enabling us to quickly avoid or reject something that is potentially harmful. Sometimes, educators may want learners to experience disgust as a way to help them learn about a particular precaution or safety skill. For example, in a session about health and safety, you can drive home the risk of skin cancer and the importance of sun protection by examining photos of skin lesions caused by sun exposure. If educators design the experience carefully so that it does not inadvertently trigger fear or anger, then disgust can positively impact learning by creating a very memorable experience. With this one exception, the vast majority of experiences facilitated by educators should involve positive emotions.

Wrap Up

The key to this best practice is ensuring that adult learners experience positive emotions during learning. The positive emotions of joy and surprise support learning in myriad ways. They are particularly beneficial in supporting collaborative learning and problem solving. Educators should avoid triggering fear or anger in learners, as these emotions limit learning.

How to Apply the Best Practice

Strategies for engaging positive emotions by reducing uncertainty and supporting social interactions.

- The more participants know in advance about what to expect from learning interactions, the more likely it is they will feel comfortable and situations that cause negative emotions can be minimized. For example:
 - In program recruitment information, clearly state the program's goals for learning, the program's format, target participants (e.g., beginning or advanced level) and expectations for participation during the program.
 - If advanced registration is required, send reminders and welcome messages to participants before the program with detailed directions, parking instructions and other logistics. Include the profile of participants, in general or in specific terms (with permission).
 - In advance of an online program, send instructions for the technology that will be required for it, then conduct a technology check-in at the beginning to ensure everyone is well connected.
 - When using technology, virtually or in person, have another colleague who can troubleshoot the audience's technical challenges throughout the program.
- Invite participants to bring a learning partner. Social interaction is supported by having a trusted partner to discuss new ideas with.
- Be organized and prepared at events by having agendas, handouts, demonstrations, etc. ready ahead of time. Being well prepared allows you to focus on meeting and greeting participants at the beginning. A frazzled educator can cre-

PROFILE

Beth Holtzman, University of Vermont Extension



Suzu Hodgson

Engaging Positive Emotions in a Tractor Safety Workshop for Women Farmers

Farm mechanization can be challenging and sometimes intimidating for some women farmers, especially those who have little prior experience operating and maintaining machinery. Recognizing the need to engage positive emotions for women to learn these skills, a team led by Beth Holtzman offered a series of tractor safety and operation workshops in Vermont specifically designed for women beginning farmers (<https://blog.uvm.edu/groundwk/>). In addition to covering key concepts in tractor safety and operation, the small-cohort workshop format provided all participants with hands-on opportunities to drive, hitch a wagon/trailer and attach/detach power take-offs (PTOs). The educators' observations of participants during the workshop and participants' evaluation comments showed that this format provided a positive and psychologically safe environment that supported the women learning these traditionally male-dominated skills.

"Instead of standing back and silently watching me give instructions to one student at a time, all the students just naturally offered each other advice and suggestions," an instructor observed. "They didn't take over for each other but did point out things the current hands-on student might want to try, or just gave her encouragement. I think this gave a more positive and collaborative feeling to the whole afternoon, with the bonus that I, too, felt like I understood hitching a lot better by the end of the day!"

One of the participants said, "I think the fact it was all women participating in the course was empowering and a connecting experience. It was less stressful and frustrating, and I enjoyed it that much more."

FOR MORE INFORMATION

SARE project: Breaking barriers: Building capacity to provide tractor education (2013)

Read more: <https://projects.sare.org/project-reports/ene13-127/>

PROFILE

Elsa Sanchez, Penn State Extension



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Creating a More Inclusive Environment for Hispanic Learners

With the number of Hispanic farmers growing steadily in Pennsylvania in recent years, Elsa Sanchez led a project in 2015 to help educators better understand and address barriers to participation in Extension programs among Hispanic farmers and farmworkers. Potential barriers they identified included lack of awareness of Extension or other agricultural programming, a misperception that

programming was focused on other farmers and not them, settings that felt uncomfortable or fearful, and timing that conflicted with other obligations. While most Hispanics in the United States are U.S. citizens and are proficient in both English and Spanish, some experience a lack of programming in Spanish and fear of government or authority as barriers. Also recognized as a barrier was that many Extension educators were unfamiliar with thinking of Hispanics as farmers rather than as farmworkers.

The educators identified and committed to a variety of strategies to make their programs more inclusive for Hispanic farmers and farmworkers, such as:

- Including pictures of diverse speakers and participants in advertisements
- Advertising in Spanish and in English, and through businesses connected to the Hispanic community
- Developing a registration system that does not require internet access, an email account or credit card information, as some potential participants may not have internet access or may be reluctant to share this information
- Providing childcare or an activity for children attending events with their caregivers
- Using translators or hosting bilingual events
- If an educator is not a Spanish speaker, encouraging them to learn some key phrases in Spanish, even if it is rudimentary, to connect with Hispanic farmers and farmworkers who prefer to communicate in Spanish
- Using presentations rich in graphics rather than text
- Seeking out farmers and building trust and personal relationships. Such activities can involve taking time to find and meet individuals at their farms, community gatherings or cultural events; arriving early and staying late at events to talk; and discussing information other than program topics to develop a personal connection.

FOR MORE INFORMATION

SARE project: Creating a sense of belonging for Hispanic farmers in Extension programming (2015)

Read more: https://projects.sare.org/sare_project/ene15-139/

ate uncertainty and diminish learners' comfort and confidence.

- At the beginning of a program, review the agenda, objectives and learning formats or activities you will use, ask for questions or concerns, and respond.
- Affirm "ground rules" for respectful discussion and openness to different viewpoints.
- Include time in your agenda for participants to introduce themselves, say where they are from, why they came and what they hope to take away. This is important in both in-person and online formats. Introductions can increase feelings of personal connection, help build a collegial atmosphere and provide an important first step towards building a learning community.
- Pay attention to nonverbal body language and facial expressions to remain aware of participants' emotional states. If you notice indicators of fear or anger, pause instruction and invite participants to express any concerns, or invite participants to speak to you during a break.
- Include unstructured break time during longer events, and invite socializing and networking.

Strategies for triggering surprise and joy.

- Present relatable but startling, provocative or fun facts and figures related to content. Ask for reactions and spend a few minutes summarizing reactions before transitioning.
- Interject a surprising or humorous photograph, graphic or story that illustrates something relevant to the content.
- Every 10-15 minutes switch from presentation format to small-group or partner discussions, games or other activities. The interruptions can be short, such as mini breaks of just a minute or two for a quick question, poll or pause to reflect and jot down notes, or they can be longer breaks with time for teamwork and discussion. Try to include activities that invite movement and social interaction. Incorporating active intervals, even brief ones, will inject an element of surprise, which supports alertness and curiosity, and triggers joy, which supports social interaction and collaboration. Examples of activities include:

- **Think-Pair-Share.** Begin by posing a

PROFILE

Richard Brzozowski, University of Maine Cooperative Extension

Chicken Surprise!

The element of surprise can be used to great effect when introducing a core component of your educational program. Richard Brzozowski did just that when he brought the element of surprise into workshops about small-scale poultry production. During a workshop discussion about assessing the health status and potential pests of poultry, Brzozowski produced crates with live birds for participants to physically examine and assess. For those new to poultry production, this was certainly a novel experience that focused attention well, inspired curiosity to learn and provided a hands-on opportunity to develop important skills. Participants worked with partners to inspect the birds, discuss what they observed and relate their observations to what they had learned about poultry pests and health status indicators. Later, working together, participants learned how to slaughter and process the chickens. The workshop culminated with the group preparing and sharing a chicken dinner, where the positive emotions evoked by the day of collaborative learning were evident in the smiles.



Richard Brzozowski, University of Maine Cooperative Extension

FOR MORE INFORMATION

SARE project: Professional development for agricultural service providers in applied poultry science (2010)

Read more: <https://projects.sare.org/project-reports/ene10-116/>

question related to the content to participants. Give time for everyone to think and write down their ideas. Pair individuals with a partner to share their ideas. If time allows, pairs share their ideas with the whole group.

- **Brainstorm** (verbal) or **Brainwrite** (written). Describe a problem, issue or challenge related to the content. Ask participants to work in pairs or small groups and brainstorm a variety of ways to address the problem. Encourage participants to be creative and not to be concerned with logistics or resources that would be needed to enact an idea. Allot time to share ideas with the whole group.
- **What Do You See?** Show a picture or video related to your topic and ask a discussion question, such as “What do you see in this picture/video?” or “What is wrong with this picture/video?”
- **Object Pass Around.** Pass around objects or specimens related to the topic

and invite participants to examine them. Then, invite discussion. (This might be an opportunity for triggering some memorable disgust.)

- **Agree? Disagree? Why?** Hand out cards containing statements related to the content or show a slide with a statement. Statements may be provocative or value laden, or may address common myths or misperceptions about the content. Have participants read cards and then discuss whether they agree or disagree with the statement, and why.
- **Poll.** Incorporate a quick poll and discuss results. A variety of formats can support polls, such as electronic clickers, colored or numbered cards that participants can hold up, cell phone poll apps, placing dots on a poster or flip chart, or moving to different locations in the room to vote.
- **Quick Quiz.** Ask brief quiz questions (written or verbal) or tests of knowledge and experience about a topic before and/or after addressing it. If at

a field event, conduct a quick quiz before or after a field or tour stop.

Review Questions and Reflections

- Think of a memorable “positive” past learning experience. What two or three things do you remember about it? Did anything relate to the emotions of joy or surprise? If yes, how? Were any other emotions involved?
- In what ways do the positive emotions of joy and surprise promote learning?
- If you are working with an adult learner who is feeling very angry or fearful, how might their learning be impaired? How might you manage these negative emotions if they manifest during learning?
- Think of a future learning program you are planning. What three things could you do to ensure that you focus on positive emotions during it? In your answer, be specific about how you can include joy and surprise to promote learning.

No. 3. Give Learners Choice

Give Learners Choice in Content, Process and Outcomes

A learner-centered educational program gives participants choice in content, processes and outcomes, which motivates them to stay engaged.

The Science Behind the Practice

Choice is a powerful motivator in adult learning. Like basic emotions, perceiving and making choices are regulated by brain functions designed to help humans survive and thrive. Humans need to perceive they have choices in order to have a sense of control, or **agency**, over their environment. Otherwise, they would constantly feel threatened: on “high alert” and in “survival mode.”

Agency is the capacity of an individual to act on their own behalf. Agency is important in fundamental aspects of adult life, like relationships, work and productivity, creativity, and learning. In adult education contexts, offering adults opportunities to make choices as they learn promotes agency. Choice is essential in developing the drive, or motivation, to learn.

The link between choice and motivation

is supported in brain research (Leotti et al. 2010). When individuals are presented with a choice, parts of the brain responsible for processing reward—the reward neural network—is activated. **Simply having a choice activates the reward network, and when a choice is made, the network reinforces the perception that what was chosen feels like a reward.** This explains why, if you offer adult learners the opportunity to choose their own topic for a project, they will value that topic and enjoy working on it more than if you assigned them the exact same topic. Choice makes the difference between “my project” and “your project” (Figure 2).

Learners will also be more motivated to do well in the project, to persist if they run into obstacles and to develop a personal connection with the topic. These are characteristics of **intrinsic motivation**. Intrinsic motivation is the result of a complex set of neural networks that become active once individuals engage in an activity of their

choosing. These networks are responsible for adults wanting to engage in the activity, keeping their attention focused on the activity, and enabling them to think about the activity and themselves as interconnected rather than as separate entities.

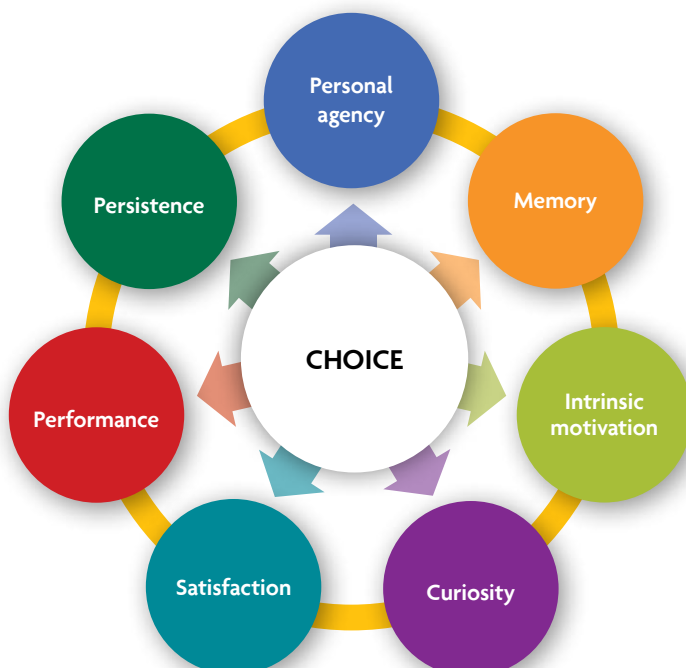
The perception of choice and the outcomes of making choices benefit learning in a variety of other ways (Murayama et al. 2017), including:

- Choice enhances curiosity.
- Choice enhances our ability to remember things related to the choice.
- Choice reduces stress associated with learning. It does this in two ways:
 - Choice regulates emotions. Giving someone a choice when they are upset acts like a “reset button” for negative emotions. It helps calm them down.
 - Choice reduces cognitive dissonance (i.e., the mental discomfort associated with having two conflicting beliefs or values). Although cognitive dissonance can challenge individuals to seek out new learning to resolve the conflict they feel, too much dissonance can be stressful and can shut down learning. Offering choice at this juncture can jump start learning again.

The benefits of choice occur when choices are directly relevant to learning, for example choosing a topic for a project, choosing when to submit a project, or choosing the members of a project team. Benefits also occur when choices are relatively inconsequential to learning, for example letting learners pick the order in which they present their work to the whole group. Because the brain processes making a choice as a reward, even a seemingly insignificant choice, like letting learners pick the color of the markers they use on flip chart paper, can serve to regulate emotions and enhance motivation.

When you are considering how to offer choice during agricultural programming, three areas to think about are the learning

FIGURE 2. The Positive Impacts of Choice on Adult Learning



content, process and outcomes. **Content** refers to the curriculum (topics and/or skills) to be learned. **Process** is the actual methods you use to teach as well as the processes adults may use to learn, such as reading, taking notes, memorizing and talking with peers. **Outcomes** refer to learners' growth in knowledge, skills and values, and the ways their accomplishments are demonstrated or displayed.

As agricultural educators, you will want to take into consideration *when* to offer farmers choice during their learning. **Giving farmers choices that directly relate to the content early in a learning event or program is especially helpful in promoting engagement among individuals who initially have a low level of interest.** In a half- or full-day workshop, you can use breakout groups within the first hour or two and give participants a choice about what aspect of the content their group will focus on for review or application. For example, in exercises targeted to planning and budgeting, give farmers the choice to form groups based on crop enterprise of interest. For study related to food safety requirements and product specifications, let farmers group by market channel. When discussions focus

When you incorporate opportunities for adults to make choices about their learning, even in small ways, you create a learner-centered environment.

on cover crop decisions, offer the option to form groups based on crop rotation. And for learning about personnel management options and regulations, give farmers the choice to group by labor concern. This combination of early social interaction and choice can be very effective in getting farmers actively engaged.

You can offer similar choices in online learning events by allowing farmers to select learning modules with content most relevant to their interests and immediate needs. Or provide choice in instructional formats such as readings, videos, narrated presentations, podcasts and interviews. With online discussion forums or ques-



Lance Cheung, USDA

tion and answer sessions you can also offer choice of content for discussion and the method for communication (e.g., written or virtual meeting).

As knowledge and skills advance, offer choices that help farmers manage obstacles they encounter during learning. You can do this strategically on an individual or group basis. For example, if you notice a group is stuck on a problem and members are getting frustrated, you could offer them the choice to take a break, start over, consult with another group, pick a different problem or use additional resources. As farmers become more advanced, motivate them to excel even more by offering choices in the types of problems to solve, how they would like to receive feedback, or ways in which they can share their knowledge and skills with others. When working with an individual farmer, ask them to explain their choices as a way to promote more self-awareness.

The profile "Giving Learners Control in an Extended Train-the-Trainer Project" illustrates how two educators offered choice in content, process and outcomes to participants at three key points in a train-the-trainer course.

Adult learners can assess their own growth and their peers' with self-tests, skills practice and reflective journals. You may not find it feasible to offer learners choice in outcomes in brief learning events, like an hour-long webinar or a conference session. In longer events or programs that involve multiple meetings over time, either in person or online, giving participants choice in how to demonstrate their growth and accomplishments can be very rewarding and enhance

their drive to continue learning after a formal program is over. In long-term events and programs, choices for learners may include:

- Demonstrating a skill and getting feedback from peers and the instructor
- Designing an original case study or scenario and explaining how they resolved it
- Developing "self-quizzes" with answer keys for peers
- Keeping a record of their efforts and results using new strategies or skills to share for feedback

Wrap Up

Some educators feel their job is done if they have "covered the content" with little regard for learners' experiences, knowledge or accomplishments. This teacher-centered approach is often characterized by educators using just one or two teaching methods, like a lecture and slides, and limited ways to assess learning outcomes. When you incorporate opportunities for adults to make choices about their learning, even in small ways, you create a learner-centered environment that fosters engagement, motivation and ownership. In the next section we provide more ideas about how you can offer learners choice in content, process and outcomes.

How to Apply the Best Practice

Strategies for offering choices in content.

- Conduct an online learning needs assessment prior to an event or program. Provide a list of topics or skills and ask farmers to

PROFILE

Ellen Mallory and Tom Molloy
University of Maine Cooperative Extension



Ellen Mallory, University of Maine Cooperative Extension

Giving Learners Control in an Extended Train-the-Trainer Project

Ellen Mallory and Tom Molloy led a train-the-trainer project on soil health that integrated opportunities for choice throughout, putting the participating service providers in control of their learning in the following ways:

- Early on, participants could choose to join one of three cropping system-focused teams (potatoes and grains, dairy or mixed vegetables).
- Participants could then sign on at their preferred level of commitment: as a core member, who received technical and financial support and committed to either working with at least one farmer per year on an on-farm demonstration trial or developing an educational resource such as a case study; or as an associate member, who helped identify needs and participated in their team's educational events.
- As learning progressed, teams could choose how they used what they were learning to support farmers. Through team meetings they identified farmers' needs and planned on-farm demonstrations and educational resources to meet those needs.

Importantly, throughout the project, Mallory and Molloy provided customized support for each team, including advice on demonstration ideas and design, on-the-ground assistance establishing demonstration plots and collecting data, coordination of cover crop seed orders, distribution of announcements for field days and farm tours, and inter-team communication.

FOR MORE INFORMATION

SARE project: Strengthening knowledge, skills and networks for soil security in Maine (2017)

Read more: <https://projects.sare.org/project-reports/neme17-001/>

indicate their priorities. Use this information to customize your curriculum.

- Review the agenda at the beginning of an event and again at break points for longer events. Invite feedback about changes farmers may want.
- During a learning event, provide opportunities for farmers to break into small groups for discussion or learning exercises based on content preferences, or to rotate among a few different groups of their choosing.
- For a learning exercise, prepare a few different scenario problems and let farmers choose which one they would like to work on.
- Ask farmers to choose a situation, problem or enterprise from their farms to use as their example in practice or problem-solving exercises. If personal examples will be used as a group exercise, then recruit volunteers who are willing to share ahead of time and give them the option to keep their example anonymous.
- In a multi-day workshop, put up a list of topics after lunch on the first day and let each farmer select a topic. Ask each individual to become the “resident expert” on that topic and to prepare a single poster sheet of topic highlights learned during the last day, to be presented on the last day. For review and wrap up on the last day, put posters on walls and let participants walk around to read, comment or ask questions. This strategy can be modified for an online course, where participants post their topic highlights on a bulletin board or wiki document.
- In an online course with components or modules, such as multiple areas of farm law, allow farmers to choose the modules most relevant to them and work on those first, leaving other components for later study as needed.

Strategies for choices in process.

- Before a learning program, provide a variety of online resources and let farmers choose which ones to review. This could involve reading articles, visiting websites or blogs, following a Twitter feed, watching videos, or working through a simulation.
- When you prepare your materials for an educational program, be ready with

- a variety of presentation formats (e.g., slides, videos, reading materials, sample equipment, models, simulations, etc.) and a variety of activities (role playing, case scenarios, short quizzes, student-led discussions or question and answer sessions, problem-solving, etc.). During a program, keep attuned to engagement levels and be ready to offer alternate formats or activities, either to all participants or to subgroups, if applicable. Offering the option to switch things up can stimulate interest and motivation. Even an alternate method or activity lasting just 2–5 minutes is enough to get participants re-engaged.
- During an in-person event, give farmers choices in how they can record their experiences and document their learning. Offer paper and pens for note-taking

and/or diagraming. If appropriate, allow participants to audio or video record portions of the event.

- Make slides available online after an in-person event. If an in-person event is recorded, provide a link to the recording after the event. If a webinar, record the session(s) and provide a link to the recording(s).
- If your program involves providing feedback to farmers about their learning, give them a choice about the feedback process (e.g., verbal and/or written, individual or group, in person or virtually, peer feedback or instructor only).

Strategies for choices in outcomes.

- In multi-day programs, in person or online, offer choices in how learners demonstrate their growth in knowledge, skills

and/or values. Examples include:

- In a question and answer session, offer the options of having a participant read aloud the response from a peer or of partners sharing their answers with each other.
- Provide time for written responders. For those who write their responses, offer the option of having a peer read aloud a response.
- In a skills demonstration, let farmers choose the order in which they demonstrate.
- If you need to assess growth in knowledge and/or skills via a standardized test, you may not be able to offer choices in testing mode. However, in helping farmers prepare for a test, offer a variety of formats to self-test or

PROFILE

Seth Wilner, University of New Hampshire Extension



Lance Cheung, USDA

Offering Choice Through Agenda Review

Seth Wilner thinks offering adult learners choices in their learning is critical. Assessing needs during planning and then designing the program agenda and facilitation strategy based on those needs is an important first step, but only a first step. Wilner also reviews the agenda and seeks agreement on it as part of every workshop. “That’s essential in my opinion for getting buy in and encouraging participants to take ownership,” Wilner says. “I want to provide the opportunity for the participants to tell me if I got it right—if the agenda looks like it’s going to address the reasons they came. Maybe there is a missing topic or, for example, maybe we should discuss one topic before another.”

Whenever possible, Wilner makes adjustments according to feedback.

For example, when teaching agricultural service providers at a weekend event, there were four major topics to be covered: effective adult education principles, leadership and communication, labor management and practical applications of whole-farm planning principles. Wilner led with the basics of adult education but then gave choice on both the order and the length of the remaining session topics. The participants, by majority decision, rearranged the agenda and shaped the event to meet their needs. Along with determining the agenda topics, participants also chose the activity type, be it small-group, large-group or individual learning activities.

Wilner also revisited the agenda at break points to check how everyone was doing, to look ahead at topics and time remaining, and to ask if the plan still looked good. When he does this at his educational events, he often receives requests for change. While it gives participants a sense of ownership, Wilner notes there can be challenges to this approach. If there are other educators or content specialists involved in the program, then revisions can be more difficult because the changes they request can sometimes be focused on topics that are too narrow or in depth. Facilitators also must be adept enough in the content area to be able to make adjustments on the fly, and confident and secure enough to decline to make an adjustment when there is a good reason not to, such as when they are not prepared to address a requested topic or when the change would deviate too far from the stated focus of the event. In this situation, they should share their reasoning.

PROFILE

Sidney Bosworth, University of Vermont Extension



Deb Heleba, Northeast SARE

Offering Choice When Assigning Content and Outcomes

When Sidney Bosworth led a training series to help farmer educators and advisors improve their knowledge of pasture weed and forage plant identification, he incorporated choice to help drive home the information.

Through hands-on, in-person training retreats and follow-up webinars, participants first built a solid foundation of knowledge about weed and forage species, growth cycles, plant characteristics, and management strategies for weed control or optimizing yield and quality of

forages. Then, as part of the learning plan, Bosworth asked each educator to choose a weed or forage species of interest and develop a helpful fact sheet about the plant's identification, growth characteristics and management considerations in pastures.

By developing fact sheets on plants of their choice, participants translated their learning into a useful collection of resource materials for farmers and other educators. Bosworth offered participants an additional choice in outcome from their learning: the opportunity to apply for a small amount of funding to offer an educational workshop or similar learning opportunity for farmers about pasture weeds and forage plant identification and management.

Bosworth advises that participants need support from the facilitator, such as a template for fact sheets, assistance finding information sources and coaching before a workshop, to follow through successfully on applied projects such as these, and it is important to budget adequate time to provide this support.

FOR MORE INFORMATION

SARE project: Professional development project in weed and forage identification and management (2014)

Read more: <https://projects.sare.org/project-reports/ene14-130/>

test peers, such as generating questions and possible answers, written or oral quizzes, demonstration, video recording responses, etc.

- If you are working with an individual farmer over time, offer choices in how they demonstrate their growth in knowledge, skills and/or values. Depending on the learning goals, options could include:
 - Demonstration of skills
 - Business records
 - Research project records
 - Personal written, audio or video journals
 - Graphic drawings or concept maps
 - Verbal description of how problems were identified and decisions were made
 - Question and answer session

Review Questions and Reflections

- Fill in the blanks in this sentence:
 - When individuals are presented with a _____, a network in the brain responsible for processing _____ is activated. Simply having a _____ activates this network, and when a _____ is made, the network reinforces the perception that what was chosen feels like a _____.
- List four ways choice positively impacts adult learning.
- Reflect on an experience you have had as an Extension educator when a group of learners did not seem very engaged. If you could do it over again, how would you incorporate two opportunities for the participants to make choices in their learning to improve their engagement?
- Think about an upcoming learning event or program you are working on. How, specifically, could you offer the participants a choice related to:
 - The content they will learn
 - The processes or methods they will use for learning
 - The outcomes or ways they can demonstrate their learning or growth

No. 4. Identify Mental Models

Identify Learners' Tacit Mental Models About the Content

The combination of knowledge and unconscious biases related to an aspect of an adult's life, such as family or farming, is called a mental model. Mental models can impact how and what farmers learn. Understanding these mental models can help educators design programs that enable farmers to succeed.

The Science Behind the Practice

In addition to core emotions and valuing choice, the human brain has evolved other ways to ensure we survive and thrive. As described in the first best practice (make content relatable), one of these ways is the spontaneous, unconscious process of comparing and organizing things you encounter based on their similarities to things you already know or have done. This is an efficient way for the brain to manage the barrage of information it processes, and it aids in memory formation, storage and

Mental models can only be changed by new experiences that are significantly different from routine prior experiences.

recall. The downside to this focus on efficiency is that it inevitably leads to making assumptions about new situations without taking the time to assess all their important characteristics. In social psychology, the term **implicit bias** is used to describe what happens when people make unconscious, automatic assumptions about other people, leading to stereotypes. Yet the brain's tendency to "cut corners" and "put things in boxes" results in unconscious biases about practically everything in one's life, not just how we view other people. We cannot avoid forming unconscious biases; they are an evolutionary adaptation of human brains. But we can become more aware of them and recognize that they play a role in our judgments, actions and how we perceive the world.

In large part, unconscious biases are a reflection of the types of experiences a person has had. At the same time, people gain knowledge through their experiences. This combination of unconscious biases and knowledge related to an aspect of one's life is called a **mental model**. Adults develop mental models about all important aspects of their lives, such as family, work, education, recreation and government (Jones et al. 2011). Your mental model about government, for example, will be reflected in your values, preferences, expectations and assumptions about government, and conceptions of how government works or is supposed to work. Your mental model will also guide you in political decisions and actions you take.

Farmers who participate in your educational programs will have mental models that relate directly or indirectly to the content. For example, an experienced produce farmer coming to an educational program about weed management will have an existing mental model about weed management. Their mental model will be reflected in their **knowledge** of weed species on the farm and the problems they cause, their **values** about such things as chemical use, their **preferences** for prevention or control management strategies, their **expectations** about the outcome of specific interventions and their **assumptions** about the ease or difficulty of changing practices. The farmer's mental model will be reflected in their past weed management practices, and it will influence how receptive they are to new information presented in the educational program.

Because adults develop mental models about key aspects of their lives, it is no surprise that farmers have mental models about farming. The past 15 years have seen a surge in research about farmers' mental models. **Findings show that mental models exert a strong influence on decisions farmers make about their operations, ac-**

Important Features of Mental Models

1. Mental models are evident in the values, preferences, expectations and assumptions a person has regarding an aspect of their life.
2. They are based on and limited by the type and extent of a person's experiences.
3. The knowledge component of a mental model can be accurate or inaccurate, depending on the limits of a person's experience.
4. Mental models are largely tacit, meaning adults are not aware of them unless they make a conscious effort.
5. Mental models tend to be self-reinforcing. They guide a person to engage in activities that align with the mental model, leading them to prefer similar experiences in the future.
6. Mental models can only be changed by new experiences that are significantly different from routine prior experiences.

tions they take and how they seek out and engage in educational opportunities (Hoffman et al. 2012). Farmers' mental models about farming often overlap with their mental models about other aspects of their lives, like family, community and health (Eckert and Bell 2005).

Agriculture educators, too, have mental models about farming, which may or may not coincide with the mental models held

PROFILE

Tom Morris, University of Connecticut Extension



Gerry Dincher

A Dairy Farmer Expands His Mental Model About N Fertilization

Tom Morris has worked with quite a few dairy farmers who believed that corn yield was proportional to nitrogen fertilizer rates. It took negative experiences like years with low yields despite higher rates of nitrogen application, combined with mounting societal pressure to reduce nitrate pollution of water bodies, before farmers were open to adopting new practices.

This quote from a discussion Morris had with Frank, a dairy farmer, illustrates a mental model of fertilizer application based on the erroneous assumption that more is better:

“The year before when we had so much rain, I was very concerned about losing yield from nitrogen loss in the field, and I want, you know, to get maximum yield. I don’t believe in losing yield especially if it only takes more nitrogen. This year, we didn’t have as much rain and the corn looked great. I know you said we should take some corn stalk samples to see how much nitrogen accumulated in the stalks ... and we took the samples. The stalk results were really high, and you recommended I cut back my nitrogen by 20–30 pounds per acre. But I can’t do that and risk getting a low yield. I don’t care how much nitrogen is in the stalks; I’m after maximum yield.”

The following year Frank had lower yields that he could not explain, and the corn stalk results showed excessive nitrogen at harvest. He was puzzled and sought out assistance again, asking Morris many questions about what, besides nitrogen, could be the reason for the low yields. After much discussion, Frank decided to pay more attention to weed control, planting dates and compaction, and he began to routinely use new methods, such as the corn stalk nitrate testing, which was cost-shared by NRCS. He used the test results to adjust manure and fertilizer applications for groups of fields.

Frank saw his fertilizer bill drop, and his corn yields did not suffer. His old assumptions about yield and nitrogen management foundered. Frank later joined a group that Morris was facilitating with local farmers who were in various stages of adopting these nutrient management methods for corn crops. Through sharing experiences, Frank continued to gain new knowledge of and appreciation for the variety of nuanced factors that can come into play when making decisions to maximize yields and to apply profit-maximizing fertilizer rates. In this way his mental model of fertilizer application expanded and became more complex, enabling Frank to more effectively address problems that might arise.

by the farmers they work with (Jabbour et al. 2013). Educators' mental models are informed by their own personal and formal educational experiences, their training in scientific research, and their work with colleagues and farmers in different settings. Educators' expertise enables them to assess challenges faced by farmers and offer recommendations for changes in practice. However, if educators' recommendations are not consistent with farmers' mental models, farmers are not likely to implement the changes. For example, farmers who value and practice organic methods are not likely to participate in on-farm trials or use pest management strategies that are not consistent with those values (Eckert and Bell 2005).

In working one on one with a farmer, you can ask questions and observe practices to become more aware of the mental models that underlie the farmer's practices, and tailor your suggestions and resources accordingly. In group settings, particularly short-duration gatherings, identifying mental models of participants

Agricultural educators cannot change a farmer's mental model, but they can support the farmer in gaining new knowledge and experiences that will enable change.

that relate to the content can be more of a challenge. However, there are strategies you can use to get a good appreciation for the range of knowledge, values, assumptions and preferences held by participants and can use that information to adapt the content to facilitate learning. We describe a variety of these strategies in the "How to Apply the Best Practice" section.

In some instances, farmers may base their practices on incomplete knowledge or erroneous assumptions that go untested until they experience a major setback that requires being open to new information and reconceptualizing their sense of "how things work" (Eckert and Bell 2006). Even though mental models tend to be self-reinforcing, they can change when an individual has new experiences that are significantly different from routine past experiences. Agricultural educators cannot change a farmer's mental model, but they can sup-

port the farmer in gaining new knowledge and experiences that will enable change. The experiences of Frank, a dairy farmer in Connecticut, illustrate how this change may occur. (See the profile "A Dairy Farmer Expands His Mental Model About N Fertilization.")

You may be tasked with developing a new curriculum or updating an existing one. The curriculum may be targeted to a specific group of farmers, such as beginning women farmers, or to a specific topic or skill set, like supervising farm workers. As you design the curriculum, take into consideration the mental models of target participants that may impact their learning. A study by Jabbour et al. (2013) provides a good example. The authors interviewed 23 organic farmers in New England states about their knowledge, beliefs, assumptions and practices related to weed management. They uncovered two commonly held misconceptions about weeds: 1) seeds of most of the weed varieties on farms can live in the soil for 20–80 years, and 2) weeds are indicators of soil nutrients. To address

these misconceptions, Extension educators modified their weed management curriculum so that they included materials that focused on weed seed longevity, and they introduced weed management in terms of soil health, rather than the science of ecological complexity.

Wrap Up

This best practice highlights the importance of identifying the mental models farmers have that may impact their learning. You can use this knowledge to tailor your programs in ways that better attend to participants' mental models and address knowledge gaps that may underlie erroneous assumptions and misconceptions.

Next, we describe activities you can use to apply this best practice. The activities will also enable farmers to become more aware of the assumptions and biases they have related to the content. This aware-

ness is the foundation for being receptive to trying out new ideas and skills. Because each farmer's mental model related to the content is unique, based on their own set of knowledge and experiences, educators must ensure that the setting in which the activities occur is respectful, non-judgmental, and engages positive emotions as much as possible.

How to Apply the Best Practice

Strategies for identifying mental models related to the content.

- When working one on one with a farmer, the following open-ended questions may be especially useful in identifying for both you and the farmer aspects of their mental models that relate to their learning needs:
 - What problem have you had with _____? How did you go about addressing it?
 - Can you tell me what led you to decide _____? What type of things did you consider when you made that decision?
 - You seem to feel strongly about _____. Can you tell me a bit more about why you feel so strongly?
 - What do you find most rewarding about _____? Why is this so rewarding?
 - What do you find most challenging about _____? Why does this seem so challenging?
 - What do you see as the greatest obstacle for making changes in _____? Why does this seem like a big obstacle?
 - What is the key factor for your success with _____? Can you tell me more about this factor?
 - What is one thing that might make this new practice, _____, work for you?
- Before or near the beginning of an educational program, conduct a survey of participants to ask about their specific interests and expectations for the program. For example, ask:
 - What is one question you want to leave this program with answers to?

PROFILE

Katie Campbell-Nelson, Northeast SARE (Cornell Cooperative Extension)



Katie Campbell-Nelson, Northeast SARE

Gaining Insights into Farmers' Mental Models with Props

Katie Campbell-Nelson designed a creative and engaging activity that can provide insight into farmers' mental models in any context. It may be particularly useful when you want to uncover mental models and discuss them in a positive environment, such as at the beginning of a process to understand a problem and seek solutions, or when conducting long-range planning.

The activity includes a bag of props. In Campbell-Nelson's case, she uses random items from the home and farm such as a straw hat, a nut and bolt, a small statue or unique seed. The props have no clear connection to each

other or to the topic of the event (for example, farming, soil, sustainability, managing weeds, etc.). Participants choose a prop from the bag and receive instructions to complete this prompt: The [topic or item relevant to the event] is like [this prop] because ...

Participants have a few minutes to write their responses and then take turns sharing them. The connections participants make between their prop and the topic offer glimpses into the knowledge, personal views and assumptions participants have about the topic. Campbell-Nelson and her colleagues use the insights to identify barriers or misconceptions they may want to address, or viewpoints and values that can serve to motivate participants. Participants may also hear things in the responses of their peers that give them new insights and prompt them to reflect on or reconsider aspects of their own mental models about the topic. After using this exercise, Campbell-Nelson has often heard comments such as, "I've never really thought of it in this way before, but ..."

This activity takes advantage of the brain's natural tendency to look for connections and to make analogies between something new and what it already knows and has stored in memory. Note that this activity also covers the best practices for offering choice and triggering positive emotions of surprise and joy; it's fun to select an interesting object from a grab bag, use it in a creative thought game and share your impressions with others in a low-risk setting.

- What is your primary motivation for enrolling in this program?
- What do you hope to be able to do by the time you leave?
- What is one thing you know or have heard about _____?
- A survey of participants is most efficiently done before a program or event via an online survey. This way you can review the responses to inform your preparation of materials and prepare a summary to share with participants at the event. When you share the summary of responses, ask participants to react. Find out if they are surprised by anything. Point out how you will address expectations or viewpoints expressed in the survey.
- If it is not possible to contact participants before an event, you can present the questions on a slide. Have index cards or paper on seats upon arrival and ask participants to respond to the prompts you provide. You can then proceed in a few different ways, depending on the nature of the event:
 - Collect cards or papers with responses and review during a break. Use the responses to guide your facilitation during the rest of the event.
 - If the content is likely to challenge participants' assumptions or values, have learners keep the cards and revisit their answers at the end to see how their responses may have changed. This can be done individually, in pairs or in small groups. Use their reflections as the basis for review and wrap up, highlighting any changes in assumptions and/or values.
- When there are many participants or when time is limited, ask for volunteers to share responses. Summarize responses on one flip chart sheet and review. Highlight responses that set the stage for the content.
- With a small number of participants or when time is not limited, have participants form groups and summarize their responses on a sheet of flip chart paper. Sheets can be put up on walls for all to review, or, if time permits, each group can summarize their responses. Follow either method with a

PROFILE

Heather Faubert
University of Rhode Island Cooperative Extension



Heather Faubert, University of Rhode Island Cooperative Extension

Factors Underlying Blueberry Varietal Preferences

Sometimes, you can learn a lot about farmers' mental models by exploring seemingly straightforward details about their farms. When Heather Faubert organized a session about blueberries at the large New England Fruit and Vegetable Conference, she set out to learn why farmers selected certain blueberry varieties over others.

Before the conference, Faubert interviewed 15 growers and asked them about the blueberry varieties they were growing. What was their preferred variety, and why was it preferred? What variety were they least satisfied with, and why were they dissatisfied?

Then, at the beginning of the conference session, Faubert presented the results from the pre-conference interviews and opened up the conversation to the 120 session participants. Many of the farmers enthusiastically contributed their experiences and preferences about blueberry varieties and the reasons for them.

Information shared about preferences for or against varieties provided direct insight into factors that were important in the farmers' mental models about successful blueberry production. The summarized discussion notes, which Faubert posted in the presentation section of the conference website, provided a source of new learning for farmers who may want to reconsider their choices and for Extension educators who advise farmers on selecting blueberry varieties. Based on feedback from some participants, Faubert recognized that she could make future conversations more meaningful for farmers and uncover greater complexity in their mental models by framing the discussion using different production contexts including climate zones, soil types and cultural practices.

brief discussion in which you highlight responses that set the stage for the content.

- To help farmers uncover their own mental models as well as learn more about the mental models of others, ask farmers in groups of two or three to share one or more things they know or believe to be true about a topic or practice.
- Activities that may provide insight into participants' mental models of farming include "quality of life" statements, which farmers are coached to write in Holistic Management whole-farm planning, and "mission statements," which beginning farmers often write as part of beginning farmer education.

Review Questions and Reflections

- In your own words, how do individuals develop mental models about aspects of their lives? From a brain science perspective, what purpose do mental models serve?
- Reflect on an occasion in which you worked with a farmer who seemed to base decisions on assumptions you knew to be false. How did you handle it? What was the outcome? Using what you now know about mental models, describe one or two additional ways you could have handled it.
- List three assumptions you have about sustainable agriculture. Do these assumptions influence your teaching? If yes, how?
- Reflect on what you have learned so far from this guide about adult learning best practices. Has anything you've learned challenged your mental model of how to be an effective educator?
- Think of a future learning event or program you are planning. What could you do before the event or at the beginning of the event to gain an appreciation of the mental models participants have related to the content?

No. 5. Provide Opportunities for Practice and Application

Let Learners Practice and then Apply the Content to Genuine Problems

Letting learners practice using new knowledge and skills helps ensure they will remember and apply them. Providing opportunities to apply what they have learned to real-world problems prepares learners to address challenges they may encounter in their work.

The Science Behind the Practice

This best practice covers two important strategies to ensure that adults use what they have learned in your events once they return to their work. The first strategy is about **creating opportunities for learners to revisit and practice** the lessons learned, whether they are scientific concepts or points of policy, a set of manual or technical skills, or troubleshooting protocols and strategies. The second aspect involves **providing real-world or genuine problems that learners can relate to and can solve by applying their knowledge and skills**. We discuss the science behind each strategy in the following sections.



Kate MacFarland, USDA Forest Service

Deliberate Practice

From a neuroscience perspective, the more an activity, either mental or physical, is repeated, the stronger and more efficient the neural networks become that represent the activity. This increases the likelihood learners will recall and apply the knowledge or skills associated with the activity when needed (Hill and Schneider 2006). Even very complex activities, like driving a car, can be

apply safe driving principles. All the while, your basic ability to drive remains on “auto-pilot.” For an example in agriculture, a dairy farmer needs to thoroughly understand the calving process and have the necessary skills so that when problem calvings arise they can focus on troubleshooting the situation and not be preoccupied with trying to recall the basics of calving.

Neural networks representing knowledge and skills developed through mistakes are longer lasting than those developed relatively easily without mistakes.

repeated so often that they become automatic and do not require much conscious thought to perform. This is one more way the brain favors efficiency. By automating frequently repeated knowledge and skills, the conscious brain is freed up to focus on how to apply them to current circumstances or special problems. Imagine driving in torrential rain. You become hyper-aware of the challenge, assess the situation each moment and consciously decide on how to

As an educator, the more you give learners chances to recall key concepts and practice essential skills, the more likely it is they will be able to apply their new knowledge and skills when challenges or opportunities arise. Fortunately, researchers have identified the most effective ways for instructors to guide learners through the processes of recall and practice. This set of strategies is called **deliberate practice** (Ericsson 2008).

Before we describe what deliberate

practice involves, let’s go over what it does not involve. Deliberate practice **does not** involve:

- Rote memorization, reviewing material already read, prolonged repetition of concepts or skills, or imitation of physical actions (These strategies are appropriate at the very early stages of learning to establish initial neural pathways, but learners should discontinue them after they develop a basic familiarity with the content.)
- Being “right” or “wrong.” As learners strive to reach higher performance goals, harsh judgement about the success of an effort will undermine progress.
- Prolonged periods of independent practice in seclusion

Now that we know what it is not, the **core concepts of deliberate practice** include:

- The overall goal is to fill in gaps in knowledge and skills, not to repeat what has already been mastered, so practice focuses on specific, well-defined performance goals that pose a modest challenge for learners. Performance goals can

be set by instructors or in collaboration with learners.

- Practice is relatively brief. Simple goals or self-quizzes may take less than a minute of practice; complex goals may require a few hours.
- Practice requires learners to retrieve or recall information from memory without the use of prompts.
- Mistakes are helpful. Neural networks representing knowledge and skills developed through mistakes are longer lasting than those developed relatively easily without mistakes (Metcalf 2017).
- Errors guide subsequent rounds of practice.
- Instructors, coaches or slightly more advanced peers are available to provide immediate, constructive feedback. Feedback focuses on the effectiveness of strategies learners used as well as the outcome of the practice.
- As learners progress, practice for one goal is interspersed with practice for other goals, and the time between practice sessions increases.

As you review the list, imagine how you might include this type of practice in one of your educational programs. The box “Practice Your Knowledge About Adult Learning Best Practices” includes an example of a quick deliberate-practice activity involving knowledge retrieval. Go ahead, give this self-quiz a try now.

If we were in a workshop setting for this self-quiz, instead of checking your work by looking up the names of the best practices, you could share your responses with another participant for feedback. If you were the workshop instructor, you could review the group responses to identify if any of the best practices tended to be overlooked, and then review that content specifically before moving to the next topic.

When you are preparing a learning program, incorporate brief deliberate-practice activities like the one just described. These activities may reveal much more about learners’ skill levels and knowledge than asking open-ended questions like, “Do you understand?” or “Does anyone have questions?” Be sure to establish a positive “learning culture” where mistakes are viewed as learning opportunities and not as failures.

PROFILE

Rachel Bespuda, Jean King and Joe Bonelli,
University of Connecticut Extension



Rachel Bespuda, University of Connecticut Extension

Deliberate Practice in a Workshop Series on Sustainable Livestock Production

In a series of classroom and field-based workshops, Rachel Bespuda, Jean King and Joe Bonelli taught farmers and agricultural service providers about nutrition’s role in sustainable livestock production. Participants learned about topics such as livestock nutrition, pasture management, forage quality and grazing. The educators included a variety of hands-on opportunities for practicing key knowledge and skills in the curriculum, including:

- Body condition scoring on cattle, swine and small ruminants
- FAMACHA testing and fecal egg counts on small ruminants to assess parasite load
- Forage growth assessment using a pasture stick and quadrant
- Collecting a uniform hay sample
- Testing for soil compaction

Instructors provided feedback to participants and used group discussions to help participants identify ways to continue to improve their knowledge and skills.

FOR MORE INFORMATION

SARE project: Nutrition’s role in sustainable livestock production practices (2017)

Read more: https://projects.sare.org/sare_project/nect17-001/

Practice Your Knowledge About Adult Learning Best Practices

You have just read about five adult learning best practices. To the best of your ability, recall and write down the names of at least three of the five practices. Take one minute for this task. When you are done, go back through the guide and check your work. Correct the wording for any best practices if needed. Write down the names of any practices you omitted.

PROFILE

Olivia Saunders, University of New Hampshire Extension



Olivia Saunders, University of New Hampshire Extension

Using Learners as a Source of Genuine Problems

An example of individuals working on their own genuine problems comes from Olivia Saunders' education module for bee school instructors. First, Saunders shared concepts about adult learning during the course. Then for homework the bee school instructors had to take their previously taught lessons they thought needed improvement and redesign them or add new features using concepts they had just learned. For example, Saunders asked them to think about how they could improve a lesson plan where learners frequently had trouble mastering a challenging concept or skill, or whether they could enhance comprehension by using a new approach to either how they explained concepts or organized a hands-on component.

Afterwards, Saunders and the bee school instructors met for an in-person workshop in which participants shared their redesigned lessons and new ideas to utilize in their bee schools. The group trialed some of the new educational activities designed by participants, and shared critiques and suggestions.

FOR MORE INFORMATION

SARE project: Tech transfer for New Hampshire beekeepers (2017)

Read more: <https://projects.sare.org/project-reports/nenh17-001/>

Integrating practice activities into your learning events requires expertise of the content as well as the ability to identify specific knowledge and skills important for learners to remember at key points throughout the learning process. The profile "Deliberate Practice in a Workshop Series on Sustainable Livestock Production" describes how a group of Extension educators incorporated deliberate practice of key skills into a workshop series.

Genuine Problems

As adult learners practice and develop strong memories for essential knowledge and skills, the next step is for them to engage in real-world activities that require them to apply what they know and can do. Through application to real-world problems, adults move from having discrete sets of knowledge and skills to having broader, interconnected abilities and a greater understanding of contextual factors that impact application (Sarathy 2018). **In addition, when learners can connect their own experiences with those presented by a gen-**

uine problem, they are more intrinsically motivated to keep working on the problem when they run into challenges.

When you design an educational program, incorporate opportunities for learners to both practice knowledge and skills and to then apply them to genuine problems. This applies to all types of programs, from a comprehensive course-based curriculum to a single workshop or webinar. One source of genuine problems is the learners themselves. Most farmers will be able to describe challenges they have experienced that can become the focus of a problem-solving activity. Depending on the learning objectives, you may ask individuals to apply their knowledge and skills to address a problem on their own farm or ask a group of learners to address a problem volunteered by one of the group members.

While genuine problems based on the experiences of participants are likely to be relatable and stimulate interest, they can have elements that fall outside the content being addressed and require application of knowledge and skills that learners have not yet developed. To ensure that the problems

learners focus on are appropriate for their ability levels and the educational context, many instructors design their own genuine problems. **Scenarios** and **case studies** are two formats you can use to present problems to your learners. They are especially adaptable to a variety of learning contexts. Use Table 1 as a guide for deciding when a scenario or a case study might be more appropriate in your particular context.

Regardless of the source or format of the genuine problem, use the following prompts to structure the activity so that learners apply their knowledge and skills effectively and further develop their problem-solving skills. These prompts are appropriate for both novice and advanced learners. Depending on the context and available time, you may ask learners to:

- "Think aloud" as they work through the problem and explain the reasoning they are using to assess it, prioritize the issues and decide on a course of action (Ericsson 2006)
- Describe assumptions or biases underlying their decisions

- Explicitly describe the knowledge and skills they applied to the problem scenario or case
- Identify what knowledge, skills or resources they need to improve based on their work on the problem scenario or case, and how they can go about making those improvements
- Identify a challenge they have faced or may face in the near future that has characteristics similar to those depicted in the problem, and describe aspects of their work on the problem they could apply to that personal challenge

Benefits of peer collaboration. Each of the prompts listed above requires individual learners to be introspective and reflective. However, this does not mean they should address the prompts in isolation. Studies show that learners benefit in numerous ways when prompts such as these are em-

bedded in collaborative problem-solving activities and when they work together on genuine problems (Luckin et al. 2017).

Learners who collaborate are more motivated, creative and successful in resolving problems compared to individuals who work alone. Novice learners in particular benefit from collaboration because it enables them to address problems that exceed their current ability levels and to expand their knowledge and skill base in the process. The benefits extend beyond the classroom to farmers who collaborate with peers to address problems they experience on their farms. For example, dairy farmers who met regularly in “discussion clubs” with peers became more proactive at solving problems on their farms, and their bottom line improved as well (Hansen 2015). Consider facilitating collaborative activities such as these dairy farmers’ clubs in your educational programs. You can design

opportunities for collaboration in both in-person and virtual settings by organizing pairs or small groups for discussion, peer interviews, practice exercises or working on scenarios or case studies.

Wrap Up

This adult learning best practice is essential for ensuring that farmers retain the knowledge and skills you have helped them to develop and to apply what they have learned to real-life challenges they may experience on their farms. This best practice requires you to incorporate opportunities for farmers to deliberately practice their knowledge and skills into your learning plan or curriculum. **Brief, focused, frequent, low-risk practice with immediate feedback usually works best.** To strengthen interconnections among discrete knowledge and skills, farmers need to apply what they have learned to genuine problems they can relate to. Structuring problem activities so that learners work together in pairs or in small groups is particularly effective in expanding farmers’ abilities to address problems that arise on their farms.

How to Apply the Best Practice

Strategies for deliberate practice and application to genuine problems.

Better for in-person settings:

- Practice using and calibrating tools for cultural practices such as on-farm energy monitoring, irrigation monitoring, tillage, weeding, spraying, etc.
- Present scenarios to participants and ask volunteers to role play how they would identify and resolve the issues. Examples of roles include buyer/seller, employer/employee, farmer/advisor and farmer/inspector.

Adaptable to both in-person and virtual settings:

- Practice creating financial plans, marketing plans or enterprise budgets using software or other tools.
- Practice creating marketing signs, logos, merchandising displays or online ads.
- Practice assessing soil test results and field management data and history, and then apply the results to make nutrient management decisions.

TABLE 1. Formats for Presenting Problems

Scenarios	Case Studies
<ul style="list-style-type: none"> • Often fictitious, designed to highlight specific real-life issues • Appropriate for novice learners or in contexts where time is limited and participants have varied levels of experience or backgrounds (e.g., a one-hour workshop) • Relatively simple with limited focus • Brief, may be addressed in minutes • Require learners to apply a narrow set of knowledge or skills • There is often a “best” or “correct” way to address issues • May depict errors or omissions made that learners must identify and correct • Cues are provided to guide learners toward the optimal outcome • Can be resolved with materials at hand • Well suited for pairs or small-group formats 	<ul style="list-style-type: none"> • Based on real-life experiences or events • Appropriate for more advanced learners and in contexts where learners can spend blocks of time on the case • Complex, may include a variety of issues • Lengthy, may require a few hours to address • Require learners to apply a broad range of knowledge and skills • No clear “best” or “correct” ways to address issues • Require learners to consider alternatives, prioritize issues, identify trade-offs • May require seeking and using materials that are not immediately at hand • Well-suited for a collaborative small group format, may involve division of labor among group members

PROFILE

Tom Morris, University of Connecticut Extension



Courtesy USDA-NRCS

Supporting Dairy Farmers in Nutrient Management through Practice, Application and Peer Collaboration

Managing nutrients efficiently requires the ability to both collect and interpret data from multiple sources, then know what actions to take based on what the data say. In a sense, it's like trying to solve a puzzle. Drawing from more than 25 years of experience working with dairy farmers to manage nutrients in corn production, Tom Morris, a key collaborator in a project led by Karl Guillard, also from UConn, used this analogy to create an engaging tool that illustrates all aspects of this best practice.

The tool, called the Nitrogen Fertilization Puzzle Solver, is used in small groups at meetings to help learners practice data interpretation. Farmers receive data from their fields about soil nutrient levels, rainfall, management history and, in more recent years, aerial images. These data are the “clues.” They then use a sheet that helps them interpret what the clues mean in terms of how sufficiently fertilized the corn was and whether the soil likely had too much, too little or an optimal amount of nitrogen available.

Farmers then practice obtaining different interpretations from the Puzzle Solver based both on their results and on scenarios where the results are higher or lower than their actual measurements (for example, scenarios that assume much higher or lower rainfall). The farmers then decide if the suggested management changes would solve the puzzle of how much nitrogen they should apply. In this way, participants combine their prior knowledge and experience with knowledge and skills gained from practice with the tool to make informed management decisions about manure and nitrogen fertilizer applications on their own farms.

Although each farmer focuses on the genuine problem of nutrient management on their own farm, they discuss their data and thought processes with peers. Over the course of several years, farmers meet routinely in small groups with other local dairy farmers whom they trust and respect. By sharing data, farm circumstances and constraints that factored into their decisions, and by making a commitment to support each other's learning, members develop a breadth and depth of knowledge and become more adept at managing nutrients on their farms.

FOR MORE INFORMATION

SARE project: Improved N management for corn using aerial images, Adapt-N, chemical and biological tests, and cover crops (2018)

Read more: https://projects.sare.org/sare_project/Ine18-363/

- Practice assessing an energy audit, a GAP inspection report, or IPM scouting and forecast data, and use the results to create an action plan.
- Use site visits or videos from sites, mock-ups of samples, or aspects of benchmark enterprises as sources of scenarios or case studies. Examples of sources include marketing displays, signage or advertising; animal handling; crop management; marketing enterprises; and labor and time management on farms. Guide participants through learning application activities with questions such as: “What do you think is the primary issue or concern?”; “What questions would you have for the operator?”; “What course of action would you recommend?” or “What might you do differently and why?”
- When engaging learners in activities such as those described above, include time after the exercise to debrief. In the debrief, highlight any gaps in knowledge or skills and assess the strengths and

weaknesses of strategies participants used in the scenario. Also, include an “action planning” activity so that participants leave with plans for enhancing their knowledge and skills and for applying them to their own enterprises.

- Provide resources and/or take-home activities or assignments to support learners in following through with their action plans. Examples include online resources like websites, wiki documents, blogs or apps, and print documents like budget tools, calibration sheets, decision support tools, planning workbooks, checklists and data/observation recording sheets.
- With permission, invite participants to share contact information with each other so they can continue to learn from and support each other after learning events. You may also build ongoing peer collaboration and learning into your program from the beginning by inviting participants to enroll with a learning partner or pick one early in the program who will be a willing contact for questions and feedback as they practice and learn.

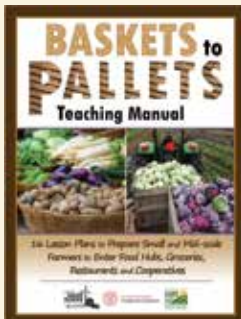
Review Questions and Reflections

- In your own words, what is the relationship between deliberate practice and memory?
- How do learners benefit when they apply their knowledge and skills to genuine problems compared to generic problems?
- How do learners benefit when they work with peers on genuine problems compared to when they work alone?
- Think about an upcoming learning event or program you are working on.
 - What is one essential concept or skill that will be covered in the event or program?
 - Describe a brief activity you could include that would provide a deliberate practice opportunity to strengthen participants’ memory of the concept or skill.
 - Briefly outline a scenario or case study that depicts a genuine problem that requires use of the concept or skill to solve.

PROFILE

Violet Stone, Cornell Cooperative Extension

Incorporating Deliberate Practice and Application of Knowledge and Skills in a Wholesale Market Training Curriculum



For direct marketing farmers, making the decisions to enter new wholesale markets requires much planning and, in most cases, new knowledge and skills. To help them through this process, agricultural educators and service providers in New York led by Violet Stone developed a comprehensive curriculum and teaching manual and delivered it through a series of regional workshops. The curriculum, called Baskets to Pallets, contains multi-component modules on a variety of needed skills. Each module in the guide is rich with de-

liberate practice and application opportunities for farmers. Here is a sampling from the course’s marketing module:

- Farmers first learn tips for approaching prospective buyers and listen to recorded interviews from buyers about their product needs. Next, they divide into small groups and conduct a buyer/seller role-playing exercise where they practice introducing themselves and making their pitch to a buyer. Members of the small group provide peer feedback. Volunteers from small groups then repeat the role play for the entire group and receive feedback from all participants.
- After learning about sell sheets (which communicate information about a farm and its product offerings for wholesale buyers), branding and labeling, farmers work in small groups to critique sell sheets from example farmers and discuss key features about the farms and the products that the sell sheets were communicating. They also critique sample product labels for messaging and regulatory compliance. Following these activities, farmers create labels for their own products.
- After learning about different forms of collaborative marketing relationships, how to form them and keys to relationship success, farmers in small groups work through a checklist for evaluating collaborative relationships and a questionnaire designed to assess prospective partners. They also try their hand at constructing a mutually satisfactory contract using an example worksheet.
- Small groups also discuss problem scenarios with collaborative marketing, such as inadequate post-harvest handling capacity and dealing with variability in certification and credentials among farms. The small groups come up with possible solutions. The larger group then offers the small groups feedback and additional thoughts on their ideas.

FOR MORE INFORMATION

SARE project: Baskets to Pallets: Preparing small- and mid-scale farmers to enter food hubs, groceries, restaurants and cooperatives (2014 and 2017)

Read more:

<https://projects.sare.org/project-reports/ny17-001/>

https://projects.sare.org/sare_project/NENY14-001/

Applying Best Practices Throughout Learning

This guide is intended as a resource for ongoing use. You will enhance your effectiveness as an educator when you practice applying the five adult learning best practices before, during and after the learning interactions you design and facilitate, whether they are single events, courses or one-on-one consultations with farmers.

Some best practices can be particularly helpful before learning interactions, such as identifying participants' mental models about the content. Other practices, such as providing opportunities for deliberate practice and applying content to genuine problems, are especially effective at sustaining learning after direct interactions. All five can be applied during events, courses and long-term consultations.

Before Learning Interactions

The planning stage is a crucial time to give attention to the best practices. At this stage, this guide can be used in two ways. First, you can enact some of the best practices to develop a profile of learners who plan to participate in your program. For example, for programs involving multiple participants, survey learners to gain an understanding of their mental models and their prior experiences related to the content, as well as their preferences in terms of con-



Preston Keres, USDA

tent, process and/or outcomes. You can gather the same type of information prior to one-on-one interactions with a farmer via an informal "intake interview."

Second, you can use the survey or interview results to tailor your curriculum and

learning activities to the group or individual. The Planning Grid for Using Adult Learning Best Practices in Educational Activities in this section can guide you through planning how to incorporate the five best practices into a learning event, course or consultation. Use the grid to record your decisions regarding the best practices you plan to apply before, during and/or after the learning interactions. In the boxes, describe the activities you will use to put a best practice into action. Feel free to reproduce this grid and modify it in any way that works best for you.

During Learning Interactions

Review the guide shortly before you meet with learners to prepare yourself to respond to new learning needs and opportunities that may arise during the interaction. Having a solid plan based on the best practices is essential, and so too is the ability to apply the best practices on the fly as you adapt to learners' needs and experiences in real time. Keep the social and emotional climate positive and remember that even a small surprise unrelated to the content can be a powerful motivator for learning.

PROFILE

Rachel Bespuda, University of Connecticut Extension

Sustaining Learning Through Communication and Sharing Resources

As described in the livestock nutrition profile shared earlier in the section about deliberate practice, Rachel Bespuda helps participants sustain their learning through a listserv that she actively manages. She established this method of communication after asking participants their preferred way to stay connected, and it helped participants form an ongoing learning community. On average, Bespuda emails the group once a month with articles, fact sheets, videos and other educational resources on topics that relate to and build upon concepts taught in the classroom and outdoor workshops. Ideas for resources to share come from not only the project team and content specialists but also from the participants themselves.

FOR MORE INFORMATION

SARE project: Nutrition's role in sustainable livestock production practices (2017)

Read more: https://projects.sare.org/sare_project/nect17-001/

Planning Grid for Using Adult Learning Best Practices in Educational Activities			
Best Practice	Before	During	After
Provide opportunities for learners to link the content to their prior experience and knowledge			
Focus on activities that engage positive emotions			
Give learners choice in content, process and outcomes			
Identify learners' mental models about the content			
Provide opportunities for practice and application			

PROFILE

Beth Holtzman, University of Vermont Extension



Tracey Coulter, Pennsylvania Department of Conservation and Natural Resources

Sustaining Learning through Learning Circles

When Beth Holtzman ran a train-the-trainer project to equip agricultural service providers with improved program evaluation skills, she used ongoing engagement as a central learning strategy. Educators first built their knowledge and skills about evaluation concepts and strategies through in-person workshops and follow-up interactive webinars. They were able to select topics based on their interests. To help the educators apply the learning to their work, Holtzman then organized them into virtual learning circles. Circle members initially met online to discuss how they planned to apply new concepts and skills in an upcoming evaluation-related challenge or task in their work. They shared methods and tools they planned to use and received feedback and advice from others. Initially, the learning circles met bimonthly and participants posted their planned actions and timetable in a Google Doc that Holtzman provided. The document became a tracking tool that members referred to and updated as they made progress toward their goals.

Holtzman has learned a few things from her experiences organizing the learning circles. First, it worked better when circles included two people versus three or four. This was in part because scheduling meetings was much harder for larger circles. Also, the more closely aligned partners were in their program areas and in their needs for improvement, the more successful the circles. For example, educators sharing a need for improved surveys to assess on-farm changes related to water quality formed a strong and productive learning circle. Holtzman also found that using Google Docs to record discussions and activities in the learning circles gave her a great tool for monitoring progress and identifying participants who may be struggling to complete tasks or who may need additional guidance.

FOR MORE INFORMATION

SARE project: Enhancing evaluation capacity to improve sustainable agriculture programs and outcomes in Vermont (2017)

Read more: <https://projects.sare.org/project-reports/nevt17-001/>

Remain mindful that participants will make sense of new information based on their prior experiences and that their mental models will influence their receptiveness to new information. **Adopt the mindset that your objective is to facilitate learning rather than to “cover the content.”** Facilitating learning may require a shift in how you manage time. Allot ample time for participants to share their experiences with each other, to practice key knowledge and skills, to receive feedback, and to apply their new knowledge and skills.

After Learning Interactions

At the conclusion of your educational interactions, new learning has just begun for participants. Be proactive about ensuring that support is in place for participants to continue their learning. This may mean following up on take-home tasks such as completing checklists or inventories, tracking data about follow-through actions, being available for follow-up questions, or facilitating continued communications and networking among farmers through in-person or online meetings, social media platforms and listservs.

Educators sometimes struggle with supporting participants' ongoing learning after direct interactions end. This may be for a variety of reasons, such as shifting their focus to the next event or pressing demand on their schedules, or feeling as if their job is completed once direct contact is over. The profiles in this section provide two examples of ways educators have successfully sustained participants' learning after educational events.



Deb Heleba, Northeast SARE

Putting It All Together

The following case example illustrates how one educator has applied all five of the adult learning best practices before, during and after a learning event. You will note that the educator applied multiple best practices in each timeframe and applied some practices more than once.

PROFILE

Seth Wilner, New Hampshire Cooperative Extension

Farm Financial Management Course: A Case Example of Adult Learning Best Practices in Use

BEFORE

Pre-Course Survey and Self-Study Resource

Gathering information from a pre-course survey helps educators identify pre-existing mental models and knowledge gaps, and design programs based on learners' needs. It also serves as a tool allowing learners to begin the process of making connections between the content and their prior knowledge and experience.

Farm financial management is an educational topic of utmost importance to farmers that can also be difficult and frustrating for many, causing some to approach it with trepidation. With the financial management course he teaches, Seth Wilner surveys farmer participants about their experience, concerns and struggles related to the subject. He uses that information to shape how he teaches the subject, focusing on making connections to their experiences.

Wilner has learned that new terminology is one significant source of negative emotions that causes frustration and trepidation. When survey results indicate participants have moderate levels of prior knowledge and experience, his first step before the course starts might be to break down this language barrier by sending registrants a list of finance terms and definitions participants will learn about.

Addressing the barrier of terminology before the course minimizes negative emotions and sets the stage for engaging positive emotions when the course meets.

Providing a helpful resource for self-study before the course is another tool that enables farmers to begin the process of making connections to prior knowledge.

DURING

Orientation at the First Class

Reviewing the agenda in relation to the survey results is an opportunity for farmers to make connections between the content and their prior experience and knowledge. Acknowledging the prior experiences of participants promotes positive emotions.

When the group gathers in person for the first class, Wilner spends a few minutes reviewing the agenda and responding to questions about it. He shares results from the pre-course survey in aggregate so participants can make connections between the results and agenda decisions and know the diverse levels of knowledge, skills and concerns the group is bringing into the course.

Orientation also includes talking about and soliciting agreement on group norms: how they are going to function as a learning community, with concerns welcomed and viewpoints respected. Wilner encourages the farmers to pay attention to their emotions. If they find themselves getting frustrated or angry about something, then he asks them to please ask a question or express a concern before shutting down. He asks them to also pay attention to whether they are getting bored. Are you on your phone? Spacing out? Talking with a friend? Checking email? If so, he asks that participants let him know so he can check in with the group to assess if a change of pace, topic or teaching method is needed.

Establishing group norms and acknowledging the role of emotions in learning helps promote positive emotions and build a safe and inclusive learning community.

Acknowledging the possibility of negative emotional reactions and offering participants a constructive way to deal with them helps promote a positive learning environment.

DURING (continued)

Enterprise Budget Terminology Exercise

Steps in this exercise include:

Giving farmers a choice in the enterprise of focus for the exercise makes it more likely they will value the exercise and persist if they run into challenges.

Fielding questions from farmers provides glimpses into their mental models related to the content. The points that Wilner brings to the whole group for further discussion often relate to common biases and perceptions or misperceptions about costs in different production systems, such as organic versus conventional.

- Farmers choose an enterprise on their farm for which they want to develop a budget (e.g., high tunnel tomatoes) and make a list of every cost they can think of that goes into this production enterprise.
- Farmers go through the list and put an up arrow (↑) next to any cost that goes up the more they produce (e.g., grafted rootstock, stakes)—these are **variable costs**.
- Farmers then put a horizontal arrow (→) next to anything that does not change (e.g., the cost of a high tunnel or tractor)—these are **fixed costs**.
- Farmers look at all the fixed costs and identify anything they use for more than just that production enterprise. They put an (i) next to them—these are **indirect costs**.
- Lastly, farmers identify any fixed costs that are used only for that production enterprise. They put a (d) next to them—these are **direct costs**.

Throughout this enterprise budget exercise, as farmers are individually marking up their lists, Wilner circulates among participants and responds to questions about costs or items to include in the list. He brings questions to the whole group for further discussion when appropriate.

Allowing farmers to make their own list of costs draws upon their prior knowledge and experience related to their chosen enterprise, and helps them make meaning of the new terms.

Hearing others' questions can broaden individuals' mental models and enhance connections they make between the content and their own prior experience and knowledge.

Deliberate Practice Activities

Giving farmers the choice to focus on enterprises that interest them the most during the individual and group practice exercises enhances their intrinsic motivation to learn and apply the content to genuine problems back on their farms.

The farmers aren't finished learning about enterprise budgets after the first exercise. There is practice time, and this may be structured as individual or group practice. An individual practice assignment may involve farmers choosing three enterprises on their farm, writing down the variable and fixed costs, and deciding whether each cost is a direct or indirect cost.

For group practice, Wilner may survey the group to identify the crops they would most like to develop an enterprise budget for. Farmers divide into small groups by enterprise to work through the budget exercises together. As with the initial budget terminology exercise, Wilner checks in with learners during individual or group practice sessions to respond to questions and share questions and answers as needed with the group.

Engaging farmers in small groups to practice new skills allows for immediate peer feedback.

Sharing experiences, perspectives and decision-making processes among peers can expand mental models about the content and potentially about other aspects of their production systems that may be discussed during the exercise.

AFTER

Providing take-home resources enables farmers to continue practicing and applying the new knowledge and skills they have learned.

After the event, having an emphasis on farmers learning together and from each other sustains learning. This encourages a sense of community and leads to positive emotions and opportunities for farmers to work together to apply their knowledge and skills to genuine problems they encounter on their farms.

Tools, Support and Community

For educators, with the end of an event, course or consultation comes the reality that they must move on to their next responsibility. Learners, too, return to their busy farm or work lives. Recognizing this, Wilner employs several strategies to help farmers continue learning and applying their new farm financial management knowledge and skills, including:

- Wilner provides information guides and worksheets from the course as resources to make it easier for the farmers to incorporate good financial recordkeeping into their work routines.
- During the last 30–60 minutes of the course, Wilner facilitates a discussion with farmers about how he can best support their continued learning with each other. In the past, this has included Wilner hosting periodic Zoom meetings, holding regularly scheduled virtual office hours, or offering a web-based listserv for sharing information and group members' questions and answers. Wilner passes out paper for farmers to exchange contact information for future follow up with each other.
- In the closing discussion Wilner asks farmers about additional educational programming they need to continue their learning. This information informs development of new workshops, projects and even grant applications.

Offering choices continues into the post-event phase of learning. Soliciting farmer preferences about future programs serves to identify needs, inform development of programs and enhance farmer motivation to participate in the future.

Adult Learning and You: Applying the Best Practices to Your Own Professional Development

You can have a positive impact on the adults with whom you work when you apply the five adult learning best practices in your teaching. You can also use these best practices as a guide for your own professional development as an educator. Two practices are particularly relevant to supporting your development: identifying your mental models related to adult teaching and learning, and employing deliberate practice in honing your “craft.”

Identifying Your Mental Models of Teaching and Learning

The mental models you have about adult teaching and learning can be a powerful underlying influence on how you teach, how you interact with learners, the expectations you have for learners and for yourself, and how you go about your own professional development as an adult educator. The nature of the mental models that guide you as an educator are reflected in your values, assumptions, expectations and preferences related to teaching and learning. **Most often, you are likely unaware of the influence these attributes have on decisions you make and behaviors you exhibit as an adult educator. However, you can engage in activities that help to “surface” aspects of your mental models so that you can be aware of them.** Articulating your mental models allows you to examine them and open them up to change.

Prompts like the ones in the box “How to Uncover Your Own Mental Models” can assist you in articulating aspects of your mental models. The wording for prompts will vary based on the nature of the mental models being explored. We have designed these prompts specifically for mental models about adult teaching and learning. Going through the prompts can be a particularly useful exercise if you find yourself grappling with a recurring challenge in your teaching or are somehow feeling “stuck” in your practice. At the end of the exercise, you may find yourself questioning long-held assumptions about your role as an educator or having new perspectives about farmers as adult learners. You can also go through the prompts as a way to guide your overall professional development as an adult educator. You may find that some

HOW TO UNCOVER YOUR OWN MENTAL MODELS

Step 1. Complete each prompt as spontaneously as possible.

1. My primary role as an educator in agriculture is ...
2. I can tell farmers learn in my courses (or workshops, field days, etc.) because ...
3. When farmers do not learn in my courses (or workshops, field days, etc.) it is mostly because ...
4. The most important factor that determines whether a farmer makes changes to their operations after participating in one of my courses (or workshops, field days, etc.) is ...
5. I am at my best as an educator when ...
6. I am at my worst as an educator when ...
7. Three things an educator should never do are ...
8. Three things an adult learner should never do are ...
9. The most challenging part of being an adult educator is ...
10. The best way for me to become the best educator I can be is ...
11. Three obstacles that may keep me from being the best educator I can be are ...

Step 2. Review and reflect.

Review each of your responses to the prompts and consider:

1. Are you surprised by any of your responses? What surprised you and why?
2. Did any of your responses make you feel uncomfortable? In what way?
3. Did you learn anything about yourself as an educator?
4. Based on what you learned about yourself, is there anything you could change in your craft as an educator? What could you change?
5. Are there any resources that would benefit you as you try to make the change?

of your responses become the catalyst to experiment with new methods or technologies, brainstorm with colleagues, or seek out new resources.

A mental models articulation activity has two steps. The first step involves responding to prompts. The second step involves reviewing and reflecting on your responses. When you engage in the first step, you want to create conditions that quiet down the conscious thinking part of your brain so that you are more likely to express more tacit or hidden thoughts. Be spontaneous and non-judgmental when responding to prompts. Do not rehearse in your head your answer to a prompt before responding. Write down your **initial** response to each prompt. You can go back and add to a response if an additional idea occurs to you a bit later, but do not go back and change your initial response. Do not concern yourself with grammar or spelling, or with using complete sentences. Use single words or short phrases, or even a quick graphic image if it pops into your head.

After responding to each prompt, move to the second step. Review your responses. Let yourself react to them. If you have been grappling with a specific challenge or have a specific goal in mind for enhancing your teaching, review your responses through that lens. Assess if any of your responses provided a new perspective or consideration related to that challenge or goal.

Go through the activity now, and then repeat it any time you would benefit from an increased self-awareness of the mental models that guide your craft as an educator.

As your knowledge and skills become second nature you will become more comfortable and flexible responding to unpredictable situations and more likely to recognize opportunities to experiment with novel approaches.

FIGURE 3. Cycle of Deliberate Practice in Teaching and Learning



Employing Deliberate Practice to Hone your Craft as an Adult Educator

The fifth best practice addresses the need for learners to practice knowledge and skills and then apply them to genuine problems. As an instructor, you can employ deliberate practice strategies to increase your knowledge and skills in teaching and learning so you are better prepared to meet the challenges inherent in helping farmers grow and make changes. As your knowledge and skills become second nature you will become more comfortable and flexible responding to unpredictable situations and more likely to recognize opportunities to experiment with novel approaches. The overall goal for deliberate practice is that you strive to become as knowledgeable, skilled and confident in strategies to facilitate adult learning as you are in your agricultural areas of specialty. And, like the need to keep up to date in your agricultural discipline, deliberate practice in adult teaching and learning is an ongoing endeavor.

As described previously, the hallmarks of deliberate practice include setting performance goals that pose modest challenges; practicing for relatively brief periods and relying on your memory as you practice; keeping track of your performance, particularly errors; and obtaining feedback from a variety of sources. Based on these features, we have developed a Cycle of Deliberate Practice in Teaching and Learning that you can use to guide your deliberate practice efforts. The steps guide you to reflect, set goals, practice and get feedback (Figure 3).

Reflect

The cycle starts with reflecting on the areas in which you can improve as an instructor. A great place to start is with the self-knowledge you gained through the process of identifying your mental models about teaching and learning. That process often results in becoming more aware of aspects of your craft as an agricultural educator you would like to change. Feedback you receive about your efforts is also a valuable consideration during reflection.



Courtesy Josef Görres, University of Vermont

Set Goals

Once you have identified what you would like to change, select one or two specific goals you can strive towards during a set time frame. For example, if you have limited experience with webinars and would like to become more skilled in conducting them, one goal could be to enhance your knowledge about the technical aspects of running a webinar over the next two months. A second goal could be to become proficient in using breakout rooms for small group discussions over the next four months. Set your goals so that they are a “comfortable challenge”—you want to achieve them with some effort, not abandon them because they are unreachable.

Practice

Depending on the type of goal you set, the practice step of the deliberate practice cycle may involve a variety of activities. If your goal is to gain more knowledge in a particular area, then you may need to review written or online resources, speak with others who have knowledge to share, or memorize key information and test your knowledge through self-quizzes and problem scenarios. For example, you would engage in this kind of practice if your goal was to become more knowledgeable about cognitive changes that occur as adults age in order to better serve older farmers. Another example is if you wanted to better

understand something like the EPA’s Rules and Restrictions for Commenting on EPA Dockets to provide more effective consultation to farmers who wish to contribute public comments on proposed regulations.

If the nature of your goal is a physical or perceptual skill, such as creating eye-catching graphic slides or being able to speak common Hmong phrases during your interactions with Hmong farmers, your practice sessions would involve breaking down the skill into subcomponents, repeating until each component is mastered, gradually making the skill more complex and applying it in different settings. Having someone who is more skilled to coach you during this type of practice is ideal.

If your goal is to become more proficient in a specific type of adult learning facilitation strategy, such as managing asynchronous online group discussions or leading farmers through a concept mapping activity during a face-to-face meeting, then the live classroom can become a practice setting. Be sure to practice the activity prior to the meeting, and during the meeting tell participants that you are trying to learn a new skill and would like to practice with them and get their feedback.

Regardless of the nature of your goal, practice needs to be focused, relatively brief and frequent. Even a few minutes of practice interspersed with your other professional activities can be very effective; just make sure during those few minutes

you keep centered on the task, stay within the parameters of your practice goal and challenge your memory.

Get Feedback

The fourth part of the cycle involves getting feedback about your practice efforts, which you use to make modifications to your next cycle of deliberate practice. You can get feedback from two primary sources: from your performance of a task or activity itself and from other people.

Performance feedback. An example of feedback from your performance of a task would be if you made flashcards of common Hmong phrases and were correct for 70% of the cards. If you practiced phrases prior to an event but found yourself at a loss to remember some of them or mispronounced some when interacting with participants who spoke Hmong, then your performance would be a key source of feedback informing you that more practice was needed, particularly in more formal social settings. Another way to get feedback from your performance is to record yourself and then review the recording, either

Set your goals so that they are a “comfortable challenge”—you want to achieve them with some effort, not abandon them because they are unreachable.

alone or with a coach or peer, making note of the extent to which you met your performance goals and what the focus of your next round of practice will be. People, either participants in an activity or observers of your practice, are also valuable sources of feedback.

Participant feedback. Obtain feedback from farmers who participate in your learning events both during the interactions as well as after. If you try out a new facilitation activity, ask for feedback from participants immediately after the activity, before transitioning to new content or another activity. Ask for specific feedback related to aspects of the facilitation you have been

practicing. For example, during a webinar, before participants leave their small group breakout rooms, visit each room and ask, “Did you have any technical difficulties in the breakout room?” or “How did you use the provided prompts to manage your small group discussion?” Educators commonly use end-of-session surveys as an assessment tool, and these can include questions to obtain feedback about the effectiveness of specific facilitation strategies.

Observer feedback. Coaches and peers are important sources of feedback as well. Obtaining constructive, timely feedback from a coach is a proven strategy for performance improvement in many disciplines, including education. A coach can be anyone who is knowledgeable and/or skilled in the area in which you are practicing. A coach can objectively observe you, offer critiques of the processes you use to learn as well as the quality of your outcomes, make suggestions for improvement and model performance.

If your goal is to become more proficient in an adult learning facilitation strategy, you can obtain valuable coaching feedback from a colleague who, like you, is striving to improve their craft. Forming a partnership with one or more “feedback friends” can offer opportunities for mutually beneficial coaching feedback. Invite a feedback friend to sit in on a learning event you facilitate and to provide feedback. Return the favor and observe a learning event offered by the colleague. In addition to providing feedback to your colleague, you can identify the practices you see in action that relate to your own professional development goals and make note of ideas you want to try yourself or what you might do differently in a similar situation.

Continue the Cycle

To optimize the feedback part of the cycle, use both sources of feedback: your performance itself and other people. Keep a record of your deliberate practice activities: what you tried, how it worked and the reactions you received from others. This record becomes the basis for reflecting on and making decisions about what to focus on as you move into the next cycle of deliberate practice. This best practice, along with examining your mental models of teaching and learning, are two habits you can adopt in your ongoing professional development as an educator.

About the Authors

Sandy Bell earned her doctorate in adult learning at the University of Connecticut in 1996. Since 2000, when she joined the faculty of that program, Sandy has focused her research and service on applications of adult learning theory and practice in agricultural settings. She has worked with farmers, agricultural educators and administrators, service providers, and policymakers. Highlights of her contributions to the field include researching the role of farmer mental models and social networks in behavioral change, addressing educational needs of beginning farmers, designing optimal learning supports for women farmers and developing training programs to implement EPA Worker Protection Standards.

Janet McAllister joined the Northeast SARE Professional Development Program (PDP) staff in 2009 and served as the PDP coordinator from 2017 to 2020. She holds a bachelor’s degree in agronomy from Pennsylvania State University and a master’s degree in education from the University of Connecticut. Before joining Northeast SARE she had career experiences in agricultural production and research, and soil science and environmental public health. As PDP staff and program coordinator, Janet developed training programs in adult learning and evaluation for Northeast SARE state coordinators and other agricultural educators who facilitate train-the-trainer and farmer education programs.

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—Sandy Bell and Janet McAllister

References

- Alia-Klein, N., G. Gan, J. Bezek, A. Bruno, T.F. Denson, T. Hendler et al. 2020. The feeling of anger: From brain networks to linguistic expressions. *Neuroscience & Biobehavioral Reviews* 108: 480–497.
- Brand, S., T. Reimer and K. Opwis. 2007. How do we learn in a negative mood? Effects of negative mood on transfer and learning. *Learning and Instruction* 17(1): 1–16.
- De Hooge, I.E., P.W.J. Verlegh and S.C. Tzioti. 2014. Emotions in advice taking: The roles of agency and valence. *Journal of Behavioral Decision Making* 27(3): 246–258.
- Eckert, E. and A. Bell. 2006. Continuity and change: Themes of mental model development among small-scale farmers. *Journal of Extension* 44(1), article 1FEA2.
- Eckert, E. and A. Bell. 2005. Invisible force: Farmers' mental models and how they influence learning and actions. *Journal of Extension* 43(3), article 3FEA2.
- Ericsson, K.A. 2006. Protocol Analysis and Expert Thought: Concurrent Verbalizations of Thinking During Experts' Performance on Representative Tasks. In K.A. Ericsson, N. Charness, P.J. Feltovich and R.R. Hoffman (Eds.), *The Cambridge Handbook of Expertise and Expert Performance* (pp. 223–241). New York, NY: Cambridge University Press.
- Ericsson, K.A. 2008. Deliberate Practice and Acquisition of Expert Performance: A General Overview. *Academic Emergency Medicine* 15(11): 988–994.
- Flannagan, K.M. and H. Addy. 2019. Introverts are not disadvantaged in group-based active learning classrooms. *Bioscene: Journal of College Biology Teaching* 45(1): 33–41.
- Fredrickson, B.L. 2004. The broaden and build theory of positive emotions. *Philosophical Foundations of the Royal Society of London* 359(1449): 1367–1377.
- Galvin, K. and collaborators. (2007). *Fluorescent Tracer Manual: An educational tool for pesticide safety educators*. University of Washington Pacific Northwest Agricultural Safety and Health Center, Seattle, WA.
- Hansen, B.G. 2015. Financial extension that challenges farmers' thinking in discussion clubs helps farmers improve their problem solving abilities. *Agricultural Systems* 132: 85–92.
- Hill, N.M. and W. Schneider. 2006. Brain changes in the development of expertise: Neuroanatomical and neurophysiological evidence about skill-based adaptations. In K.A. Ericsson, N. Charness, P.J. Feltovich and R.R. Hoffman (Eds.), *The Cambridge Handbook of Expertise and Expert Performance* (pp. 653–682). New York, NY: Cambridge University Press.
- Hoffman, W., B.J. Schmeichel and A.D. Baddeley. 2012. Executive functions and self-regulation. *Trends in Cognitive Sciences* 16(3): 174–180.
- Jabbour, R., S. Zwickle, E.R. Gallandt, K.E. McPhee, R.S. Wilson and D. Doohan. 2013. Mental models of organic weed management: Comparison of New England U.S. farmer and expert models. *Renewable Agriculture and Food Systems* 29(4): 319–333.
- Jones, N.A., H. Ross, T. Lyman, P. Perez and A. Leitch. 2011. Mental models: An interdisciplinary synthesis of theory and methods. *Ecology and Society* 16(1): 46.
- Kuhbandner, C. and R. Pekrun. 2013. Affective state influences retrieval-induced forgetting for integrated knowledge. *PLoS ONE* 8(2): e56617.
- Leotti, L.A., S.S. Iyengar and K.N. Ochsner. 2010. Born to choose: The origin and value of the need for control. *Trends in Cognitive Science* 14(10): 457–463.
- Lindenberger, U. and M. Lövdén. 2019. Brain plasticity in human lifespan development: The exploration–selection–refinement model. *Annual Review of Developmental Psychology* 1: 197–222.
- Luckin, R., E. Bains, M. Cukurova and W. Holmes. 2017. *Solved! Making the case for collaborative problem solving*. London, England: Nesta. uk.org.
- Metcalfe, J. 2017. Learning from errors. *Annual Review of Developmental Psychology* 68: 465–489.
- Murayama, K., K. Izuma, R. Aoki and K. Matsumoto. 2017. “Your choice” motivates you in the brain: The emergence of autonomy neuroscience. In S. Kim, J. Reeve and M. Bong (Eds.), *Recent Developments in Neuroscience Research on Human Motivation* Volume 19 (pp. 95–125). Bingley, UK: Emerald Books.
- Oh, S., J.Y. Lee and D.K. Kim. 2020. The design of CNN architectures for optimal six basic emotion classification using multiple physiological signals. *Sensors* 20(3): 866.
- Sarathy, V. 2018. Real world problem-solving. *Frontiers in Human Neuroscience* 12: article 261.
- Schlichting, M.L. and A.R. Preston. 2014. Memory reactivation during rest supports upcoming learning of related content. *PNAS* 111(44): 15845–15850.
- Sloan, D. and C. Norrgran. 2016. A neuroscience perspective on learning. *Chemical Engineering Education* 50(1): 29–37.
- Talarico, J.M., D. Berntsen and D.C. Rubin. 2009. Positive emotions enhance recall of peripheral details. *Cognition and Emotion* 23(2): 380–398.
- Tyng, C.M., H.U. Amin, M.N.M. Saad and A.S. Malik. 2017. The influences of emotion on learning and memory. *Frontiers in Psychology* 8: article 1454.

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